

Wikipedia gender gap: a scoping review

Núria Ferran-Ferrer; Juan-José Boté-Vericad; Julià Minguillón

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Núria Ferran-Ferrer ✉

<https://orcid.org/0000-0002-9037-8837>

Universitat de Barcelona
Fac. d'Informació i Mltjans Audiovisuals
Centre de Recerca en Informació,
Comunicació i Cultura
Melcior de Palau, 140
08014 Barcelona, Spain
nferranf@ub.edu



Juan-José Boté-Vericad

<https://orcid.org/0000-0001-9815-6190>

Universitat de Barcelona
Fac. d'Informació i Mltjans Audiovisuals
Centre de Recerca en Informació,
Comunicació i Cultura
Melcior de Palau, 140
08014 Barcelona, Spain
juanjo.botev@ub.edu



Julià Minguillón

<https://orcid.org/0000-0002-0080-846X>

Universitat Oberta de Catalunya
Estudios de Informática, Multimedia y
Telecomunicación
Rambla del Poblenou, 156
08018 Barcelona, Spain
jminguillona@uoc.edu

Abstract

In this scoping review, we portray an examination of the gender gap on *Wikipedia* by analyzing scholarly literature from 2007 to 2022. Employing quantitative methods, the study identifies key author characteristics such as gender, disciplines, countries, and institutions. The research reveals a slight majority of female authors, followed by male authors, with limited representation from non-binary authors. Qualitatively, content analysis uncovers two central themes: addressing the contribution gap and incorporating content related to underrepresented genders. Additionally, the study assesses results on the content gap, editing and participation bias, readership imbalances, and strategies to mitigate the gender gap. Furthermore, it explores the repercussions of this gap and categorizes the contributing factors as "the women's problem," "the mirror effect," and "the systemic problem." Overall, this comprehensive review enhances our comprehension of the *Wikipedia* gender gap and provides valuable insights into the research landscape in this domain.

Keywords

Wikipedia; Scoping review; Online collaboration; Open content; Gender gap; Content gaps; Publication trends; Community engagement; Editing biases.

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1. Introduction

Information and communication technologies have expanded opportunities for pluralism and new forms of expression, fostering an interconnected public sphere (Castells, 2008). *Wikipedia*, a key component of this modern public sphere, uniquely enables more equitable knowledge production through collaborative efforts and virtual discussion spaces. *Wikipedia* embraces the ideals of intellectual democracy, grounded in principles such as rational deliberation, consensus, and negotiation (Black *et al.* 2008). This platform has revolutionized information creation and dissemination via open collaboration (Tkacz, 2014), orchestrated by a global community of volunteers. Undoubtedly, it stands as a remarkable feat of human cooperation, involving an immense number of contributors and generating an enormous body of work. The *Wikimedia Foundation* aspires to a grand objective: “to be the sum of all existing human knowledge” (*Wikimedia Foundation*).

Since its inception in 2001, *Wikipedia* has expanded to nearly 300 languages, dominates *Google* search results, and serves as a free, reliable information source for over five billion people daily. However, concerns exist regarding its decentralization, flexibility, and openness, as it operates within existing economic, social, and political structures (Hood; Littlejohn, 2018). This can inadvertently hinder inclusivity and diversity (Ferran-Ferrer *et al.*, 2022).

Wikipedia suffers a persistent gender bias in terms of content and editorial participation. For instance, a paltry 19% of all biographies corresponds to women’s (Tripodi, 2022). Furthermore, it is worth noting that the information gaps related to women, gender, and sexual identity are not limited to English *Wikipedia* alone (Park; Bridges, 2022). To date, no data has suggested that any of the nearly 300 *wikipedias* are free from gender imbalance in editing and content.

The emergence of concerns regarding gender imbalances on *Wikipedia* did not manifest until the year 2010. Specifically, the problem was acknowledged by the *Wikimedia Foundation* and her executive director at that time, Sue Gardner, that set a goal to raise the share of female contributors to 25 per cent by 2015. Four years later, in 2014, Jimmy Wales, one of the co-founders of *Wikipedia*, openly admitted that the *Wikimedia Foundation* had failed to achieve such objective. Previously, the academic community had taken notice of the gender perspective

within *Wikipedia*, with concerns emerging in the year 2007, with Nov (2007) reporting about a questionnaire survey to identify the factors of motivation and establish the correlation between levels of motivation and contribution. However, it was not until 2009 that a paper entirely focused on the subject of gender and *Wikipedia* (Lim; Kwon, 2009) emerged, but it was in 2011 when the Wikisym conference had the two best papers about gender issues. Lam *et al.* (2011) started to quantify the gender gap in contributions and topics covered, and (Antin *et al.*, 2011) the level of activity in editing. It was revealed that women tend to be underrepresented compared to men (Lam *et al.*, 2011), although in 2015 Klein and Konieczny (2015) projected that gender parity would be achieved by 2034. However, this estimation did not account for the impact of women candidates in articles for deletion, as Tripodi (2022) noted. Lastly, the involvement of women in this community of free culture was discovered to be deficient, as evidenced in several works (Collier; Bear, 2012; Morgan *et al.*, 2013), and the policies and rules generated in this culture are contradictory and not transparent to newcomers and are enforced by experienced editors that often further their own interests and agendas (Jemielniak, 2014). In 2016, the feminist viewpoint brought attention to *Wikipedia*’s gender gap, a subject that Ford and Wajcman (2017) delved into further in connection with the platform’s inception.

Our research aims to analyze the gender gap on *Wikipedia* from 2007 to 2022 through a scoping review of academic literature. We quantitatively examine author characteristics (gender, discipline, country, institution), publication trends, and paper types. We use content analysis to identify key research themes: content gaps, editing biases, readership imbalances, gap mitigation strategies, and perceived contributing factors by scholars.

2. Materials and methods

In order to carry out our study, we employed a methodological systematic literature review, following the SALSA Framework (Grant; Booth, 2009). Figure 1 shows how the corpus of documents comprising the subject of our analysis was obtained.

The scoping review started with a query including the gender values for the gender identity in *Wikidata*, that is to say, the sex or gender property of human or animal (P21) and Queer identity (Q12964198). *Wikidata* currently encompasses a range of human gender categories, including male, female, non-binary, intersex, transgender female, transgender male, and agender. The definitions of the queries were broad enough to detect the maximum number of academic publications related to *Wikipedia* and gender, although we were aware that the proposed search queries could potentially generate overlaps and repetition in the search results. During the screening procedure, which entailed evaluating titles, abstracts, and keywords, we systematically excluded articles lacking a gender-focused perspective or those unrelated to *Wikipedia* as the central subject of investigation. Books and non-empirical papers (such as letters, editorial columns or papers without methodology section) were also excluded.

After assembling the corpus of documents, a consistent analytical framework was applied to conduct thorough examinations. Two coders used Atlas.ti software to carefully review and categorize each article. This categorization was guided by the predefined analysis variables outlined in the Analysis stage (refer to Figure 1): encompassing the paper’s focal

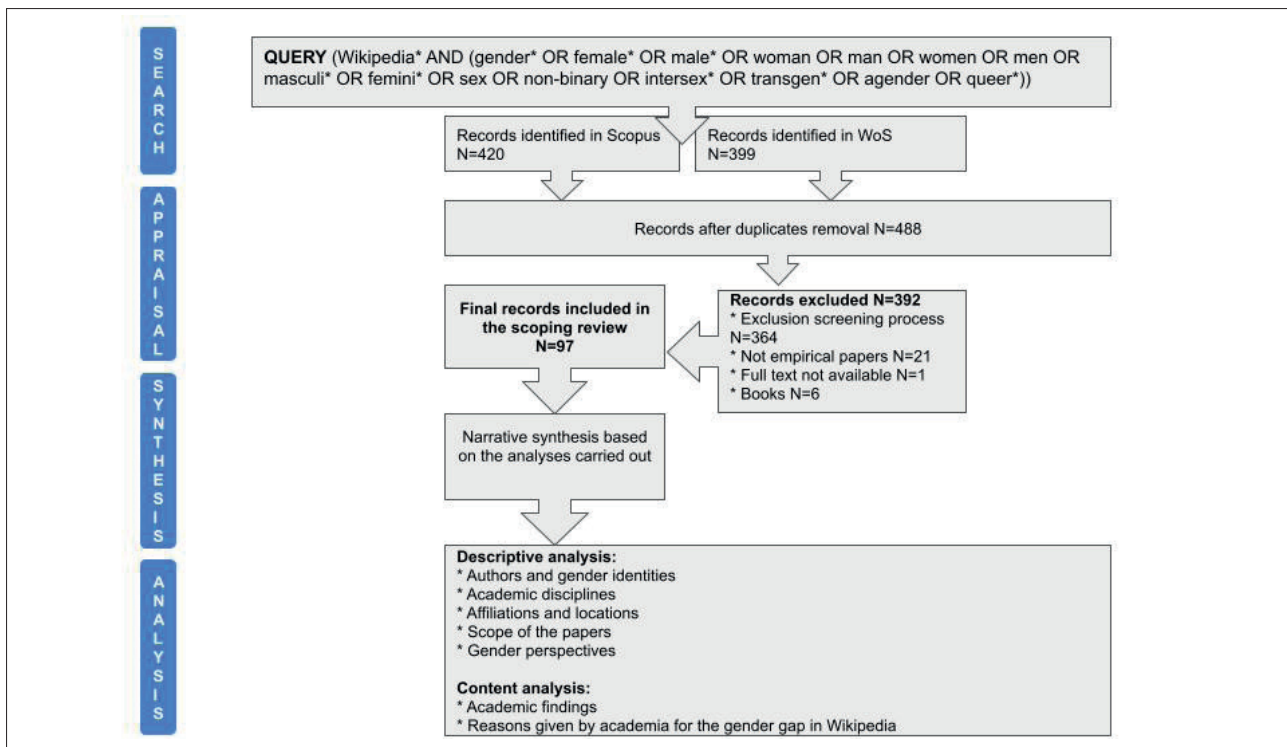


Figure 1. Adapted from the SALSAs framework (Grant; Booth, 2009)

points (including content, participation and editing practices, and readership dynamics), the research gender perspective (distinguishing between binary and non-binary categorizations), the disciplinary domain (classified based on the *EGI Glossary* of terms, while considering the primary author's disciplinary affiliation), gender and affiliations of the authors, presented paper findings, and strategies/solutions employed to address gender disparity:

<https://confluence.egi.eu/display/EGIG>

The determination of the gender identity pertaining to distinct authors was accomplished through a systematic procedure involving the correlation of author names and affiliations with the entries within the *Virtual International Authority File (VIAF)*. In instances where ambiguity persisted, we analyzed the attribute denoting gender or sex (P21) as designated within the individual author's entry in *Wikidata*. If required, additional investigation of gender-affirming pronouns was performed through analyzing 16 cases from *Google Scholar* and institutional web pages.

A reliability test was conducted between two coders and Krippendorff's alpha coefficient achieved a high level of agreement with a score of 0.848.

3. Results

In this section, we report the findings of a thorough scoping review of 97 papers (60 articles, 30 conference papers, and 7 book chapters). Our analysis is divided into two parts: descriptive analysis and content analysis, each providing distinct contributions to the comprehensive investigation.

3.1. Descriptive analysis

3.1.1. Authors

We analyzed 97 papers with 230 authors (187 unique). Most authors (155) contributed to one paper, while 32 worked on multiple. Prof. Claudia Wagner had 4 papers, 9 authors had 3, and 22 had 2 each.

Regarding gender, the number of female authors surpasses other gender identities, females comprised 54.3%, males 45.2%, and one non-binary author 0.4%. Female authors were most common as first (54), second (45), and fourth (10) authors. In terms of team composition, 16 had all-female authors, 7 all-male, and 15 had equal male and female representation.

3.1.2. Academic disciplines in which authors are engaged

To analyze the academic disciplines of the authors, our initial step was to confirm the paper for each author's associated discipline. As required, we then conducted a thorough examination of the authors' institutional affiliations to ensure the accuracy of attributions. The results showed that the discipline of Computer Science had the most authors (87) studying gender and *Wikipedia*, followed by Media and Communications (35) and Information Science (28), as shown in Figure 2. These findings emphasize the diversity of academic perspectives in this research field.

3.1.3. Academic affiliations and locations of authors

The US led the gender and *Wikipedia* research with 53 papers, followed by Germany with 12 as first authors and Spain with 8. Globally, North America had 54 papers, Europe had 31, South America had 5, Asia had 4, Australia/New Zealand had 2, and Africa had 1. These findings demonstrate global interest in the subject.

3.1.4. Focus of the papers

We categorized papers by their topics. These included content-related issues in 29 papers, editing practices in 33 papers, various forms of participation in *Wikipedia* in several papers, and 10 papers on readership. Most papers focused on the English *Wikipedia* (53), with a few covering other languages. Surprisingly, 11 papers on *Wikipedia* lacked specificity by assuming it was the English version without a clear statement. Additionally, 8 studies looked at multiple *wikipedias*, and another 8 concentrated solely on the Spanish *Wikipedia*. This difference in coverage highlights the global nature of *Wikipedia's* gender problem and the need for more comprehensive research across different language editions.

3.1.5. Chronological analysis

The analysis encompassed papers published from 2007 to 2022, revealing notable trends in document production over the years. The year 2021 emerged as a standout period, with 20 papers dedicated to the topic. Following closely were the years 2015, 2016, 2018, and 2022, each with 9 papers (see Figure 3).

3.1.6. Gender perspective

In terms of the gender perspective reflected in the papers, the majority of papers (n=79) adopted a binary perspective. Only 2 papers acknowledged limitations in options such as the *Wikipedia* user page, which only allowed categorization into male, female, or unspecified gender. Few papers (n=16) had a non-binary perspective, some of them using *Wikidata* in their study.

3.2. Content analysis results

3.2.1. Academic findings

Three areas of research have focused on the gender gap on *Wikipedia*, namely content bias, editing and participation, and readership. In addition, strategies to address this gap have also been investigated by researchers.

The gender gap on *Wikipedia*, both in editorship and biographical coverage, is widely acknowledged in academia (Hube, 2017; Falenska; Çetinoğlu, 2021). Scholars emphasize the need to address biases and barriers in order to foster a more diverse and inclusive *Wikipedia* community (Laniado et al., 2012), influenced by factors such as editor demographics, platform structure, and cultural values (Evans; Mabey; Mandiberg, 2015).

The gender gap within *Wikipedia* has a significant societal impact. Research by Luo, Adam and Brueckner (2018) shows that women's under-representation on the platform has consequences, such as their visibility and participation in communities.

Gender content gap

Women's representation on the platform remains modest, with only a range of 13.2% to 22.5% of biographies covering females, 19% according to Tripodi (2022). This disparity appears across *Wikipedia's* aspects such as article deletion, writing length, lexical choice, classification, and network position. Furthermore, multilingual notability asymmetry reveals gender discrepancies in the dissemination of biographies across multiple languages, potentially leading to biases in international audiences' perspectives.

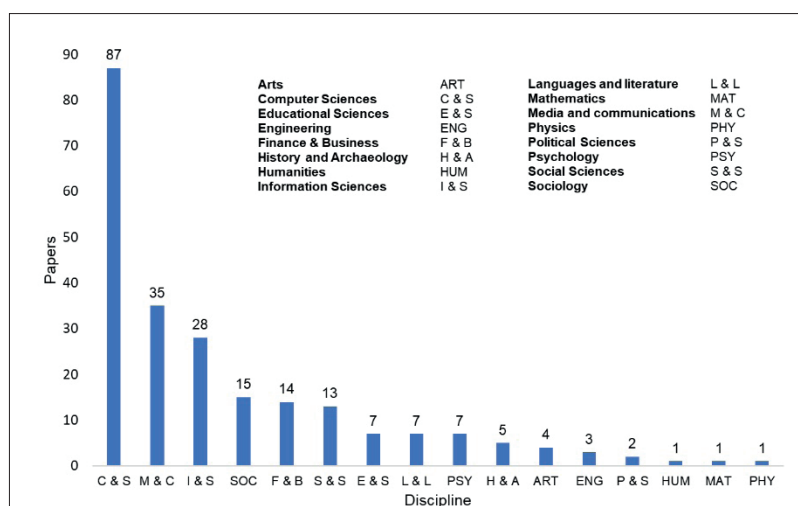


Figure 2. Distribution of authors by discipline

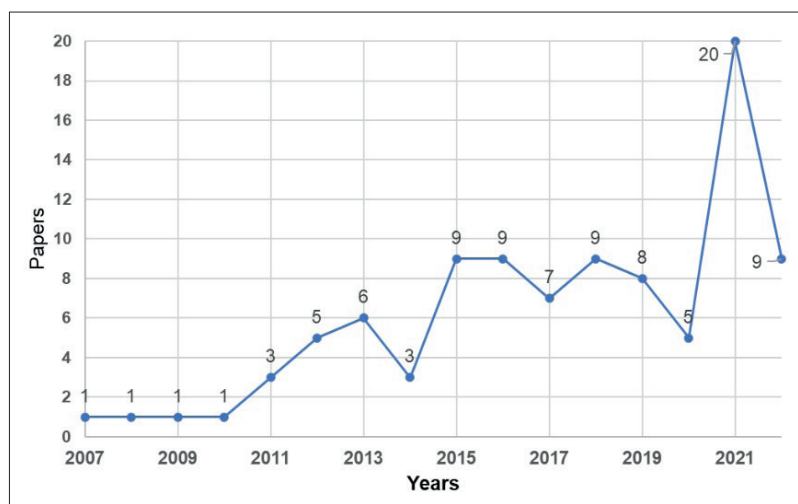


Figure 3. Document production per year

The under-representation is particularly evident in certain fields, as highlighted in studies focusing on classics (Leonard; Bond, 2019) and politics (Hollink; Van-Aggen; Van-Ossenbruggen, 2018). Numerous studies have shed light on the manifestations of gender bias on *Wikipedia*, including its intersections with race and sexuality, and the resulting experiences of safety and marginalization on the platform (Lam *et al.*, 2011; Ju; Stewart, 2019; Toupin, 2021; Tripodi, 2022).

“*Wikipedia* suffers a persistent gender bias in terms of content and editorial participation. For instance, a paltry 19% of all biographies corresponds to women’s”

Nevertheless, Adams, Brückner and Naslund (2019) research found no strong evidence that pages about women are more likely to be deleted than those about men, countering anecdotal claims of harassment and editor bans for adding notable women and minorities. In a similar vein, Worku *et al.* (2020) argued that once content relevant to women is added to *Wikipedia*, it tends to remain, aligning with previous findings on notable biographies of women scientists. The study also showed that topics likely of interest to men are more often nominated for speedy deletion, challenging assumptions about content biases. Worku *et al.* (2020) concluded that the data doesn’t strongly suggest a systematic bias from deletion activities.

However, when the emphasis shifts towards notability, as *Wikipedia* articles necessitate the inclusion of reliable sources and the demonstration of an individual’s notability in biography articles, certain studies, such as the work conducted by Wagner *et al.* (2015; 2016) have found gender disparities in content, indicating that offline biases aren’t the only explanation. In this sense, the study presented by Tripodi, (2022), suggested that women are generally seen as less notable, leading to repeated targeting of women and LGBTQ+ biographies as non-notable and subsequent nomination for deletion. The monthly proportion of women nominated for deletion on English-language *Wikipedia* exceeds the proportion of recently created available biographies about women. This significant observation highlights a concerning trend, suggesting that there may come a time when new articles about women would not be created on *Wikipedia*.

In alignment with these insights, the article from Ford and Wajcman (2017) discussed how *Wikipedia*’s structure and policies affect gender relations. They pointed out that *Wikipedia*’s foundation draws from Western scientific and free software principles, which impact gender equity. The article argued that *Wikipedia*’s identity as a fact-based encyclopedia still reflects historical (male) scientific views of expertise and has gendered technical requirements. For instance, editing *Wikipedia* articles involves difficulties in finding credible citations that meet notability and verifiability standards (Ukwoma *et al.* 2021).

Another study that revealed gender and country-based disparities is Zheng *et al.* (2022). They examined *Wikipedia*’s citation practices and found that women authors are cited less, particularly outside English-speaking countries. This marginalization within the scientific ecosystem also extends to network imbalances in article hyperlinks, which affect the visibility of biographies. Additionally, they discovered multilingual gender biases in biography dissemination, potentially leading to biases in international perspectives.

A study by Gauthier and Sawchuk (2017) highlights the significance of addressing notability, media exposure, and verification on *Wikipedia*, particularly in relation to underrepresented topics like women and aging. The study also discusses how gender bias on *Wikipedia* goes beyond biographies of women and points out how certain concepts are associated with only one gender, as indicated by asymmetrical tuples. These imbalances can impact content creation, curation, and search on *Wikipedia*, as noted by Falenska and Çetinoğlu (2021).

Wikipedia’s core principle of neutrality, alongside verifiability and notability, requires articles to include all significant perspectives from reliable sources. Menking and Rosenberg (2021) challenged this by suggesting that knowledge is influenced by context, making true neutrality impossible. The gender gap in contributions to the platform perpetuates an imbalanced coverage of topics, as evidenced by the findings presented in Hinnosaar (2019). Consequently, when participation lacks diversity, the resulting content also lacks diversity. Volunteers, driven by their interests, favor certain content, making diversity suffer (Worku *et al.*, 2020), discouraging new editors, and worsening the gender gap.

Gender gap in editing and participation

Bear and Collier (2016) confirmed a significant gender gap among *Wikipedia* editors, leading to gender-oriented disparities in content. Lir (2021) identified various barriers that hinder women from participating further on *Wikipedia*. These barriers include negative reputation, lack of recognition, anonymity, fear of being erased, experiences of rejection and alienation, lack of time, and ownership of knowledge. Another study (Kim, 2013) found that negative perceptions and constraints deter female college freshmen from editing, with differences in interests and editing behavior. Minguillón *et al.* (2021) highlighted that women tend to withdraw from editing *Wikipedia* sooner than men, particularly within the first weeks. Additionally, women were observed to behave more as collaborators rather than contributors. However, gender differences among women and men editors diminish among the most active contributors.

Women constitute a small percentage of editors on *Wikipedia*, but they contribute longer texts than men (Hinnosaar, 2019), although they tend to have lower confidence about their competence in editing. There are other notable differences in behaviour and attitudes: women are more likely to edit articles about women and show a higher inclination

to contribute to articles related to women. A study on Spanish *Wikipedia* revealed that women editors, despite editing less than men due to time constraints, reported satisfaction with their experience. Although they tend to edit fewer pages and focus on specific issues without creating new pages, a small percentage of long-term women editors exhibited equally or more active editing behaviour than men in terms of the number of edits. However, female editors tend to concentrate their edits in User and User Talk namespaces, rather than in Main and Talk namespaces that involve encyclopaedic content and discussions about it (Lam *et al.*, 2011). Some *Wikipedia* pages directly related to gender issues also tend to attract a higher percentage of female editors (Minguillón *et al.*, 2021).

The gender gap in editing on *Wikipedia* is affected by internet skills, with high-skilled males contributing more (Hargittai; Shaw, 2015). Among low-skilled users, there is no significant gender gap. However, when gender and internet skills intersect, the gap widens, especially for those with advanced skills. Some studies suggest women are not lacking digital skills, but face time constraints due to unpaid care work (Ferran-Ferrer *et al.*, 2021). It is crucial to consider time availability for women's participation. Factors like education, internet skills, and age play a role in participation gaps on *Wikipedia* (Shaw; Hargittai, 2018).

Improving the visibility of female editors on *Wikipedia* and promoting constructive feedback are crucial steps toward addressing the gender gap on the platform and enhancing the quality and inclusivity of its content (Shane-Simpson; Gillespie-Lynch, 2017). Studies have shown that the presence of visible female peers encourages women to edit collaboratively in groups. Conversely, the high proportion of anonymous editors in online spaces may discourage women from participating. Women who edited essays with constructive peer editors reported more positive evaluations from gender-neutral peers compared to anonymous peers.

Female administrators on *Wikipedia* play a significant role in fostering an atmosphere of openness and concern for others in online spaces. These female administrators diverge notably from their male counterparts by being more relationship-oriented. Additionally, Iosub *et al.* (2014) identified a special group of confident women who actively engage in discussions within the community. The insights gained from this study provide valuable understanding of community evolution and engagement, with implications for communities facing membership stagnation.

Described as feminist peer production, Toupin (2021) emphasizes the integration of race and gender into the production process. It involves social transformation, collective efforts against gender-based violence, making feminist peer production practices visible, and recognizing that all practices are rooted in situated knowledge. This perspective sheds light on the cycle of technology production and its environmental impact.

Female participation on *Wikipedia* varies by topic, with a greater presence of women in categories related to gender studies or feminism compared to STEM topics. This variation reflects traditional gender stereotypes and preferences (Cabrera *et al.*, 2018). It has also been argued that the site's generic constraints can limit women's digital credibility and authority, making it difficult for them to contribute to certain topics or to have their contributions recognized and valued by other contributors (Lukowski; Sparby, 2020).

It is worth noting that the main page of *Wikipedia* also experiences a content gap. A specific study analysed the frequency of biographies of individuals with non-heterosexual sexual orientations on *Wikipedia* and found that they are slightly more prevalent among Featured Articles. The study also observed that English celebrities receive the most visibility in this category. To address the LGBT+ content gap on *Wikipedia*, the study suggests the importance of creating articles and establishing connections to the topic within already existing articles (Miquel-Ribé; Kaltenbrunner; Keefer, 2021).

Gender gap in readership

According to Lam *et al.* (2011), *Wikipedia* has a relatively balanced gender readership (47% female). However, trustworthiness significantly affects information adoption intentions differently among genders. Male students have more positive views of *Wikipedia's* information quality than female students (Huang *et al.*, 2016). This study examined how trustworthiness influences information adoption on *Wikipedia*. It found that accuracy, stability, and validity positively impact willingness to adopt information. To enhance trustworthiness, the study suggests adding citations and external links for verification, tracking information edits for stability, and establishing clear information trustworthiness standards.

In a separate study by Lim and Kwon (2009), it was found that male students held a more positive belief in the *Wikipedia* project compared to female students, despite females showing a preference for collaboration. This divergence could be attributed to the fact that people's perceptions of *Wikipedia* are primarily shaped by the quality of information rather than its collaborative aspects. Additionally, male students reported more positive experiences with the information quality of *Wikipedia* than their female counterparts, even though there was no gender disparity in terms of years of use.

“ A growing number of female authors are now actively participating in writing about *Wikipedia* and gender, outnumbering their male counterparts in this specific field ”

“ The overall quantity of papers on the subject of *Wikipedia* and gender is steadily increasing ”

It is important to note that there is no evidence indicating lower demand for articles about women compared to those about men, as highlighted by **Lukowski and Sparby (2020)**.

Strategies to overcome the gender gap

To address the gender gap on *Wikipedia*, various strategies are employed. Women Wikipedians establish safe spaces within and outside *Wikipedia* due to differing experiences with the gender gap and safety issues. Simple interventions, like proactive moderation and positive feedback, can boost female contributions. Smaller *Wikipedia* communities are seen as more welcoming for women (**Ferran-Ferrer et al., 2021**). However, the relationship between the gender gap and harassment is intricate and requires further study (**Menking; Erickson; Pratt, 2019**).

Feminist interventions, such as women-only edit-a-thons, effectively combat gender inequality by creating secure editing environments (**Ferran-Ferrer et al., 2021**). Edit-a-thons, where women create and edit feminist content while addressing misogynistic language, have gained popularity in narrowing the gender gap. They have succeeded in increasing the coverage of African women (**Bear; Collier, 2016; Ukwoma et al., 2021**), and their contributions and serve as educational experiences (**Hood; Littlejohn, 2018**), empowering participants to challenge biases and power dynamics on *Wikipedia*.

Research also suggests that female mentorship plays a crucial role in encouraging the inclusion of more women in *Wikipedia* (**Karczewska; Kukowska, 2021**). It has been found, with network analysis software, that female mentorship encourages the inclusion of more women in various fields. In the same network analysis, it has been seen as crucial to pay attention to the portrayal of women on *Wikipedia* and adopt a more gender-balanced vocabulary when writing articles (**Leonard; Bond, 2019**).

Also, efforts to attract more women to *Wikipedia* are showing positive outcomes, but **Menking; Erickson and Pratt (2019)** the need for greater gender parity among influential editors, despite positive outcomes in efforts to attract more women to *Wikipedia*, the study emphasises the need for greater gender parity among influential editors. It is also important to address the gender disparity among the most active editors who shape policies and perform high-level tasks (**Antin et al., 2011**). Other strategies suggest that it is essential for promoting equality on *Wikipedia* to be in an inclusive approach in the design of the platform and in the governance of online communities are essential for promoting equality (**Lam et al., 2011**).

3.2.2. Reasons for the gender gap on Wikipedia

Most papers on the *Wikipedia* gender gap identify multiple factors, with three main categories: ‘women problem’ (blaming female characteristics), ‘mirror effect’ (excusing *Wikipedia*), and ‘systemic problem’ (blaming the original male-dominated editor community). However, these three explanations are often presented independently, hindering the understanding of their interconnectedness.

The women problem

The ‘women problem’ in *Wikipedia*, as discussed by **Eckert and Steiner (2013)** and cited in **Menking and Erickson (2015)**, highlights the male dominance in editing, resulting in an underrepresentation of women’s contributions (**Ukwoma et al., 2021**). In the context of editor participation within *Wikipedia*, there is a notable gender imbalance, with men outnumbering women, representing a minority percentage of the overall population (**Collier; Bear, 2012; Wagner et al., 2015; Hube, 2017**). This lack of gender diversity affects the topics covered (**Cabrera et al., 2018**) and hinders editing persistence (**Minguillón et al., 2021**). In some articles, this distortion in participation is attributed to the *Wikipedia* contribution, which is said to involve competitive and aggressive behaviour that runs counter to the traditional feminine gender role (**Bear; Collier, 2016**). Several papers related the imbalance to the lack of women’s technical skills, as pointed out by the *Wikimedia Foundation* in 2011 (**Gardner, 2011**). By contrast, it has been said that women may have more nuanced understanding of the issues and topics they want to write about, which could lead to more complex and detailed contributions, but also to a higher threshold for publishing them (**Calvo-Iglesias, 2020**).

There are compelling reasons to believe that emotional factors are also involved, as some female editors have reported feelings of isolation and emotional exhaustion (**Zhang; Terveen, 2021**), sensitivity to conflict and criticism (**Collier; Bear, 2012**), a desire for social interaction and reluctance to publicly express opinions or acknowledge their capabilities (**Sierra-Obregón; González-Fernández, 2019**). Other papers suggest that some women may find *Wikipedia* editing intimidating due to a lack of confidence, discomfort (**Kim, 2013; Calvo-Iglesias, 2020**), daunting feelings and divergent psychological experiences (**Bear; Collier, 2016**). It has been pointed out that women’s perception of their own work is inferior to that of men (**Ukwoma et al., 2021**). Gender socialization can also shape public comportment and impact women’s confidence and willingness to contribute to *Wikipedia* (**Evans; Mabey; Mandiberg, 2015**).

According to **Bear and Collier (2016)**, women tend to lack confidence in their abilities and expertise, while men tend to be overconfident. This lack of confidence among women presents a challenge for their active participation on *Wikipedia*, which often requires competi-

“ A gender gap is evident within *Wikipedia*, not only in terms of content bias but also in the decreased participation of women as editors, and to a lesser extent, as users who rely on *Wikipedia* as a source of information ”

ve and aggressive behaviour. Women reported lower confidence in their expertise, discomfort with editing, and negative responses to critical feedback compared to men, which partly explains the gender gap in contribution. Also, women are more likely to report their gender when editing and tend to focus on editing biographies of women (Hinnosaar, 2019).

Other academic articles try to find reasons for gender differences in the gender roles ascribed by patriarchal societies. For example, variations in discretionary leisure time (Eckert; Steiner, 2013; Gruwell, 2015; Ferran-Ferrer *et al.*, 2021). It has also been said that women spend more time on platforms like YouTube and LinkedIn (Sierra-Obregón; González-Fernández, 2019) and that they are interested only in fashion or celebrity gossip and uninterested in knowledge or science (Eckert; Steiner, 2013). This disparity in interests may help to account for the greater number of male than female contributors to *Wikipedia* (Sierra-Obregón; González-Fernández, 2019).

Finally, stereotypes associated with gender identity can also contribute to gender differences in online collaboration (Shane-Simpson; Gillespie-Lynch, 2017).

The mirror effect

The ‘mirror effect’ absolves *Wikipedia* of responsibility for the under-representation of real-world inequalities or hierarchies, consequently, *Wikipedia* closely resembles the world in terms of inequality (Eckert; Steiner, 2013). Imbalances and content gaps imply that *Wikipedia* is reflecting the structural and representative inequalities of our world (Miquel-Ribé; Laniado, 2021). Sexism is a pervasive issue in various domains, including society, academia, technology, computer science, the internet, publishing, and media, which contributes to the gender gap on *Wikipedia* (Eckert; Steiner, 2013).

Media plays a crucial role in achieving gender equality on *Wikipedia*. Its influence can shape public perceptions and bring attention to issues that need addressing, such as the gender gap (Konieczny; Klein, 2018; Hinnosaar, 2019). Furthermore, in the mirror effect phenomena, media might also be essential in meeting *Wikipedia*'s need for reliable sources and promoting inclusivity. As a result, it can help break down the barriers that prevent women from meeting the notability criteria (Morgan *et al.*, 2013; Tripodi, 2022) by promoting local and embodied knowledge which may be excluded by the *Wikipedia* community (Hollink; Van-Aggelen; Van-Ossenbruggen, 2018). But despite decades of research on the systematic under-representation of women in news media, the bias in information diffused through traditional media persists, perpetuating the interests of power holders and reinforcing the status quo (Young; Wigdor; Kane, 2020).

Furthermore, *Wikipedia* can be the mirror of society but also, given its influence, it can amplify and deepen its inequalities and imbalances (Miquel-Ribé; Laniado, 2021). Illustrating this amplification, Zheng *et al.* (2022) delves into *Wikipedia*'s citation practices, unearthing disparities in citations to scholarly works linked to particular gender and nationality groups. Notably, women authors receive fewer citations than anticipated, indicating a bias toward citing male-authored publications. This practice, notably prevalent in non-Anglosphere scientific contexts, can exacerbate the marginalization of women authors.

The systemic problem

Gender gaps on *Wikipedia* can also be approached from the frame of a systemic problem (Ford; Wajcman, 2017), as it can be seen as a consequence of that most editors share social and cultural characteristics (Miquel-Ribé; Laniado, 2021) and/or the culture, dynamics, and values of online communities, which may cause a contributor gap and content gap.

According to Beytía and Wagner (2022), the gender gap in *Wikipedia* participation arises from systemic factors. *Wikipedia*'s geeky image may not attract some genders, and its open editing system can attract problematic individuals, making it tough for women. Concerns about editorial diversity are often overlooked due to the perceived freedom of participation. Furthermore, the project is built on infrastructures that historically excluded women, like the enlightened encyclopaedia and the open Internet (Ford; Wajcman, 2017).

The under-representation and misrepresentation of women on the platform stem from both the limitations of traditional print histories and the challenges of the new online public sphere. The burden of familial responsibilities that many women face further exacerbates this issue (Luo; Adam; Brueckner, 2018).

Although there were initial hopes that *Wikipedia*'s open-source knowledge production could address the problem of gender gaps, it has proven insufficient in fully tackling this issue. Certain spaces within the platform, such as talk pages, where discussions on knowledge production occur, may contribute to the gender gap by creating an environment in which women feel less comfortable participating (Cabrerá *et al.*, 2018). These spaces often exhibit a perceived high level of conflict, and critical or confrontational environments are generally disliked by women (Collier; Bear, 2012).

Deletion asymmetry reveals gender bias in article removal, with women's articles often longer, indicating the need for better coverage. Lexical bias and classification asymmetry reinforce gender stereotypes. *Wikipedia*, while a knowledge hub, harbors structural sexism, impeding women's participation and recognition. This complexity underscores digital gender inequalities (Beytía; Wagner, 2022).

Gender gap can be explained by three main factors: ‘women problem’ (blaming female characteristics), ‘mirror effect’ (excusing *Wikipedia*), and ‘systemic problem’ (blaming the original male-dominated editor community)

When women do participate on *Wikipedia*, they often find themselves facing harassment and marginalization at the hands of male editors. These experiences create a hostile environment that makes it difficult for women to contribute freely and feel valued on the site. Their voices are silenced, and their perspectives are undermined, perpetuating an unequal power dynamic (Evans; Mabey; Mandiberg, 2015; Ukwoma *et al.*, 2021).

The very fabric of *Wikipedia's* community and rhetorical practices is tainted by a lack of openness to feminist ways of knowing and writing. This narrow-mindedness restricts the inclusion of diverse viewpoints and perpetuates the gender inequalities that exist in the wider world (Gruwell, 2015).

Moreover, *Wikipedia's* hierarchical collaboration model reinforces power structures that favour dominant voices, often excluding non-dominant viewpoints. As a result, women's contributions are easily discredited or disregarded by men in socially and structurally powerful roles (Ukwoma *et al.*, 2021).

The perception that women's contributions are subjected to greater scrutiny compared to their gender-neutral counterparts further exacerbates the issue. Women's work is often subjected to critical evaluation, leading to a discouraging environment where their contributions are undervalued (Sichler; Prommer, 2014).

Dissatisfaction with *Wikipedia's* policies and norms is also a significant barrier for women's participation in editing. The dissatisfaction stems from the realization that these policies and norms are inadequate in addressing gender disparities and fail to create an inclusive space for women (Ukwoma *et al.*, 2021).

The gender harassment faced by women editors on *Wikipedia* contributes to emotional distress and creates an inhospitable atmosphere for their creative expression and intellectual contributions (Ukwoma *et al.*, 2021). Macho attitudes prevail on the internet, manifesting as toxic and hostile online environments. These attitudes deter women from actively participating in online communities, including *Wikipedia* (Calvo-Iglesias, 2020). Furthermore, safety risks add another layer of discouragement for women editors. Certain topics and contentious spaces on *Wikipedia* can expose women to safety hazards, making them hesitant to contribute and limiting their ability to shape the content on the site (Tripodi, 2022).

4. Discussion

The present study involved a comprehensive analysis of 97 scholarly papers authored by 187 individuals, aimed at shedding light on the dynamics surrounding the gender gap within *Wikipedia*. Through this scoping review, the researchers constructed a theoretical framework for this field, tracked the evolution of academic publications on the subject, and explored strategies to address the gender gap. Notably, the majority of contributors had only one publication, indicating widespread participation from various continents, though a heavy emphasis remained on the English *Wikipedia*.

The papers were categorized into distinct topics, highlighting issues related to gender and *Wikipedia* research. These topics included content-related disparities, editing practices, collaborative knowledge creation, participation forms, and readership engagement. The prevalence of a binary perspective in many papers underscored the need for more inclusive approaches.

The study spanned publications from 2007 to 2022, with a significant increase in scholarly attention observed in 2021, following a period of limited interest during the initial years. The analysis also revealed the interdisciplinary nature of gender and *Wikipedia* research, with Computer Science, Media and Communications, and Information Science emerging as prominent disciplines.

Geographically, the United States took the lead in research on gender and *Wikipedia*, while Germany and Spain also made significant contributions. One highlighted paper Zhang and Terveen (2021) investigated gender bias in *Wikidata*, and their findings indicate that the quality of the items related to women in *Wikidata* is on par with those related to men. Consequently, the proportion of female representation within each profession in *Wikidata* aligns with the assessment of notability in professional society. In other words, *Wikidata* does not contribute to the widening of the gender gap; instead, it offers a more accurate reflection of reality, thus providing better fidelity. The content analysis of data pertaining to the gender gap on *Wikipedia* offers a comprehensive view of the research landscape in this area. Academic literature consistently highlights the bidirectional relationship between biased contribution and the gender gap in encyclopedic content (Zagovora; Flöck; Wagner, 2017; Cabrera *et al.*, 2018). This reciprocal relationship underscores that bias in participation and content mutually reinforce each other. The gender gap among *Wikipedia* editors leads to an overrepresentation of articles appealing to men, resulting in inadequate coverage of topics more appealing to women and a disproportionate number of male biographies (Bear; Collier, 2016). This cycle can perpetuate the glass-ceiling effect, where editors favor those from their own group (Konieczny; Klein, 2018).

Scholars investigating the gender gap have identified three main phenomena: the 'women problem' (Eckert; Steiner, 2013), the 'mirror effect' (Miquel-Ribé; Laniado, 2021), and the 'systemic problem' (Ford; Wajcman, 2017; Beytía; Wagner, 2022). These explanations are often discussed in isolation, hindering a comprehensive understanding of their interconnectedness.

“ The current dynamics of *Wikipedia*, coupled with its core principles of notability, verifiability, and neutrality, contribute to a self-perpetuating cycle that hinders increased engagement of women editors and perpetuates the gender gap ”

Addressing the systemic problem requires long-term strategic solutions, recognizing that merely adding more female biographies is insufficient, as the attrition rate is high (Tripodi, 2022). It necessitates diversifying contributions and acknowledging that *Wikipedia's* hierarchical collaboration model reinforces dominant voices, excluding non-dominant perspectives (Ukwoma *et al.*, 2021). To bridge the gender gap effectively, from this point of view, scholars argue for a deeper understanding of *Wikipedia's* knowledge production culture (Menking; Erickson, 2015), rooted in its encyclopedic and open culture, which may hide exclusionary practices (Ford; Wajcman, 2017). *Wikipedia's* gendering is shaped not only by editors but also by infrastructural logics (Ford; Wajcman, 2017). The goal is not just reducing bias but also making *Wikipedia* a more robust, reliable, and transparent platform for knowledge production (Menking; Rosenberg, 2021). This holistic approach is essential for lasting change.

5. References

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