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Exploring the Intellectual Structure of “Fear of Missing Out” Scholarship: Current Status and Future Potential

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ABSTRACT

Fear of missing out (FoMO) is a psychological construct that recently emerged in the age of social media. This study aims to provide an overview of the progress on FoMO research and offer a future research agenda based on FoMO-related scientific articles published. We carried out this aim using a two-stage methodological approach, based on an initial pool of 314 peer-reviewed articles in the Scopus database: (1) co-citation analysis, a bibliometric analysis technique, with a subset of 103 articles to show how FoMO research develops intellectually; and (2) a systematic review to discuss clusters that emerged after co-citation analysis. Results of the co-citation analysis uncovered four clusters: (1) social media, (2) negative affectivity, (3) problematic social media use, and (4) problematic smartphone use. We discuss the content of each cluster in the context of central themes, key theoretical influences, and characteristic methodological approaches. We also present a future research agenda based on this discussion. In conclusion, this study provides an up-to-date overview that can assist researchers in understanding and designing future FoMO research and for practitioners to improve the well-being of society or users.

1. Introduction

Social media has become a more accessible and frequently used internet-based media tool, especially with the prevalence of smartphones (Frampton & Fox, 2021). However, some people spend too much time on these platforms that most people use worldwide. As of 2022, 4.65 billion people across the world actively use social media (Statista, 2022a). These rates are expected to increase day by day and even in 2027, it is estimated that the number of social media users will increase to 5.85 billion people (Statista, 2022b). Social media provides a means of communication to meet a social need and information sharing among users, allowing users to create their self-image, contribute to their psychological well-being, and improve social capital (Ashley & Tuten, 2015; Li et al., 2020). Also, people use social media platforms to alleviate tension and stimulate their minds and emotions (Whelan et al., 2020). Although social media offers people these advantages, excessive use has led to negative consequences (Baccarella et al., 2018; Kaur et al., 2021; Salo et al., 2018). For instance, excessive use of social media has exposed people to difficulties such as sleep problems, substance use, academic impairment in students, loneliness, and social isolation (Alwagait et al., 2015; Dhir et al., 2021; Oberst et al., 2017).

According to Przybylski et al. (2013), FoMO is defined as “a pervasive apprehension that others might be having

rewarding experiences from which one is absent, FoMO is characterized by the desire to stay continually connected with what others are doing” (p. 1841). Thus, FoMO has received significant attention among researchers in the context of social media use (Casale & Flett, 2020; Fioravanti et al., 2021). Furthermore, with the increasing social media platforms and users, research on FoMO has led to a rapid rise in the scientific literature over the last decade.

There are very few published review studies about FoMO. As can be seen in Table 1, these studies have included an overview (Elhai, Yang, et al., 2021), systematic literature review (Tandon, Dhir, Almgren et al., 2021), and meta-analytic research (Akbari et al., 2021; Fioravanti et al., 2021; Zhang et al., 2021). These reviews have some limitations, especially in terms of scope. For instance, Elhai, Yang, et al.’s (2021) overview was not a systematic review. Also, the overviews focused on a limited and analyzable number of research papers (Schöbel et al., 2021). In addition, despite the assertion of being exhaustive, Tandon, Dhir, Almgren et al.’s (2021) systematic literature review analyzed and synthesized only 58 articles on FoMO published until 2019. However, 189 articles on FoMO were published between 2019 and 2021 in journals indexed in the Scopus database as included in the present research. In fact, systematic literature reviews also narrow the scope of the subject and may lead to decreased objectivity (Boell & Cecez-Kecmanovic, 2015).

Table 1. Current reviews on FoMO.

No.	Authors (year)	Source	Focus	Review type	Type of articles considered for review	Number of studies	Year range
1	Elhai et al. (2021)	Braz J Psychiatry	FoMO	Overview	The empirical literature on FoMO	N/A	N/A ^a
2	Tandon, Dhir, Almgren et al. (2021)	Internet Research	FoMO	Systematic literature review	Peer-reviewed journal articles	58	2013–2019
3	Fioravanti et al. (2021)	Computers in Human Behavior	FoMO and social networking site use and problematic social networking site use	Meta-analysis	Journal articles (Quantitative)	33	2015–2019
4	Zhang et al. (2021) ^b	Acta Psychologica Sinica	FoMO and social media use	Meta-analysis	Journal articles (Quantitative), dissertations and theses, conference papers, book chapters	65	2013–2020
5	Akbari et al. (2021) ^b	Journal of Behavioral Addictions	FoMO and internet use	Systematic review and meta-analysis	Journal Articles (Quantitative) and thesis/dissertations	85	2013–2021

(1) ^aThe year range in this study covers the past couple of years.

(2) ^bAlthough this article is about FoMO, it did not meet our eligibility criteria and was not considered for bibliometric analysis in the following sections.

(3) We created this table based on Jebarajakirthy et al. (2021) study.

Moreover, previous meta-analytic studies on FoMO (Akbari et al., 2021; Fioravanti et al., 2021; Zhang et al., 2021) have focused on the relationship between FoMO and a small number of variables, such as internet use, social networking, and problematic social media use (PSMU). Thus, the number of publications included in that research remained relatively small (85 publications, 33 articles, and 65 publications, respectively). Also, meta-analysis only addresses the strength of impact from antecedents on outcome variables in quantitative studies (Schöbel et al., 2021), but has inherent limitations in terms of the kind and range of research it can examine, and does not create a detailed and comprehensive examination of the subject or concept (Zupic & Čater, 2015). On the other hand, to the best of our knowledge, there has not been a review study examining the knowledge base/scientific knowledge/intellectual structure of FoMO through co-citation analysis over the published documents. The intellectual structure is defined as the identification of the main research lines within a scientific field (García-Lillo et al., 2016). Using mathematical and statistical approaches, document co-citation analysis is employed to analyze the intellectual structure of a research area by analyzing citations or references to research. By mapping intellectual links in the research domain, this analysis explores correlations among prominent references (Arici et al., 2021). In brief, the most-cited publication group by current research on the subject generates the intellectual structure of a field (Zupic & Čater, 2015).

The aforementioned limitations call for a comprehensive and complementarity two-stage methodological approach (co-citation analysis and systematic review) to explore the growing literature on FoMO. This approach makes it suitable for analyzing new study topics, allowing us to discover essential characteristics and speculate on new views or possibilities for FoMO research (Maseda et al., 2022). Also, the two-stage methodological approach can offer a more realistic overview of the scientific contributions of FoMO research.

Thus, this current review which is based on both bibliometric analysis and systematic review methodologies, aims to (1) provide an overview of the FoMO research field, (2) explore the intellectual structure of the field, and (3) offer a future research agenda.

First, we addressed the first research question through descriptive analysis to provide an overview of FoMO (RQ1): What is the annual scientific production and most influential articles of the FoMO research field? Second, to explore the intellectual structure of FoMO, we proposed a second research question by applying a systematic review to identify clusters or themes resulting from co-citation analysis and discuss them separately (RQ2): What are the central themes, key theoretical influences, and characteristic methodological approaches that emerge in the development of the intellectual structure of research on FoMO? Finally, based on our results, we address the third research question (RQ3): What is the future research agenda for FoMO research?

By answering these questions and extending previous reviews, this review offers several contributions to FoMO. First, this research includes a considerable number of FoMO-related articles in the Scopus database between 2006 and 2021. Second, this study specifies the most influential articles in FoMO research based on quantified indicators (citation analysis). Third, we performed co-citation analysis based on the most cited articles in FoMO research to explore the intellectual structure of the FoMO field. Studying the field's intellectual structure may help eliminate confusion and provide a basic compass better to understand it (Dharmani et al., 2021). Fourth, we provide a methodological contribution by applying the systematic review technique to the clusters that emerged after co-citation analysis, discussing them separately in the context of central themes, key theoretical influences, and characteristic methodological approaches. As Alayo et al. (2021) point out, this approach in research provides a complete overview of how the research field has evolved, identifying key research clusters/

themes, and revealing its main findings and research agenda. Fifth, based on the discussion of clusters reflecting the intellectual structure of FoMO, we suggest a research agenda for future research. Finally, by discussing the dynamic nature of FoMO-oriented research, we make beneficial contributions to practitioners for society or users' well-being. As Lim et al. (2022) have noted, practitioners along with scholars can use reviews such as this one to obtain a quick overview of the field, understand the concept and its potential, and draw useful implications for society.

2. Literature review

In addition to Przybylski et al. (2013) definition of FoMO, there are different definitions, and FoMO has been defined by scholars in both social media contexts (online) and offline behavior (Dinh & Lee, 2021; Zhang et al., 2020). For instance, FoMO is characterized by Wortham (2011) as a rise in anxiety, inadequacy/deficiency, and anger experienced by people when utilizing social media platforms such as Facebook, Twitter, Snapchat, and Instagram. Similarly, Gil et al. (2015) described that FoMO is a term used to express being left out of something occurring on social media. However, since the offline and online worlds are not separate from each other, and one's online life is an extension of who one is in the offline world, FoMO definitions have been made in a more general context (Bui et al., 2022). For example, Zhang et al. (2020, p. 1631) defined FoMO as "a feeling of fear of potential negative consequences from inaction on perceived opportunities." Moreover, Budnick et al. (2020) conceptualized FoMO in the workplace context: It is characterized as a widespread fear of missing out on potential job possibilities while absent from work. Although FoMO has such definitions in different contexts, its body of knowledge has mainly advanced within the scope of social media and is increasingly linked to social media use (Sette et al., 2020). Previous review studies on FoMO also support this assumption (Fioravanti et al., 2021; Tandon, Dhir, Almugren et al., 2021; Zhang et al., 2021).

Given that the majority of FoMO research has been evaluated in the context of social media, these studies have frequently examined the relationship between FoMO and concepts such as PSMU. Recent meta-analytic review has revealed a positive relationship between PSMU severity and FoMO (Fioravanti et al., 2021; Zhang et al., 2021). Individuals who tend to seek closeness with others may excessively use social media due to FoMO (Boustead & Flack, 2021). In short, FoMO may be both an explanation for the widespread usage of social media and an antecedent to loss of control over it (Fioravanti et al., 2021). Similarly, there is a positive relationship between FoMO and problematic/excessive smartphone use (PSU) severity. Increased smartphone use and social media app availability have increased people's awareness of possible missing out on potentially rewarding social opportunities (Servidio, 2021). Thus, as social media is permanently accessible via smartphones, FoMO triggers more frequent social media and smartphone use (Wegmann et al., 2017). Accordingly, several research papers have found a positive

relationship between FoMO and phubbing behavior (e.g., Chotpitayasunondh & Douglas, 2016; Franchina et al., 2018; Tandon et al., 2022). Phubbing is defined "the act of snubbing someone in a social setting by concentrating on one's phone instead of talking to the person directly" (Chotpitayasunondh & Douglas, 2016, p. 9). Hence, it seems reasonable that FoMO has an influence on phubbing behavior, which is an indication of inappropriate smartphone use (Al-Saggaf, 2021).

Moreover, previous studies revealed that FoMO was associated with negative affectivity variables such as depression, stress, anxiety, boredom proneness, loneliness, jealousy, paranoia, and low life satisfaction (Beyens et al., 2016; Elhai et al., 2018; Elhai, Yang, et al., 2021; Elhai, Rozgonjuk, et al., 2020; Hogan, 2015). On the other hand, FoMO has also been studied in the context of viewing TV consumption in recent years (Conlin et al., 2016; Su & Chen, 2020). FoMO impacts media consumption and may dictate what people watch and why (Maxwell et al., 2021). In addition, FoMO has influenced fake news sharing on social media platforms (Talwar et al., 2019). To compensate for concerns of social inadequacy, FoMO encourages more online connections and, as a result, greater information exposure. This may lead people to share gossip or fake news on social media (Nottingham Trent University, 2016; Talwar et al., 2019). On the other hand, FoMO has also attracted the attention of scholars in the workplace context in recent years. For example, Tandon, Dhir, Islam, et al. (2021) found that a high FoMO-focused PSMU may have unfavorable work-related implications if workers retain virtual contacts with social groups while at work. Budnick et al. (2020) have also suggested that workplace FoMO has a different construct from other contextual FoMOs and that it predicts work burnout and excessive message checking behavior. As can be seen, in the conceptual development process, the number of publications on FoMO is increasing rapidly day by day in different fields, and it has become a researched phenomenon in various fields, such as psychology (Elhai, Yang, et al., 2020; Wegmann et al., 2017), communication (Conlin et al., 2016; Maxwell et al., 2021), marketing (Hodkinson, 2019; Zhang et al., 2020), tourism (Sigala, 2019), sports (Larkin & Fink, 2016; Yim et al., 2021), business (Budnick et al., 2020; Tandon, Dhir, Islam, et al., 2021), computer science (Beyens et al., 2016; Roberts & David, 2020; Rogers & Barber, 2019), and education (Alt, 2015; Rozgonjuk et al., 2019).

Furthermore, scholars have studied FoMO through different theoretical approaches. For instance, self-determination theory (SDT; Beyens et al., 2016; Przybylski et al., 2013), the stress-strain-outcome (SSO) model (Dhir et al., 2018; Elhai, Levine, et al., 2017), social comparison theory (Reer et al., 2019; Talwar et al., 2019), uses and gratifications theory (UGT; Conlin et al., 2016; Wolniewicz et al., 2018), compensatory internet use theory (CIUT; Elhai et al., 2018; Tandon et al., 2020), and the Interaction of Person-Affect-Cognition-Execution (I-PACE) model (Elhai, Yang, et al., 2020; Wegmann et al., 2017) have been used as theoretical lenses in previous FoMO research.

Besides the fields researching FoMO and various theoretical perspectives on FoMO, the scales used to measure FoMO are also important regarding conceptual development. While

FoMO has been evaluated as a unidimensional construct, such as in the original and first FoMO scale (Przybylski et al., 2013), some studies have examined it as a multidimensional construct. Considered as a multidimensional construct, various FoMO factor conceptualizations have emerged. First, Alt (2015) developed a FoMO scale for college students with three factors: Social FoMO, news FoMO, and commercial FoMO. Second, Wegmann et al. (2017) considered FoMO a two-dimensional construct—trait FoMO and state FoMO—by adding items to the first FoMO scale. Third, Song et al. (2017) developed a FoMO scale in the context of mobile social media in China, where eastern culture is dominant. They revealed a four-dimensional construct involving psychological motivation, cognitive motivation, behavioral performance, and emotional intelligence dependence. Fourth, Sette et al. (2020) criticized the original FoMO scale's unidimensional nature and suggested a need for a multidimensional psychometric scale. The authors revealed a four-dimensional construct including the need to belong, need for popularity, anxiety, and addiction in their scale development studies on FoMO. Fifth, Zhang et al. (2020) developed a FoMO scale with personal FoMO and social FoMO factors in both online and offline contexts. Finally, a recent FoMO scale development study was carried out by Ma et al. (2021) for Chinese college students. The authors introduced a new FoMO scale with four factors, including missing motivation, missing cognition, missing emotion, and missing behaviors. Overall, while unidimensional scales may be used for rating FoMO levels, multidimensional scales allow for a more customized evaluation (Sette et al., 2020).

3. Methodology

We used a two-stage methodological approach in our study, including bibliometric analysis and systematic review, as this approach is more applicable to studying an emerging field (Alayo et al., 2021; Kohtamäki et al., 2022; Maseda et al., 2022). It also helps us discover what we know and reveal what we do not know about new insights and possibilities (Maseda et al., 2022).

3.1. Bibliometric analysis

First, the method of bibliometric analysis is based on a strategy to discover, describe, and evaluate published research and provide a wide range of analytical tools and data understanding metrics obtained from published scientific papers (Annarelli & Nonino, 2016; Bretas & Alon, 2021). By rigorously making sense of huge quantities of unstructured data, the bibliometric analysis may help understand and map the accumulated scientific knowledge and evolutionary subtleties of well-established disciplines (Donthu et al., 2021). Moreover, the bibliometric study examines how research has been conducted in the past and now, providing new research topics that might also emerge in the future (Rojas-Lamarena et al., 2022). In conclusion, the desire by scholars to analyze and summarize the rising volume of publications has led to an increase in bibliometric research in social

science fields in recent years (Caputo & Kargina, 2022). Because it helps researchers conduct literature reviews by pointing them to the significant publications and mapping the study area objectively (Zupic & Čater, 2015).

This review utilized the most reliable and widely used bibliometric analysis techniques—citation analysis and co-citation analysis (Cepiku & Mastrodascio, 2021). Citation analysis of a research area is employed in fundamental bibliometric studies (Dzikowski, 2018). Citations are used as a measure of impact, and an article with a large number of citations is deemed significant and influential (Zupic & Čater, 2015). Citation analysis, which consists of units of analysis such as authors, journals, documents, cited references, institutions, and countries, can analyze various aspects of a field depending on the analysis unit chosen according to the purpose of the research (Dzikowski, 2018). Because the citation frequency of a document presents important findings and helpful contributions to the research field (Hota et al., 2020), we performed citation analysis on documents as the analysis unit. Citation analysis is easy to implement and has long been used as a formal scholarly evaluation tool. However, it does not consider the linking structure of cited studies and is insufficient for intellectual discussion (Dzikowski, 2018). Therefore, it is also recommended to apply co-citation analysis.

Thus, we next employed co-citation analysis on references of the articles in the dataset to explore the intellectual structure of the FoMO field. Co-citation analysis is a technique for quantitatively detailing the intellectual structure of a particular area via the use of citations (Zupic & Čater, 2015), but unlike citations, co-citations are defined as the number of times two documents are cited together (Small, 1973). Documents, journals, and authors are among the units utilized in co-citation analysis (Wong et al., 2021). Because the primary purpose of this study was to determine the intellectual structure of a research field (e.g., FoMO), co-citation analysis was carried out using documents instead of authors or journals (Hota et al., 2020). Moreover, researchers use the document co-citation technique as part of the bibliometric analysis to reduce or remove critical deficiencies (e.g., unsystematic, non-transparent, and non-reproducibility) in scientific research (Köseoglu, 2020). However, co-citation analysis also has some limitations as with any analytic technique. For example, representation of the content of publications cited in co-citation analysis is limited (Tandon, Kaur, Mäntymäki, et al., 2021). Similarly, it may give limited scope and perspective (Arici et al., 2021). In addition, bibliometric reviews such as co-citation analysis cannot adequately describe theories, methods, and themes in a particular field, such as FoMO (Paul & Criado, 2020). Therefore, it is important to systematically examine, analyze, and discuss the clusters that emerge from co-citation analysis.

3.2. Systematic review

As the second methodology in this study, we carried out a systematic review on the clusters that emerged from co-citation analysis. The systematic review is described as an

approach that discovers, analyzes, and evaluates all available data relevant to a specific research issue in an unbiased and replicable manner (Fan et al., 2022). It is expected to significantly overcome some limitations of bibliometric studies such as co-citation analysis. As it presents a high-quality synthesis and organization of subjects such as the FoMO body of knowledge by a systematic review, it provides scholars and practitioners with an integrative framework of comprehensive knowledge and assists in presenting a future research agenda (Vrontis et al., 2021).

In the systematic review process, we discussed central themes, key theoretical influences, and characteristic methodological approaches separately to evaluate the clusters in an elaborative manner (Kohtamäki et al., 2022). Researchers have recently suggested (e.g., Alayo et al., 2021; Khanra et al., 2021; Maseda et al., 2022); using this two-step approach to interpret and complement results of bibliometric analysis through a systematic review to reveal main findings and a likely agenda for a research field.

3.3. Sample identification

We decided on the related keywords to obtain associated articles as the first step. Prior reviews have included an overview (Elhai, Yang, et al., 2021), systematic literature review (Tandon, Dhir, Almugren et al., 2021), and meta-analytic research (Fioravanti et al., 2021; Zhang et al., 2021), and based on both these reviews and other empirical studies in the literature, we determined the following keywords: “fear of missing out” OR “feeling of missing out” OR “FoMO.” As the second step, we considered databases to locate related articles and preferred Scopus to collect data in this study. Scopus is a more suitable database for examining and analyzing relatively newer emerging research areas/subjects (Bretas & Alon, 2021). Compared to other databases, such as Web of Science (WoS) and PubMed, it indexes more journal articles (Paul & Criado, 2020). Also, Scopus is employed in several bibliometric analytical studies since it is the largest collection of citation data and abstracts of literature; it is easily accessible, and it allows users to analyze and download meta-data (Aznar-Sánchez et al., 2019). Furthermore, it has also been frequently adopted as a single database in similar two-stage methodological approach studies (Khanra et al., 2020, 2021; Tandon, Kaur, Mäntymäki et al., 2021). Thirdly, we limited publications in terms of document type and included only peer-reviewed journal articles written in English. The search results for conference papers, letters to the editor, books, and book chapters were excluded, as articles and reviews published in academic journals are deemed “certified knowledge” (Ramos-Rodríguez & Ruíz-Navarro, 2004). This improves the reliability of the analysis and results (Hota et al., 2020; Pizzi et al., 2021).

3.4. Data collection and cleaning

The search was carried out in Scopus on October 12, 2021, employing the identified keywords by article title, abstract,

and keywords. This search yielded a total of 437 publications. We then limited these publications concerning document type and included only journal articles (published and in press) while excluding letters to the editor, books, and chapters (Singh et al., 2021). As a result of these procedures, 370 articles remained. In addition, we only considered articles written in English and excluded articles written in other languages (13 articles). Moreover, all selected articles were reviewed without time restrictions until 2021. The first article about FoMO was published in 2006. Therefore, the analysis stage was from 2006 to 2021. Consequently, we downloaded the dataset of 357 articles from Scopus.

One of the co-authors scanned all articles’ titles, abstracts, and keywords in this study. As a result, some articles were extracted as duplicates (one article) or were not relevant (42 articles), leaving a total of 314 articles. After FoMO-related articles were identified, one of the authors organized the references uniformly for data integration because co-citation analysis would be performed through references of the articles. In this data integration, the researchers manually detect any misspellings or spelling differences in all references (Wong et al., 2021; Zhang et al., 2021).

3.5. Data analysis

A new dataset, including only the articles and FoMO-related references, was created after the data were coded and cleaned in a Microsoft Excel spreadsheet (Wong et al., 2021). We evaluated this dataset with a two-stage approach consisting of bibliometric analysis and systematic review (Kohtamäki et al., 2022; Maseda et al., 2022). We analyzed 314 journal articles with 2,873 appearances from a reference list, including 18,726 reference appearances for bibliometric analysis. First, the annual scientific production on FoMO was revealed. Second, we performed two analyses—citation and co-citation analyses.

Consistent with prior research, the 100 most cited articles were reviewed for co-citation analysis (Köseoglu et al., 2020; Wong et al., 2021). As a result, 103 articles were included, with a cut-off value of 12 citations and four different clusters emerging in the mapping. After identifying clusters using co-citation analysis, we labelled clusters based on article titles, keywords, abstracts, and the full text. Once thematic clusters were determined via co-citation analysis, we finally conducted a systematic review to identify important issues in the field of FoMO and specify potential avenues for future research (Alayo et al., 2021).

As with previous review studies (e.g., Kohtamäki et al., 2022; Parsons et al., 2021), we used qualitative thematic content analysis to analyze and interpret articles in clusters overall. This analysis identifies, analyzes, and reports themes (patterns) based on the dataset in review studies (Braun & Clarke, 2006). When conducting reviews, it is increasingly being utilized to examine existing knowledge and comprehend intellectual structure (Gaur & Kumar, 2018). It also identifies the most developed (hot spots) and least developed (blind spots) themes within the literature, providing future

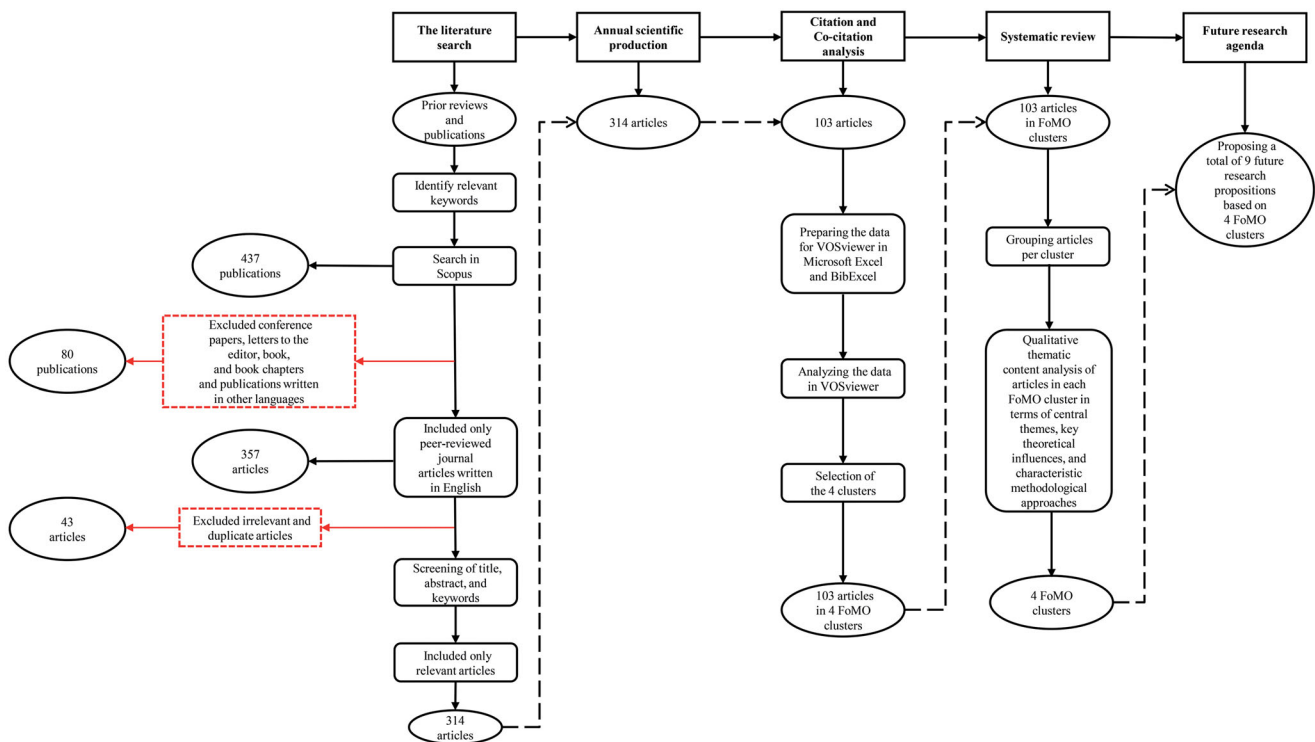


Figure 1. Review process. (1) We generated this figure inspired by the study of Kohtamäki et al. (2022).

research agendas for researchers (Bretas & Alon, 2021; Verma & Yadav, 2021). Next, as Ali et al. (2021) practised, we created a spreadsheet to evaluate the articles included in the clusters. This spreadsheet included data about (a) year of publication, (b) author(s), (c) journal name, (d) theoretical approach, (e) research approach (quantitative, qualitative, mixed, review, or conceptual approach), (f) research method (experimental, cross-sectional survey, longitudinal survey, focus group, interview, secondary data etc.), (g) platforms in focus (Facebook, general internet use, general social use, smartphone use etc.), (h) unit of analysis (participants), and (i) the statistical methods used.

Each cluster's primary research content was identified in the spreadsheet by one co-author through reading, analyzing, and coding the whole article in each cluster. Next, other co-authors reviewed the spreadsheet and chose a random sample for cross-checking. Any disagreements between the two authors were handled and resolved until consensus was achieved (Busalim et al., 2022). To evaluate clusters in detail, we drew on the perspective of central themes, key theoretical influences, and characteristic methodological approaches as in a recent review (see Kohtamäki et al., 2022). Finally, we created a research agenda for future researchers based on these perspectives.

Furthermore, we used Microsoft Excel and BibExcel applications to prepare the data for analysis. Then, we employed the VOSviewer package program to analyze and visualize the data. Because of their high degree of flexibility in altering and updating the input data imported from sources, such as Scopus, these software programs were utilized in the study (Jain et al., 2021). The entire review process is summarized in Figure 1.

4. Result and discussion

4.1. Annual scientific production

Figure 2 shows the evolution of the FoMO knowledge base in Scopus based on the annual number of publications. At first, research on FoMO was started in 2006 by Kivetz and Keinan. Drawing on construal level theory, they suggested that temporal distance from decisions reduces guilt and brings about FoMO on enjoyment, resulting in self-control regrets being reserved (Kivetz & Keinan, 2006). The following study on FoMO was published in 2009 (Gilbert et al., 2009). Then, Przybylski et al. (2013) published the first FoMO scale development study in the literature. The number of articles has been continually rising since 2014.

Furthermore, the reporting period 2006–2021 may be divided into two major periods, as shown in this figure: (1) emergence phase and (2) take-off phase (Hota et al., 2020; Singh et al., 2021). Until 2016, little research was published on FoMO, so we named this period the emergence phase. Only 22 of a total of 314 (7%) studies were published in this phase. The most notable increase in the number of publications in this phase was in 2015. While there was only one article about FoMO in the previous year, seven articles were published in 2015. There may be several reasons for this growth. First, this growth may have resulted from the increase in the number of social media users. In 2015, the number of social media users across the world increased by 12% (222 million) compared to the previous year and reached 2.08 billion. This number corresponded to 29% of the world's population (Kemp, 2015). The other reason may be the increase in the number of researchers and available journals (Palácios et al., 2021). Lastly, the fact that 2 years

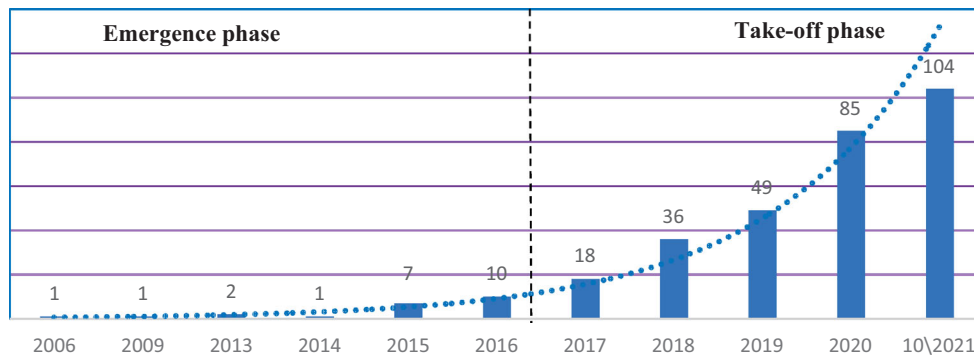


Figure 2. The annual number of publications on FoMO.

had passed since the development of the first FoMO scale (Przybylski et al., 2013) might have led to a growth in the number of publications on the subject.

After 2016, nevertheless, 292 of a total of 314 (93%) research were published during the take-off phase. Furthermore, while the annual average number of publications on FoMO was 19.62, the highest productivity rate was 2021, with 104 articles published in the first 10 months. There may be several reasons for the increase in the number of articles on FoMO. For example, the increase in social networking sites and users, use of smartphones, journals dealing with social media or digital media content, and emergence of problematic situations caused by excessive social media/internet/smartphone use may have increased the number of publications about FoMO recently. Another factor in the increase in FoMO research over the past few years may be the COVID-19 pandemic. Besides the physical and biological effects of this pandemic, psychological effects have also emerged, and many studies on this subject have been made in the literature (Alimoradi et al., 2022). A prior study has claimed that there has been an increase in FoMO levels of individuals during the COVID-19 process (Casale & Flett, 2020). Furthermore, it has been suggested that COVID-19 healthy anxiety may have influenced FoMO due to social isolation and stay-at-home rules as virus containment strategies (Elhai, McKay, et al., 2021). Additionally, as peoples' use of social media have increased during the COVID-19 lockdown than before the pandemic, their FoMO levels might have strengthened their attitudes about online communication (Boursier et al., 2020; Gioia et al., 2021). Hence, FoMO may appear to be the main driver of various problematic technology use patterns due to the impact of COVID-19 (Throuvala et al., 2021).

4.2. Citation analysis

Supplementary Appendix A shows the 103 most cited papers¹ in FoMO research. In citation analysis, if a study is cited too frequently, it may be that the study was conceptual or review research or had an earlier publication date (Ozturk, 2021). First, Przybylski et al. (2013) is by far the most cited article in the FoMO field, with 268 citations. It is not surprising that this article is the most cited because it

represents the first scale development research on FoMO. In addition, it is still frequently referred to in the literature.

Second, Oberst et al. (2017) and Elhai et al. (2016) were the second and third most-cited articles, with 103 and 100 citations, respectively. These two articles have suggested that there is a relationship between FoMO with psychological problems such as anxiety and depression, problematic smartphone use, and social network intensity. In addition, Oberst et al. (2017) argued that adolescents with FoMO, or the feeling that they are missing out on their peers' pleasurable experiences, are particularly vulnerable, since they may use social media to make up for this deficiency by attempting to connect with people online excessively. Elhai et al. (2016), on the other hand, showed the importance of FoMO in fulfilling the social and tactile needs of human beings.

Fourthly, Beyens et al. (2016) conducted a study on adolescents with a cross-sectional survey design. According to this study, the authors uncovered that FoMO has an important impact on adolescents' media use and well-being. In addition, adolescents with stronger needs for popularity/belongingness suffer from greater FoMO. Lastly, Alt (2015) conducted the first empirical research on FoMO in higher education to the best of our knowledge. She suggested that FoMO should be considered as a multidimensional rather than unidimensional phenomenon, and developed a three-factor FoMO scale, namely social FoMO, news FoMO, and commercial FoMO. Furthermore, she discovered that FoMO mediated the relationship between students' motivational deficits in the classroom and social media engagement.

4.3. Documents co-citation analysis

Through co-analysis in the VOSviewer program, we identified four clusters, each representing different colors (red, green, blue, and yellow), as seen in Figure 3. These are the citations each article has obtained in FoMO research, and the distance between circles denotes co-citation frequency (Kohtamäki et al., 2022). Furthermore, we gave each referenced article a reference code (see Supplementary Appendix A).

We examined articles in the red, green, blue, and yellow color clusters that emerged from co-citation network analysis as title, keywords, abstract, and full text. Then we carried out the naming process of the clusters and defined the central focus of each cluster mainly according to topics

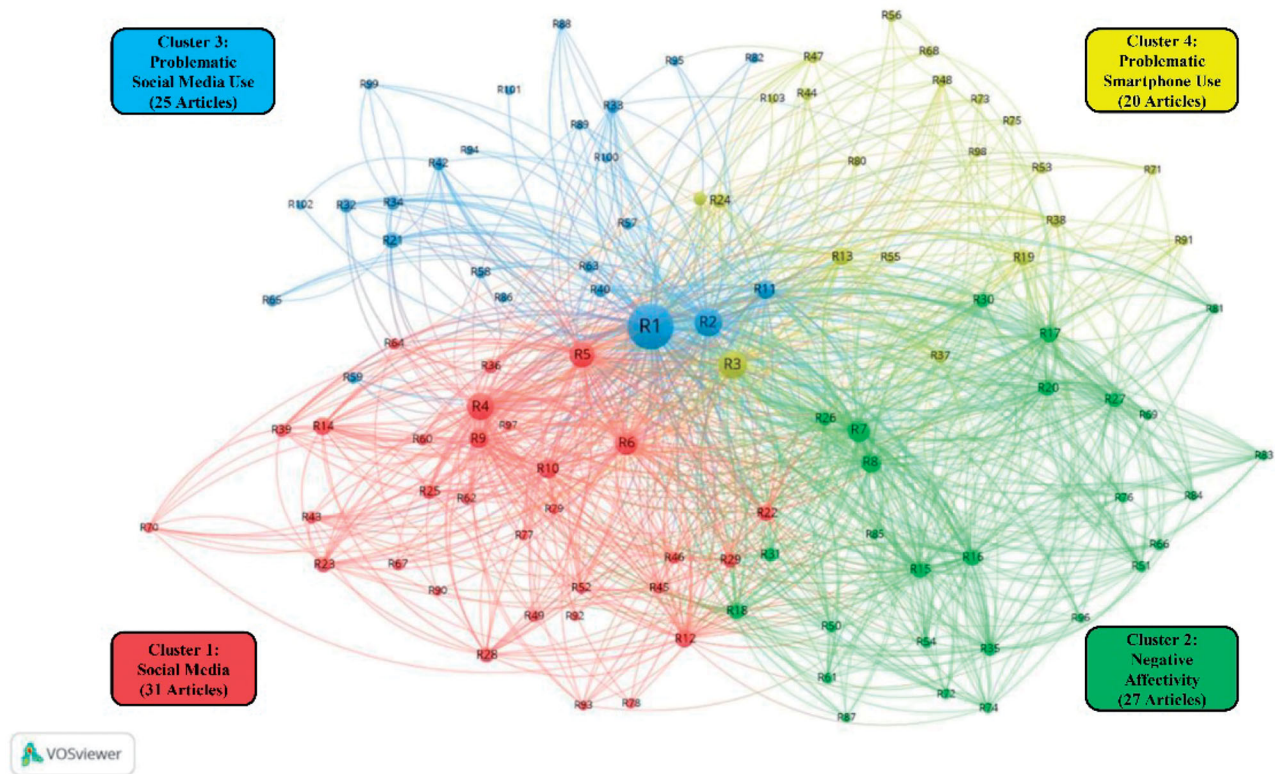


Figure 3. Network visualization of co-citation analysis.

covered most frequently in the cluster. Figure 4 shows the evolution of four distinct FoMO clusters that emerged through document co-citation analysis, namely “social media,” “negative affectivity,” “problematic social media use,” and “problematic smartphone use.”

In general, the number of most-cited publications in FoMO research started to increase since 2011. The most productive year was 2018, with 16 articles. Additional productive years were 2017 and 2015, with 15 and 14 articles, respectively. On the other hand, the three most-cited articles among FoMO studies were R1 (268 citations), R2 (103 citations), and R3 (100 citations). When clusters were evaluated separately, articles in the social media cluster constituted 30% ($n=31$) of all publications between 1954² and 2021. In addition, while there were 27 articles in the negative affectivity cluster, there were 25 articles in the PSMU cluster. The PSU cluster ($n=20$) was the fourth and last among the most frequently cited clusters in FoMO research.

4.4. Content analysis for clusters

We examined in detail below, a total of four clusters that emerged as a result of co-citation analysis. In addition, Table 2 summarizes the prominent authors, main sources, and top cited articles in each cluster, besides the key theoretical influences and characteristic methodological approaches followed by the researchers.

4.4.1. Cluster 1: Social media

4.4.1.1. Central themes. Publications in the social media cluster (red), the largest cluster of FoMO research, have

increased, especially in 2015. Many of the studies in this cluster focused on general social media. Social media has a prominent place in research on FoMO, and its emphasis is prominent in the operationalization of the concept.

Some concepts related to social media draw attention as central themes, such as social media engagement (R5, R6, R25, R28, R45) in the social media cluster. With the difference in the use of social media tools, social media engagement is defined as the state of cognitive and emotional immersion in the usage of social media platforms (Smith & Gallicano, 2015). The relationship between FoMO and social media engagement has been examined in previous studies (R1, R5, R28). It suggests that FoMO is an influential and key factor in understanding social media engagement (Przybylski et al., 2013). FoMO was initially used to indicate a potential route to high social media engagement (Fioravanti et al., 2021). In brief, people with high levels of FoMO, especially because of social comparison, may be more likely to engage in social media use (Bui et al., 2022).

Another notable concept in the social media cluster is self-esteem (R16, R19, R40, R52). Self-esteem is defined as “a positive or negative attitude toward a particular object, namely, the self” (Rosenberg, 1965, p. 30). It is very important for individuals to interact with other people as a determinant of his/her self-esteem (Krause et al., 2021). For nearly the past two decades, social media has become an important setting for people to interact more directly with one another and has drawn the attention of scholars in regulating self-esteem. According to Valkenburg et al. (2006), social media has provided users with more opportunities to increase their social self-esteem than face-to-face situations.

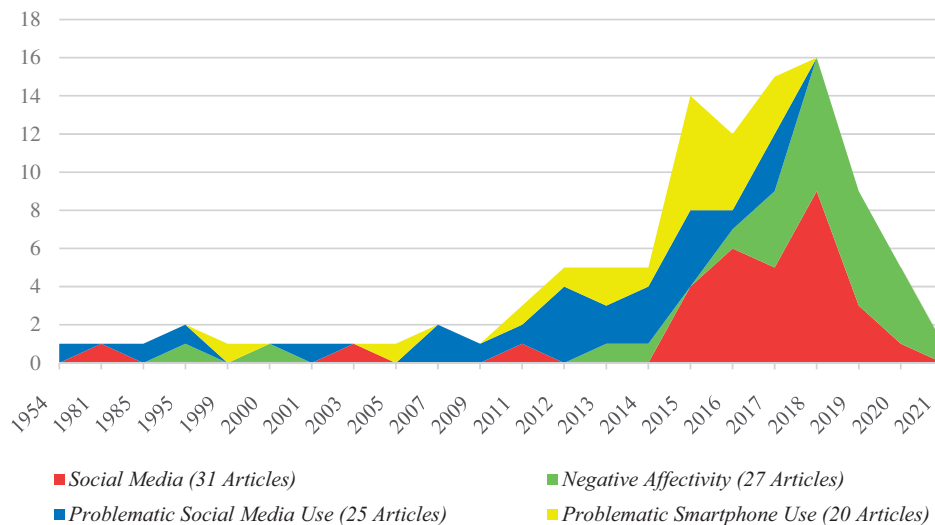


Figure 4. Number of articles per cluster. (1) We generated this figure inspired by the study of Kohtamäki et al. (2022).

Hence, those with low self-esteem may benefit from social media engagement since it provides an opportunity for self-disclosure (Forest & Wood, 2012). Similarly, individuals who have a strong emotional connection to social media sites are likely to experience a greater boost in self-esteem as a result of interaction and social comparisons through social media (Woods & Scott, 2016). However, a recent study (Krause et al., 2021) suggested that if individuals use social media to compare themselves to others, it might often result in a decrease in their self-esteem. On the other hand, FoMO draws attention as a function of lower self-esteem as well as higher social media engagement (Barry & Wong, 2020). Abel et al. (2016) also claimed that self-esteem might be an important determinant of FoMO levels. A new study indicated (Uram & Skalski, 2022) that there is a negatively relationship between self-esteem and FoMO. Moreover, Buglass et al. (2017) have suggested that the association between social media use and self-esteem was mediated by FoMO, revealing that increases in FoMO result in direct declines in self-esteem. Another recent study (Sekścińska & Jaworska, 2022) showed that FoMO has a mediating role in the relationship between self-esteem and mood (both positive and negative mood) in women.

Furthermore, the field of education comes to the forefront in this cluster (R5, R28, R39, R43, R78). There is no doubt that social media has become an important part of the lives of many students (Alt, 2018). It has helped to developing learning environments that allow students to connect, interact with each other, and share ideas quickly and effectively (Rutherford, 2010), leading to a radical and transformational change in teaching and learning (McLoughlin & Lee, 2007). However, social media has also led to the emergence of some problems. For example, Dhir et al. (2019) have suggested that social media can be an escape strategy, especially for students with lower academic performance. Similarly, a prior study has claimed (Alt, 2015) that students with academic motivation deficits may tend to overuse social media tools in the classroom. Another a study found (Alt, 2018) that students who were apprehensive about starting college were more likely to use social media

via FoMO. Accordingly, FoMO may act as a mediator between students' deficits in psychological needs, such as lack of academic motivation, and social media engagement (Alt, 2015; 2018). On the other hand, Adams et al. (2017) have suggested that social/technological distractions such as cell phones and social media and FoMO have an impact on students' sleep.

4.4.1.2. Key theoretical influences. Some basic theories were used in the social media cluster, formed according to the most-cited publications in FoMO research. For example, SDT stands out in this cluster (R4, R5). Individuals, according to SDT, may manage their behavior to create a feeling of achievement for their purposes (Tandon et al., 2020). For SDT, people have three basic psychological needs: competence, autonomy, and relatedness (Ryan & Deci, 2000). Efforts to minimize FoMO are attempts to meet these needs, and thus people spend more time on social media (Tandon et al., 2020). SDT may help understand why individuals utilize social media to express themselves (Li et al., 2022). Another key theoretical approach in this cluster is the SSO model (R22, R91). As a theoretical framework, SSO model helps explain how diverse stressors affect people's strain, which in turn influences their behavior (Koeske & Koeske, 1993). It is a suitable theory for examining stress-related situations and their consequences in the context of social media use (Dhir et al., 2018). Furthermore, social comparison theory (R45), self-theory (R29), biopsychosocial model (R43), cognitive-behavioral model (R46), cognitive appraisal theory and agency theory (R70), information foraging theory (R92) are other theoretical approaches are used in the social media cluster.

4.4.1.3. Characteristic methodological approaches. While the cross-sectional survey is used in many social media studies (R4, R5, R6, R10, R14), experimental (R12, R25) and longitudinal designs (R9) are used in a few studies. That is why surveys and questionnaires are the most popular practices for data collection in studies in the social media cluster.

Table 2. Overview of the key features of the four clusters.

CI	TA	Main sources	Top cited articles	Central themes	Key theoretical influences	Characteristic methodological approaches
1	31	Computers in Human Behavior (5) Journal of Adolescence (3) International Journal of Information Management (2) Personality and Individual Differences (2) Addictive Behaviors Reports (4) Psychiatry Research (3) International Journal of Mental Health and Addiction (2) Journal of Affective Disorders (2) Neuroscience & Biobehavioral Reviews (2)	Alt, 2015; Beyens et al., 2016; Blackwell et al., 2017; Buglass et al., 2017 Elhai et al., 2017, 2018; Stead & Bibby, 2017; Wegmann et al., 2017; Wolniewicz et al., 2018	Social media engagement (5) Education (5) Self-esteem (4) Depression (7) Anxiety (7) Stress (2) Boredom proneness (2)	Self-determination theory (2) The stress-strain-outcome (2) I-PACE model (8) Self-determination theory (6) Compensatory internet use theory (6) Uses and gratifications theory (2)	<ul style="list-style-type: none"> Quantitative (23), Mixed (2), Qualitative (1) Cross-sectional survey (18), Experimental (3) SEM (11), regression analysis (7), ANOVA (4) General social media (20), Facebook (3) Young adults (9), Adolescents (6) Quantitative (23), Conceptual/review (4) Cross-sectional survey (19) SEM (10), PLS-SEM (1), Regression analysis (6), Latent growth curve modelling (4) Smartphone (8) General internet (4), Facebook (4) Young adults (11), Facebook users (2), General social media users (2) Quantitative (14), Conceptual/review (8), Qualitative (1) Cross-sectional survey (11), Experimental (1), Focus Group (1) SEM (4), Regression analysis (6) Facebook (10) General social media (8) Students (12), Articles (4) Quantitative (17), Mixed (1), Conceptual/review (1) Cross-sectional survey (15), Longitudinal (1), Exploratory sequential (1) SEM (4), PLS-SEM (1), Regression analysis (4), ANOVA/ANCOVA (3), Latent profile analysis (1) Smartphone (14), General social media use (3) Student (8), Amazon's Mechanical Turk (2), General internet users (2)
3	25	Computers in Human Behavior (5) Journal of Computer-Mediated Communication (3) Journal of Behavioral Addictions (2)	Chotpitayasunondh & Douglas, 2016; Ellison et al., 2007; Oberst et al., 2017; Przybylski et al., 2013	Social media addiction (9) Social media use intensity (2)	Social comparison theory (1) The Cognitive-Behavioral model of pathological internet use (1) Social capital theory (1) Self-determination theory (1)	<ul style="list-style-type: none"> General social media users (2) Quantitative (14), Conceptual/review (8), Qualitative (1) Cross-sectional survey (11), Experimental (1), Focus Group (1) SEM (4), Regression analysis (6) Facebook (10) General social media (8) Students (12), Articles (4) Quantitative (17), Mixed (1), Conceptual/review (1) Cross-sectional survey (15), Longitudinal (1), Exploratory sequential (1) SEM (4), PLS-SEM (1), Regression analysis (4), ANOVA/ANCOVA (3), Latent profile analysis (1) Smartphone (14), General social media use (3) Student (8), Amazon's Mechanical Turk (2), General internet users (2)
4	20	Computers in Human Behavior (8)	Billieux et al., 2015; Elhai et al., 2016; Hu & Bentler, 1999; Kuss & Griffiths (2017)	Depression (6) Anxiety (6)	Flow theory (2) Uses and gratifications theory (1) Behavioral addiction model (1) Extended-self theory (1)	<ul style="list-style-type: none"> Quantitative (23), Mixed (2), Qualitative (1) Cross-sectional survey (18), Experimental (3) SEM (11), regression analysis (7), ANOVA (4) General social media (20), Facebook (3) Young adults (9), Adolescents (6) Quantitative (23), Conceptual/review (4) Cross-sectional survey (19) SEM (10), PLS-SEM (1), Regression analysis (6), Latent growth curve modelling (4) Smartphone (8) General internet (4), Facebook (4) Young adults (11), Facebook users (2), General social media users (2) Quantitative (14), Conceptual/review (8), Qualitative (1) Cross-sectional survey (11), Experimental (1), Focus Group (1) SEM (4), Regression analysis (6) Facebook (10) General social media (8) Students (12), Articles (4) Quantitative (17), Mixed (1), Conceptual/review (1) Cross-sectional survey (15), Longitudinal (1), Exploratory sequential (1) SEM (4), PLS-SEM (1), Regression analysis (4), ANOVA/ANCOVA (3), Latent profile analysis (1) Smartphone (14), General social media use (3) Student (8), Amazon's Mechanical Turk (2), General internet users (2)

(1) CI: clusters; TA: total articles.

(2) We created this table based on Maseda et al. (2022) study.

The recent systematic literature review suggested that the vast majority of research on FoMO is based on self-report surveys with a cross-sectional design (Tandon, Dhir, Almugren et al., 2021). On the other hand, quantitative statistical techniques such as structural equation modelling (SEM) are most used in these quantitative studies (R4, R5, R9, R10). Another preferred analytic technique in the social media cluster research is indirect effect (mediation) analysis (R29, R62, R92), widely used in social science research (Hayes, 2018). In addition, linear, hierarchical, and multiple regression analysis (R6, R45, R49, R79) and analysis of variance (ANOVA; R14, R25, R52) are other analytic techniques used in research in this cluster. Conversely, there are very few qualitative (R43) and mixed studies (R39, R78) in the social media cluster.

Furthermore, the studies in this cluster were evaluated as the context in terms of platform and participants (samples). First, in terms of the platform, most studies focused on general social media use (R5, R6, R9, R10, R28), while only two studies were explicitly evaluated for Facebook use (R4, R24). It seems intuitive to conduct research specific to Facebook, which has the largest number of users among social media platforms and is also one of the oldest platforms. Second, participants in the social media cluster were mostly young adults (i.e., university students) (R5, R10, R23, R43). Since their presence on social media platforms is among the most productive in terms of both user numbers and they also spend most of their waking hours with technology (e.g., social media use), they are frequently preferred in social media research (Dhir et al., 2021; Vaterlaus et al., 2015). Moreover, adolescents have often been used as participants in studies in the social media cluster (R4, R22, R46, R49, R62). Based on the assumption that there may be a relationship between adolescents' social media use and their sleep quality and psychological well-being, social media studies are conducted on these samples (Dhir et al., 2018; Woods & Scott, 2016). In addition, according to Beyens et al. (2016), adolescents' need to belong and their desire to be popular relate to greater FoMO, which is in turn correlated with increased Facebook use. On the other hand, it is suggested that non-student samples should be included in future studies to explore the relationships between social media use and FoMO and present generalized conceptual frameworks (Tandon et al., 2020).

4.4.2. Cluster 2: Negative affectivity

4.4.2.1. Central themes. The articles in the negative affectivity cluster (green), the second-largest cluster of FoMO research, have accrued especially as of 2017. Articles in this cluster have generally focused on negative affectivity cited in FoMO research. Negative affectivity is defined as an emotional state caused by pressure and an unpleasant environment for various aversive moods, including anger, contempt, disgust, guilt, fear, and irritability (Watson et al., 1988). According to Elhai, Yang, et al. (2021), FoMO has been defined as anxiety-related psychopathology in the context of negative affectivity, and anxiety disorders are seen as a key component of this. Previous studies have shown that there is a relationship between negative affectivity variables and

FoMO (Elhai et al., 2018; Elhai, Yang, et al., 2021; Elhai, Rozgonjuk, et al., 2020).

Studies examining the relationships between several variables in the negative affectivity cluster and FoMO come into prominence. For example, some studies have found that there is a relationship between depression severity and FoMO (R16, R96). However, some papers have determined that there is no significant relationship between these two variables (R15, R35). Additionally, positive associations were found between FoMO and anxiety symptoms (R15, R35, R96). The conceptualization of FoMO can explain these results as an anxiety-related variable rather than a depression-related variable (Elhai, Yang, et al., 2020). In addition, positive relationships were found between FoMO and stress (R15), rumination (R15), and boredom proneness (R7, R76). In conclusion, several articles have characterized FoMO as a driving force for negative affectivity, whereas others have conceived negative affectivity as an antecedent to FoMO. It is unclear if FoMO generates negative affectivity or vice versa (Elhai, Yang, et al., 2021).

4.4.2.2. Key theoretical influences. Some important theories draw attention in papers in the negative affectivity cluster. For example, in some of the articles in this cluster, CIUT stands out in the most cited publications in FoMO research (R7, R15, R16, R30, R35, R76). CIUT is a suitable theory to explain the use of the internet or technology in the modern age (Kardefelt-Winther, 2014). Persons who experience life pressures or unfavorable occurrences are more likely to engage in excessive usage of technology as a way of coping with their negative feelings and thoughts (Wolniewicz et al., 2018). Thus, Kardefelt-Winther (2014) proposed CIUT, stating that unfavorable life events might lead to a need to go online to relieve negative sentiments. In addition, CIUT views compensatory use of technology as a coping strategy to reduce negative affectivity (Kardefelt-Winther, 2014).

Another key theoretical approach in this cluster is the I-PACE model (R8, R16, R20, R35, R76, R85). To understand the mechanisms behind the development and maintenance of a particular internet-use problem, I-PACE highlights the connection between a person's fundamental traits and cognitive, affective, and executive processes (Servidio, 2021). Regarding the usage of certain internet apps and websites, I-PACE reveals that predisposing factors, emotional and cognitive reactions to internal and external stimuli, executive and inhibitory control, and decision-making behavior all play a role (Brand et al., 2016). This model is also frequently used in research to explore underlying mechanisms of FoMO (Elhai, Yang, et al., 2020; Elhai, Yang, et al., 2021; Wegmann et al., 2017). On the other hand, UGT (R7, R81), the threaded cognition model (R72), SDT (R31, R54, R66), and sensation seeking theory (R61) are other theoretical approaches used in the negative affectivity cluster.

4.4.2.3. Characteristic methodological approaches. While the cross-sectional survey is predominantly used for papers in this cluster (R7, R8, R15, R16), repeated measures study designs (R81) and experience sampling methodology (R97)

were each used in one paper. In addition, a conceptual approach was employed in two articles (R20, R30). Qualitative and mixed methods, however, were not used in any articles in the negative affectivity cluster. Furthermore, as in the social media cluster, SEM is frequently preferred by researchers in quantitative research in this cluster (R8, R16, R26, R35). In addition, latent growth curve modelling draws attention to this cluster (R81, R97). On the other hand, mediation (R61, R74), regression (R7, R15, R18), and ANOVA (R27) are other analysis techniques used.

Concerning the platform, while many articles focused on smartphone use (R7, R15, R27, R35), others focused on general internet use (R8, R20, R30) and Facebook use (R16, R26, R74) as platforms. Considering that previous studies found a relationship between negative affectivity and smartphone use (Elhai et al., 2018; Wolniewicz et al., 2018), this finding is not surprising. Moreover, the studies' participants in the negative affectivity cluster were mostly college students (R35, R72, R96). Recent studies found that social media use was associated with increased negative affectivity, including with college students/young adults (Metin-Orta & Demirtepe-Saygılı, 2021; Wirtz et al., 2021). As social media use is more common and popular among young adults and excessive social media use is associated with increased negative affectivity (see above), young adults are one of the groups most at risk of negative affectivity (Pujazon-Zazik & Park, 2010). Therefore, it would indeed seem reasonable for articles in the negative affectivity cluster to focus mostly on college students who are young adults. In addition, some articles in this cluster focus on Facebook users (R8, R26) and general social media users (R74, R85) as units of analysis.

4.4.3. Cluster 3: Problematic social media use

4.4.3.1. Central themes. The papers in the PSMU cluster (blue), the third-largest cluster of FoMO research, have increased as of 2012. The focus of this cluster is the negative consequences of social media use, such as problematic behavior. On the other hand, this cluster has some differences from the social media cluster. For example, the social media cluster focuses more on general social media use (e.g., social media engagement and students' use of social media). In contrast, the PSMU cluster only considers social media's dark side, such as problematic behaviors and habits. Social media is not just about the dark side, and it also has non-negative effects on human life.

Terms such as "PSMU," "disordered social media use," "excessive social media use," "addictive social media use," "compulsive social media use," and "dependent social media use" are used interchangeably in the literature to refer to the same problematic behavior (Bányai et al., 2017; Okazaki et al., 2021). PSMU is the appearance of key symptoms related to behavioral addictions in its extreme cases, such as salience, mood modification, tolerance, withdrawal symptoms, conflict, and relapse, and refers to uncontrolled, excessive social media use (Griffiths, 2005; Kircaburun et al., 2020). Moreover, recent meta-analytic studies have revealed that there is a positive relationship between PSMU severity and FoMO (Fioravanti et al., 2021; Zhang et al., 2021).

There are some terms (themes) that appear in the PSMU cluster, such as social media addiction (e.g., social networking sites addiction) (R33, R63, R88, R89). A subcategory of internet addiction, social media addiction focuses on online social networks (Longstreet & Brooks, 2017). This term refers to a mental state where people become addicted to using social media to the point where they show signs of behavioral addiction (Chen, 2019). It has been suggested that higher levels of FoMO may contribute to such addictive behavior (Li et al., 2022). Moreover, previous empirical research has found positive associations between FoMO and social media addiction (Al-Menayes, 2016; Fabris et al., 2020).

Another term that draws attention to the articles in the PSMU cluster is social media use intensity, as in the social media cluster (R2, R21). People believe that social media use intensity is the essential risk factor for the emergence of negative consequences, such as PSMU (Oberst et al., 2017). It also is asserted that increased social media use intensity (excessive use) may lead to PSMU (Müller et al., 2016). Furthermore, there is a positive relationship between FoMO and social media use intensity (Oberst et al., 2017; Roberts & David, 2020).

4.4.3.2. Key theoretical influences. A few theories were used in the PSMU cluster, which is formed for the most cited papers in FoMO research. For example, we observed that Festinger's social comparison theory (R59) draws attention to this cluster. This theory proposes that we use others as sources of comparison to understand who we are, how we perform, and our talents, social standing, and performance (Dinh & Lee, 2021; Festinger, 1954). Nowadays, social media offers people important opportunities to make social comparisons as it allows them to interact with others (Dinh & Lee, 2021; Pahlevan Sharif et al., 2022). Content and interactions shared by other users on social media (e.g., photo sharing or status updates) can be used for social comparison processes (Krause et al., 2021). Moreover, according to some empirical evidence, there is a positive correlation between excessive social media use/PSMU and social comparison (Pahlevan Sharif et al., 2022). Especially social comparison on social media can lead to PSMU behavior. Furthermore, there is a positive relationship between FoMO, conceptualized by Przybylski et al. (2013) as a construct that includes social relationship needs and social comparison orientation. That is why FoMO is more likely to emerge in social media settings for those with a high social comparison tendency (Reer et al., 2019).

Another theoretical approach in the PSMU cluster is the cognitive-behavioral model of pathological internet use (PIU) (R95). This model is used as a theoretical approach to contextualize current issues regarding PSMU (Dhir et al., 2021). According to Davis (2001), this model postulates that PIU is caused by problematic cognitions combined with actions that either enhance or perpetuate the maladaptive reaction. The cognitive-behavioral model of PIU has been used frequently in PSMU research in recent years (see Fioravanti et al., 2020; Longstreet & Brooks, 2017). Based on this model, it was determined that there is a relationship

between PSMU severity and psychological well-being, self-esteem, and affect (Schivinski et al., 2020). Furthermore, overuse of the internet can occur in those with a maladaptive mental state, according to the cognitive-behavioral model of PIU. Given that FoMO is classified as a kind of concern related to undesirable results, FoMO may be seen as a maladaptive psychological position in general (Davis, 2001; Przybylski et al., 2013; Wang et al., 2019). Finally, SDT (R1), social capital theory (R102), social rank theory of depression (R86), UGT (R100) are other theoretical employed in the PSMU cluster.

4.4.3.3. Characteristic methodological approaches. As in the prior two clusters, the cross-sectional survey is the most used research design in the PSMU cluster (R1, R2, R11, R40). In addition, while there are some conceptual articles (R24, R95) and review articles (R33, R88, R89, R100) in this cluster, only one experimental study has been conducted (R42). On the other hand, only one article was published using the qualitative method/focus group (R32). SEM (R1, R2, R11, R101) and regression analysis (R21, R65, R86, R102) draw attention as analytic methods in articles from the PSMU cluster.

The papers in the PSMU cluster mostly focused on general social networking sites (R2, R24, R33, R63) and Facebook (R21, R42, R65, R86) in terms of platforms. Because excessive Facebook use is frequently examined in the literature as problematic behavior, it can be considered a sub-field of PSMU. And even recently, most research on PSMU has explicitly focused on problematic Facebook use (Ruggieri et al., 2020). On the other hand, study participants in the PSMU cluster were mostly university students, as in the prior two clusters (R21, R32, R40, R42). Since this age group is among the most prolific groups in social media settings, researchers frequently prefer these samples/participants in PSMU studies. In addition, the articles draw attention as a unit of analysis/sample in this cluster because there are some important review studies (R33, R99, R100).

4.4.4. Cluster 4: Problematic smartphone use

4.4.4.1. Central themes. Articles in the PSU cluster (yellow), the fourth and latest cluster of FoMO research, have increased as of 2015. The focus of this cluster is the negative aspect of smartphone use, such as problematic behavior and excessive use. Currently, several terms are used interchangeably to describe this behavior: “PSU,” “maladaptive smartphone use,” “smartphone addiction,” “smartphone dependence,” “nomophobia,” and “excessive smartphone use” (Billieux et al., 2015; Elhai, Levine, et al., 2017; Panova & Carbonell, 2018). Though these terms are accepted and used extensively by many scholars in the behavioral addiction discipline (Li et al., 2022), we preferred to use PSU in this study, as noted by some scholars (Elhai et al., 2016; Elhai, Levine, et al., 2017). PSU is characterized by excessive smartphone usage, withdrawal symptoms while not using phones, and functional impairment (Billieux et al., 2015; Elhai, Levine, et al., 2017). Furthermore, a growing number of individuals are concerned about losing out on fun social

interactions (FoMO) because of the widespread usage of social media apps and the corresponding rise in smartphone ownership (Servidio, 2021). Also, people with high FoMO levels are motivated to stay online permanently via smartphones to stay connected to their social world, leading to excessive smartphone use/PSU (Servidio, 2021; Zhou, 2019). Consequently, previous empirical studies have shown that there is a positive relationship between PSU severity and FoMO (Elhai et al., 2016; Li et al., 2022; Oberst et al., 2017). To summarize, it is not surprising that a PSU-related cluster occurs in FoMO research.

The most prominent theme in the PSU cluster is that of psychopathological problems such as depression and anxiety (R3, R21, R53, R80, R91). Jenaro et al. (2007) have emphasized that there are relationships between cell phone overuse and additional symptoms of broader moods such as depression and anxiety. First, previous research has determined inverse associations between PSU and depression severity (R3, R53), similar to that of FoMO. For example, Demirci et al. (2015) found a positive relationship between both, while Elhai et al. (2016) found a negative relationship. On the other hand, there is uncertainty in the literature about which of these two variables can be the antecedent and which is the outcome variable. In some studies, depression was found to be an antecedent of the PSU (Babadi-Akash et al., 2014; Elhai, Dvorak, et al., 2017), while in others it was found to be an outcome of PSU (Demirci et al., 2015; Thomée et al., 2011). A recent longitudinal study found that depressive mood may be an outcome of PSU in emerging adults (Coyne et al., 2019). These individuals may be more prone to depressive states if they use technology for extended periods or increase disconnection from their social environments (Baker & Algorta, 2016). However, a study put forward that those individuals who are depressed might be less interested in their smartphones for several reasons (Elhai et al., 2016). It is pointed out that these individuals may tend to especially avoid the social sides of technology use due to social withdrawal (Elhai, Levine, et al., 2017). These inverse relationships might exist because of different measurements or methodologies used in different research or as a result of eliminating other essential factors that play a role (Radtke et al., 2022; Wolniewicz et al., 2020). Consequently, according to most scholars and theories depression may be what triggers some people to engage in PSU (Elhai, Dvorak, et al., 2017; Kara et al., 2021; Xu et al., 2019).

Second, studies have suggested that there is a positive relationship between PSU and anxiety severity (R3, R21, R53, R91). Especially, PSU may lead to state anxiety in users when the device is absent (Cheever et al., 2014). Nevertheless, according to the cross-sectional survey, anxiety severity can predict on PSU (Billieux et al., 2015; Elhai, Dvorak, et al., 2017). Also, anxiety is predicted by FoMO, which in turn predict PSU severity (Elhai, Gallinari, et al., 2020). However, a longitudinal study found that anxiety is not shown to be related to PSU, either as an antecedent or outcome of PSU (Coyne et al., 2019). Finally, in previous studies, FoMO has been found to mediate the effect of depression and anxiety on problematic technology use such

as PSU and PSMU (Dempsey et al., 2019; Elhai, Gallinari, et al., 2020; Oberst et al., 2017; Wolniewicz et al., 2020). Consequently, according to most scholars and theories, anxiety (like depression) may drive PSU (Billieux et al., 2015; Elhai, Dvorak, et al., 2017; Hong et al., 2012).

4.4.4.2. Key theoretical influences. In the PSU cluster, which consists of the most cited articles in FoMO research, a few notable theories have been used by researchers. For instance, flow theory draws attention to this cluster (R47, R68). Csikszentmihalyi (1975) describes flow as a positive and pleasurable sensation that arises from engaging in a worthwhile activity in and of itself. Boredom or anxiety will not take over if the flow state is maintained via the usage of skills and steady increases of difficulties and skills (Csikszentmihalyi, 1990). This theory has been used frequently in computer-mediated environments such as the internet, webpages, social media, mobile services, and computer games in the last two decades (Valinatajbahnamiri & Siahtiri, 2021). Furthermore, because of smartphones' usefulness, the convenience of use, fashion engagement, and flow, people are eager to use them (Yang & Shih, 2020). However, flow theory posits that mobile technology use might cause problematic behavior such as PSU (Salehan & Negahban, 2013). PSU will be more likely to occur, as individuals with FoMO are thought to be more involved in the online flow process (Görgün Devenci & Ünal, 2021). Moreover, previous empirical studies have found that there is a relationship between flow and PSU severity (Pearson et al., 2021; Zhang et al., 2014). According to recent research, the lack of flow experience due to PSU leads to lower life satisfaction (Pearson et al., 2021).

On the other hand, UGT theory (R91), behavioral addiction model (R19), the Cain and Gradisar (2010) Model (R98), extended-self theory (R80), and embodied motivated cognition (R80) are other theoretical approaches used only once in the PSU cluster.

4.4.4.3. Characteristic methodological approaches. Similar to previous clusters, the cross-sectional survey is the most widely used design in the PSU cluster (R3, R37, R38, R41). Also, one experimental study (R89) and literature review (R19) were used. On the other hand, the exploratory sequential (mixed method) research design was preferred in one study (R103). Furthermore, SEM was preferred as the analytic technique in some studies in this cluster (R13, R38, R47, R91). However, partial least squares structural equation modelling (PLS-SEM) was used in one study (R47). Researchers preferred PLS-SEM apart from one exception (R97) for the first time among the most cited articles in FoMO research. Moreover, a few articles used regression analysis (R3, R73, R98), while three articles used ANOVA/ANCOVA (R71, R80, R98), and one article used latent profile analysis (R37).

The articles in the PSU cluster extensively focused on smartphone use as expected in terms of the platform (R38, R41, R44, R53). Few articles have focused on general social media use regarding platforms (R37, R47). Today, smartphone and social media use are intertwined and inseparable

parts of each other. People mostly use social media on their smartphones. Thus, it is usual for general social media to be preferred as a platform for research in the PSU cluster. Furthermore, the samples in the PSU cluster are mostly college students, as in other clusters. Because these persons are more frequent users of online technological devices such as smartphones and browse social networking sites via these devices, they are frequently preferred in smartphone and social media research as samples (Arya et al., 2022). Moreover, Amazon's Mechanical Turk (Mturk) users draw attention as a unit of analysis in the articles in this cluster, as well as college students (R3, R91). Mturk is a platform that is frequently used in social and behavioral sciences research and has most of what is needed for research participant recruitment (Buhrmester et al., 2011; Shapiro et al., 2013).

4.4.5. Future research agenda

Based on the clusters revealed in this research, our propositions for future research are discussed elaboratively below. We expect that scholars will have many research opportunities thanks to these propositions. We have summarized them in Table 3.

When we look at the clusters that emerged from co-citation analysis in this research, it is seen that the large majority of articles were published in the field of psychology. In the marketing field, only one study was found in cluster 1 (R70). However, many studies have been conducted in recent years on the relationship between FoMO and marketing (e.g., Bui et al., 2022; Dinh & Lee, 2021; Zhang et al., 2020). Nevertheless, additional research is also needed to understand how FoMO can be addressed in social media marketing practices. For example, it is known that promotional ads published on social media platforms increase unplanned purchases. Even if the consumer does not need the product, they can buy it due to the promotional price (Jebarajakirthy et al., 2021). FoMO may be a potential mediator variable in this relationship. Because promotional ads may increase FoMO, consumers may make an unplanned purchase of the product included in the relevant ads. Moreover, whether this relationship chain can result in regret or satisfaction with the unplanned purchased can be investigated in future research. From this point of view;

Proposition 1 (a). FoMO might mediate the relationship between promotional ads on social media platforms and unplanned purchasing behaviors, which in turn can lead to post-purchase regret or satisfaction.

Similarly, the unbiased product experiences shared by consumers through social media may directly influence the buying decisions of others (Chang & Dong, 2016). However, FoMO triggers users' negative affectivity like depression, stress, and anxiety. Social media acts, including liking, sharing, and commenting about social media ads, might reduce eWOM regarding practices of consumption experiences due to negative affectivity (Bui et al., 2022). In such a case, the decrease in online social support of consumers and the lower in eWOM affects their purchase intention, which may also cause a decrease in sales (Alves et al., 2016; Riaz et al.,

Table 3. Selected future research propositions.

Future research agenda	Research proposition
<i>Central themes</i>	<p>1(a). FoMO might mediate the relationship between promotional ads published on social media platforms and unplanned purchasing behaviors of consumers, which in turn can lead to post-purchase regret or satisfaction.</p> <p>1(b). In the future, causal relationships among FoMO, negative affectivity, eWOM, and purchase intention should be investigated via an experimental study.</p> <p>3. Future research can examine the relationships between FoMO and dissemination of fake news or the intention to verify before sharing news, using the modern techniques above and comparing the accuracy of these models with traditional statistical models.</p> <p>4. Future research should examine potential moderator variables between FoMO and PSMU.</p> <p>5. PSU might have a mediating role in the relationship between FoMO and social media fatigue. These relationships should be further explored in the future studies.</p>
<i>Theoretical perspective</i>	<p>2(a). Concrete and abstract ways of thinking can moderate the relationships between FoMO and other variables (procrastination, negative affectivity, PSMU, PSU, etc.) in terms of CLT.</p> <p>2(b). From the perspective of two-stage flow and source credibility theories, the relationship among influencers creating FoMO for the products, purchase intentions, and post-purchase experiences should be examined empirically in future research.</p>
<i>Methodological approach</i>	<p>6. Future research should consider more studies with experimental and longitudinal designs in order to examine the cause-outcome relationships between FoMO and social media, negative affectivity, PSMU, and PSU clusters.</p> <p>7. Given that the quantitative techniques are the main methodological approach in the clusters, future research may use a qualitative or mixed-methods approach to gain further insights and meanings about FoMO.</p>

(1) FoMO: Fear of missing out; eWOM: Electronic word of mouth; PSU: Problematic smartphone use; PSMU: Problematic social media use; CLT: Construct level theory.

2021). However, there is a scarcity of empirical research on this process. Consequently;

Proposition 1 (b). In the future, causal relationships among FoMO, negative affectivity, eWOM, and purchase intention should be investigated via an experimental study.

In the FoMO studies, STD, SSO, social comparison theory, CIUT, I-PACE, UGT were the most preferred theoretical lenses in the clusters formed by the most cited articles. Some theories may not always be specific enough to explain the phenomenon; thus, further theoretical approaches are required to better understand FoMO's mechanisms and consequences (Maseda et al., 2022). For example, FoMO can be investigated from the perspective of construct level theory (CLT). By relating the degree of mental abstraction to psychological distance, CLT provides a useful paradigm for explaining processes that drive assessments, predictions, and actions (Adler & Sarstedt, 2021). According to CLT, people can perceive a phenomenon in concrete and detailed or abstract and undetailed/straightforward way (Trope & Liberman, 2010). Also, it was found that individuals who think abstractly show more procrastination while performing their tasks than those who perceive concretely (McCrea et al., 2008). On the other hand, a recent study revealed that individuals with excessive procrastination are more likely to experience FoMO in online settings (Müller et al., 2020). Therefore, examining the procrastination behavior and FoMO in terms of CLT may unveil the connections between FoMO and CLT elements.

Proposition 2 (a). Concrete and abstract ways of thinking can moderate the relationships between FoMO and other variables (procrastination, negative affectivity, PSMU, PSU, etc.) in terms of CLT.

In line with Tandon, Dhir, Almgren et al. (2021), FoMO researchers are expected to further develop the theoretical perspectives of FoMO by applying theories from

sociology, media and communication, marketing, and psychology. FoMO can be studied in the context of communication through media effect theories. For example, according to Katz and Lazarsfeld (1955) two-stage flow theory, information in the media reaches opinion leaders first, and then the public and the opinion leaders have the role of mediating between the media and public at this stage. Today, being identified as “digital opinion leaders,” “bloggers,” “influencers,” “phenomena,” and “celebrities,” these people are more involved in the digital world (Uzunoğlu & Misci Kip, 2014). Additionally, they are defined as users with large number of connections affecting the attitudes or behaviors of others through eWOM (Moldovan et al., 2017). By creating promotional content related to products or brands, these individuals ensure marketing efforts to be more effective. Also this type of influencer marketing is called product placement strategy or native advertising (Lee & Eastin, 2021) by which the influencer can possibly increase consumers' purchase intentions (Yıldız, 2021).

Furthermore, some studies on influencer marketing are based on source credibility theory (Djafarova & Rushworth, 2017; Teng et al., 2014). The influencers' trustworthiness, attractiveness, and expertise are all factors in this theory (Ohanian, 1990). The credibility perceptions of influencers enable followers to rely on and accept the premises which developing favorable attitudes towards eWOM messages (Teng et al., 2014). If the influencer emphasizes that the product s/he is promoting is especially scarce (e.g., “don't miss out” or “limited edition”) or discounts, this may cause an increase in consumer concerns about missing out on the products. Depending on the level of source credibility, the referrals can boost buying intentions, which in turn, leads to satisfaction, regret, or frustration during the post-purchase period (AlFarraj et al., 2021; Dinh & Lee, 2021).

Proposition 2 (b). From the perspective of two-stage flow and source credibility theories, the relationship among

influencers creating FoMO for the products, purchase intentions, and post-purchase experiences should be examined empirically in future research.

As in the field of marketing, only one article (R102) in the clusters that emerged in this study was conducted with a direct communication focus. In the last few years, there has been an increase in research investigating FoMO in the context of communication (e.g., Ahmed, 2022; Talwar et al., 2019). For instance, a study has found that FoMO can expose social media users to critical or hurtful comments, fake news, and rumors (Nottingham Trent University, 2016). It has become easier for fake news to spread in social media settings. It is becoming increasingly difficult for users to realize whether the content on these platforms are real or fake (Michael & Breaux, 2021). This situation has led to the emergence of the motivation of intention to verify news before sharing. The relationship between FoMO and intention to verify before sharing is still unclear, and more empirical research is needed. Moreover, advanced techniques such as artificial intelligence, machine learning, natural language processing, and deep learning can automatically analyze users' insights into fake news (Manzoor et al., 2019; Ravi & Ravi, 2015; Zhuk et al., 2018). Therefore;

Proposition 3. Future research can examine relationships between FoMO and dissemination of fake news or the intention to verify before sharing news, using modern techniques above and comparing the accuracy of these models with traditional statistical models.

As can be seen in Cluster 3, many studies have been conducted to examine the relationships between FoMO and PSMU, and an important body of knowledge has emerged. In these studies, mostly direct and indirect effects (mediation) were examined. However, more research is needed on the moderating effect of different variables to better understand the mechanism between the two variables. For example, a recent meta-analysis suggests (Fioravanti et al., 2021) that the strength of the relationship between FoMO and PSMU severity may vary depending on specific situations. These results point to potential moderators between the two variables. To illustrate, social media usage duration or frequency, gender, education, different social media engagement levels (e.g., light, moderate, and heavy users), the tool used to login to social media (e.g., smartphone, computer, etc.), and the five-factor personality traits can be moderators in the relationship between FoMO and PSMU. From this viewpoint;

Proposition 4. Future research should examine potential moderator variables between FoMO and PSMU.

Some studies have found that FoMO triggers social media fatigue (Bright & Logan, 2018; Tugtekin et al., 2020). One of them revealed that FoMO does not directly lead to social media fatigue but indirectly affects via PSMU (Dhir et al., 2018). In addition, PSU is known to predict on social media fatigue (Tugtekin et al., 2020). Therefore, PSU, just as PSMU, may be a mediating variable in the relationship between FoMO and social media fatigue. For this reason;

Proposition 5. PSU might have a mediating role on the relationship between FoMO and social media fatigue. These relationships should be further explored in the future studies.

As the clusters have indicated, the vast majority of articles in the FoMO literature have adopted quantitative methods using a cross-sectional research design. While such design can help researchers explore significant relationships between variables, they are incapable of providing evidence on temporal or causal relationships (Parry et al., 2021). In addition, SEM was mainly performed as an analysis technique in these studies. Despite providing robust validity tests to examine the relationships, the SEM methodology is insufficient in itself to test causal relationships (Noar, 2003). The most basic condition for testing causality between variables is to design rigorous experimental and longitudinal studies. In research designs that do not have an experimental design, it is unclear which of the variables is the cause and which is the outcome. For instance, FoMO can be both a cause and an outcome of PSMU or PSU, and a vicious circle can occur between FoMO and these variables (Li et al., 2022; Sette et al., 2020). In line with recent calls for research (Tandon, Dhir, Almugren, et al., 2021), therefore, there is a need for rigorous experimental and longitudinal studies on FoMO.

Proposition 6. Future research should consider experimental and longitudinal designs to examine the cause-outcome relationships between FoMO and social media, negative affectivity, PSMU, and PSU clusters.

It is evident that quantitative research procedures are the main methodological approaches in all four clusters. These results demonstrate that despite the relatively young research topic, there is a tendency towards theory testing rather than theory development (Alayo et al., 2021). Whereas the quantitative methodology is widely used in behavioral sciences to examine the complicated relationships (Hyun et al., 2022), qualitative and mixed procedures provide a more detailed understanding on causal relationships that interact with one another. Thus, these methods can also likely be used to address specific current and future issues (Maseda et al., 2022). Therefore;

Proposition 7. Given that the quantitative techniques are the main methodological approach in the clusters, future research may use a qualitative or mixed-methods approach to gain further insights and meanings about FoMO.

5. Conclusion

Despite the growing research interest in FoMO in recent years, relatively few previous reviews have been undertaken to understand the literature coverage of the subject entirely. In this review, we aimed to provide an overview of the FoMO research field, explore the field's intellectual structure, and provide a future research agenda based on FoMO articles published in journals. This study provides an important

complement to the previous few attempts to review FoMO. In addition, the current paper is the first to attempt to review FoMO-related research by applying bibliometric analysis and systematic review in a two-step approach to synthesize the topics studied in the FoMO field and present some future research trends.

This review contributes to the literature in several ways, seeking answers to the research questions we have put forward (RQ1, RQ2, and RQ3). We first noted the annual scientific production of the FoMO to present its recent standing. Publications on FoMO have rapidly increased in recent years. Not only increases in the number of social media platforms and users but also increases in the number of researchers and journals may have influenced the number of studies on FoMO, which is a popular topic. Furthermore, the number of papers related to FoMO has started to increase much more since 2019. One of the main reasons for this increase may be the COVID-19 pandemic process. The pandemic has accelerated technology adoption and social practices associated with the adoption of technologies (Lim, 2021). It is suggested that FoMO may be one of the main factors of various problematic technology use because of the impact of COVID-19 (Throuvala et al., 2021). In addition, the need for a holistic understanding of the subject, together with the increase in the number of publications and the body of knowledge, have led to the publication of several reviews on FoMO in the last few years (e.g., Akbari et al., 2021; Elhai, Yang, et al., 2021; Fioravanti et al., 2021; Tandon, Dhir, Almgren et al., 2021; Zhang et al., 2021). As a result, it is expected that the number of publications related to FoMO will raise day by day. With a straightforward Google Scholar search, some 2.910 FoMO-related publications appear to have been published by the end of the first half of 2022.

Second, we applied citation analysis, which is used as an impact measure. When an article has higher citation, it is seen as significant (Zupic & Čater, 2015). In addition, articles having a greater citation count are assumed to be at least 5 years old since the number of citations rises with time (Jain et al., 2021). According to citation analysis in this study, the article containing the first scale development study on FoMO is by far the most influential publication in the field (Przybylski et al., 2013). Besides this article, other most influential publications were those that were more than five years old (Alt, 2015; Beyens et al., 2016; Elhai et al., 2016; Oberst et al., 2017). Consequently, the heavily cited articles in the literature are considered by many scholars as an important contribution to the field (Üsdiken & Pasadeos, 1995). Third, we applied co-citation analysis to explore the intellectual structure of FoMO studies. This intellectual structure consists of the most cited articles in FoMO research, is divided into four clusters: social media, negative affectivity, PSMU, and PSU.

Fourth, by applying a systematic review to clusters representing the intellectual structure of FoMO, we discussed them separately in the context of central themes, key theoretical influences, and characteristic methodological approaches. This approach can assist scholars who wish to have a

comprehensive overview of the scientific literature produced so far. Moreover, the complementarity of co-citation and systematic review is highly plausible in examining emerging research areas. Using these two-stage methodological approaches provides a strong methodological basis and contribution to identifying key aspects of how the research field has evolved and speculating about new perspectives or directions in research on the subject (Alayo et al., 2021; Maseda et al., 2022). Fifth, based on the two-stage methodological approach, we presented a research agenda with a total of nine propositions for future research. If reviews identify knowledge gaps as well as existing knowledge, this indicates a need for research and raises potential research questions for future studies (Denyer & Tranfield, 2009; Jain et al., 2021). Therefore, scholars can design new studies using the research agenda we have presented and thus make an important contribution to the FoMO corpus.

Finally, our review findings also offer practical implications. Practitioners should carefully consider FoMO to reduce the prevalence of negative affectivity, PSU, and PSMU evoking the dark side of social media. Increasing the well-being and self-esteem among society or users can reduce the influence of such dark sides. In addition, governments should in particular raise awareness about the negative consequences of the heavy use of social media. If these consequences are not prevented, it is inevitable that societies will come face to face with more severe individual and social problems. Furthermore, technology and social media company managers should consider the negative consequences of technology use when designing their tools and platforms and improving the user experience.

Our research has limitations, just like any other study. Firstly, we included literature on FoMO in the Scopus database up to October 2021 and excluded studies published in other databases, which may also mean that information from publications in different databases and non-indexed journals with less international circulation is lost (Monteagudo-Fernández et al., 2021). Therefore, care should be taken when generalizing the results and future research may consider including databases such as Google Scholar and WoS. Second, in the dataset of this study, only research and review articles in peer-reviewed journals were evaluated; other types of publications were excluded. Thus, our analysis may have suffered from the “file drawer effect.” Future studies should consider documents, such as conference papers, letters to the editor, books, and book chapters (grey literature) to generalize our findings. Third, we only considered articles written in English and did not include others in the search.

Fourth, although our overall publication size was relatively large, we encountered technical limitations in co-citation analysis. For example, as bibliometric analyses such as citation and co-citation are retrospective, recent studies do not have enough time to be cited, and thus previous studies have higher citation counts (Dharmani et al., 2021; Ramos-Rodríguez & Ruíz-Navarro, 2004). In addition, it is only possible to classify a small number of the documents linked to by co-citation analysis (Ramos-Rodríguez & Ruíz-Navarro, 2004). We were able to apply co-citation analysis to only 103 articles in this review.

Because the VOSviewer program may reveal complex and incomprehensible images when a large number of articles are included in the analysis, and the interpretation of the results becomes very difficult. In addition, there is no consensus on the cut-off point for co-citation analysis in the literature (Köseoglu, 2020). As a result, these situations may have disadvantaged the formation and subjective interpretation of clusters (Maseda et al., 2022). Future research can apply text-net analysis or latent Dirichlet allocation (LDA) to overcome these limitations. These two approaches are more comprehensive than co-citation analysis and can be applied to any size data because they analyze the entire sample (Köseoglu, 2020). Furthermore, we have considered the most cited articles in the citation and co-citation analysis process in this study. However, PageRank analysis is one of the calculations used to measure recent publications' impact, quality, and prestige. This analysis can also be applied to clustering processes to reveal themes in a field (Ding et al., 2009; Donthu et al., 2021). Hence, future research can also identify the most influential and prestigious publications through PageRank calculation.³

Consequently, bibliometric analysis can indeed help increase the amount of objectivity in systematic reviews, but it still has these limitations that we should be aware of (Maseda et al., 2022). Despite these limitations, this review makes significant contributions by providing a state-of-the-art understanding for readers, identifying the body of knowledge and gaps, advancing knowledge in the field of FoMO, and presenting a future research agenda for future study.

Notes

1. The citation numbers in this study are based on the publications in the references of 314 articles in our data set. That is, these publications are cited by the total number of references in our dataset as many times as in this study. In brief, these numbers do not represent global citations. On the other hand, although we carefully reviewed all the articles included in our dataset, we do not cite all of them as this would increase the length of our article. The full list of datasets is available as an [online supplement](#).
2. We present the most-cited articles of FoMO-related articles in the co-citation analysis. For this reason, several FoMO studies have cited Festinger (1954). This gives us a clue about how the FoMO field is shaped.
3. We would like to thank an anonymous reviewer for bringing this limitation to our attention.

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Author contributions

Fatih Çelik: Conceptualization, Literature review, Methodology, Investigation, Resources, Validation, Data curation, Writing-Original draft preparation, Project administration.

Mehmet Ali Koseoglu: Methodology, Validation, Formal analysis, Software, Visualization, Writing-reviewing and editing.

Jon D. Elhai: Supervision, Writing-reviewing and editing.

Ethical approval

This research has never been published before and is not currently considered by another journal. All the authors approved the article in the study, and they all agreed to submit it.

Disclosure statement

The authors declare that they have no conflict of interest regarding this paper. However, outside the scope of the present paper, Dr. Elhai notes that he receives royalties for several books published on posttraumatic stress disorder (PTSD); is a paid, full-time faculty member at University of Toledo; occasionally serves as a paid, expert witness on PTSD legal cases; and receives grant research funding from the U.S. National Institutes of Health.

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