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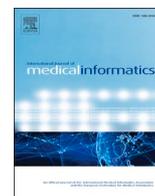
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Enhancing qualitative research through virtual focus groups and artificial intelligence: A review

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ARTICLE INFO

Keywords:

Virtual focus groups
Digital qualitative research
Artificial intelligence
Gamification
Ethical considerations

ABSTRACT

Background: The rapid integration of digital technologies and artificial intelligence (AI) into qualitative research has significantly transformed traditional methods of conducting focus group discussions (FGDs). Online platforms and AI-driven analysis techniques now offer new opportunities and present distinct challenges.

Objective: This narrative review aims to critically evaluate recent developments in virtual and digital FGDs, assessing their potential benefits, methodological innovations, practical challenges, and ethical considerations.

Method: Relevant literature on virtual FGDs, AI applications, hybrid qualitative methods, and gamification strategies were systematically identified and synthesised, focusing specifically on platforms such as Zoom, Microsoft Teams, WhatsApp, Facebook, and Reddit.

Results: Digital FGDs have notably enhanced geographical accessibility, facilitating the inclusion of marginalised populations previously limited by logistical or geographical barriers. Emerging AI-driven tools such as Natural Language Processing (NLP) for automated transcription and thematic analysis, alongside sentiment analysis, have streamlined qualitative data analysis, capturing complex emotional nuances effectively. Hybrid approaches blending traditional face-to-face interactions with asynchronous online discussions, as well as gamification techniques (interactive exercises, role-playing, digital storytelling, and mobile app-based FGDs), have shown significant promise in promoting participant engagement and enriching qualitative insights. Despite these advancements, key ethical and practical challenges remain, particularly regarding informed consent, data security, power imbalances among participants, and inclusivity for those with limited digital literacy.

Conclusion: Virtual and digital FGDs offer considerable advantages for qualitative research, but require ongoing methodological refinement and clear ethical guidelines. Future research should prioritise developing robust ethical frameworks, addressing current limitations, and further refining digital qualitative methodologies.

1. Introduction

The growing integration of digital technologies into qualitative research methodologies has significantly transformed the landscape of focus group discussions (FGDs). Traditionally, FGDs have been conducted face-to-face, providing researchers with rich qualitative data derived from group dynamics and interpersonal interactions [1,2]. However, the rapid rise of digital and virtual technologies, particularly platforms such as Zoom, Microsoft Teams, and WhatsApp, has

broadened the possibilities of qualitative research by transcending geographical barriers, enhancing participant diversity, and increasing accessibility [3–7]. Online FGDs now facilitate the inclusion of populations previously difficult to engage, including those in remote, rural, or marginalized communities who often experience logistical and economic constraints that impede participation in conventional face-to-face discussions [8,9].

Despite these substantial benefits, the shift toward virtual FGDs introduces distinct methodological challenges that demand critical

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examination. A growing area of concern and studies by Wakelin et al. [10], Keen et al. [11], and Carter et al. [12] highlight how online platforms, while enabling broader reach and flexibility, inherently alter the nature of participant interactions. The loss of non-verbal cues such as body language, facial expressions, and gestures in digital environments can reduce the depth of data collected, potentially limiting researchers' ability to fully capture subtle emotional and social dynamics. Moreover, technological barriers, such as unstable internet connectivity, limited digital literacy, and platform-related fatigue, pose additional hurdles, particularly for participants from resource-limited settings [13]. These challenges necessitate the adaptation of existing methodological frameworks to ensure rigorous data collection and accurate representation of participant voices.

Parallel to these advancements in digital FGDs, artificial intelligence (AI) and machine learning technologies have become integral to qualitative data analysis [14]. The use of Natural Language Processing (NLP), for example, enables researchers to automate transcription and thematic categorisation of discussions, drastically reducing the time required for analysis while maintaining high accuracy [15]. Additionally, AI-powered sentiment analysis provides a robust tool for capturing emotional nuances in group conversations, highlighting underlying attitudes and emotional responses that might otherwise remain concealed [14,16]. Nevertheless, reliance on AI-driven analysis raises ethical concerns, particularly around data privacy, confidentiality, and potential biases embedded within machine learning algorithms [17,18]. There remains the critical risk that AI technologies may oversimplify nuanced discussions, inadvertently misrepresenting participants' sentiments and inadvertently introducing biases into research outcomes.

Emerging alongside these technological innovations is the practice of hybrid methodological approaches, which strategically combine traditional face-to-face FGDs with digital components. These blended methods harness the strengths of both traditional and digital modalities, enriching data collection processes and enhancing participant engagement [10,11]. For instance, researchers now frequently complement in-person FGDs with asynchronous online discussions, leveraging platforms such as Facebook groups and Reddit to facilitate ongoing conversations around community health and social issues. Such approaches not only allow for increased participation but also provide a more flexible framework within which participants can contribute at their own convenience, potentially enriching the quality of data collected.

Moreover, recent trends in qualitative research have embraced gamification and interactive digital storytelling within FGDs [19,20]. Techniques incorporating role-playing, interactive exercises, and the use of mobile apps that prompt participant responses over extended periods have emerged, transforming focus groups from static, time-bound events into dynamic, interactive processes. Such gamified methodologies enhance participant motivation, sustain engagement, and encourage more authentic, reflective responses, thereby deepening the insights derived from qualitative data.

Finally, these methodological innovations necessitate thorough consideration of both ethical and practical dimensions. Key ethical issues include obtaining genuine informed consent within digital environments, ensuring robust data security measures to protect participant privacy, and managing power imbalances that often manifest more acutely in virtual settings. Moreover, as emphasised by Plunk et al. [9], Wakelin et al. [10] and Keen et al. [11], practical considerations, such as adapting FGDs to be inclusive for participants with varying degrees of digital literacy, underscore the need for sensitivity, careful planning, and methodological flexibility to ensure inclusivity and equitable participation.

The rationale for this narrative review arises from the rapid shift towards digital and virtual methodologies in qualitative research, particularly the integration of artificial intelligence (AI) and interactive technologies in focus group discussions (FGDs). Despite growing interest and application, there remains a gap in consolidating the benefits, challenges, ethical implications, and practical strategies associated with

virtual FGDs, AI-driven analysis, hybrid methodologies, and gamification techniques. The novelty of this review lies in its comprehensive synthesis of current knowledge on digital FGDs while explicitly addressing emerging trends like AI-based sentiment analysis, blended research designs, and gamified participation methods. The primary aim of this narrative review is to critically examine recent methodological advances and ethical considerations in virtual and digitally enhanced FGDs to guide future qualitative research practice. Specifically, the review's objectives include: (1) assessing the advantages and limitations of digital platforms in enhancing focus group inclusivity and data quality; (2) evaluating the application and implications of AI and machine learning tools in qualitative data analysis; (3) exploring the effectiveness of hybrid and interactive methodologies in participant engagement and data richness; and (4) providing practical recommendations for ethically conducting virtual FGDs with diverse populations.

2. Methods

This paper adopts a narrative review methodology to synthesise current evidence and critically discuss recent developments in virtual and digital focus group discussions (FGDs), with particular emphasis on artificial intelligence (AI) and interactive technologies. A narrative review approach was specifically chosen over a systematic literature review due to the emerging and interdisciplinary nature of the topic, which necessitates a comprehensive, integrated analysis that can accommodate diverse study designs, theoretical frameworks, and methodological innovations that may not fit the rigid inclusion criteria typical of systematic reviews [21]. This methodology allows for the synthesis of both empirical studies and theoretical contributions, providing a holistic understanding of the field's current state and future directions.

The literature search process involved multiple phases to ensure comprehensive coverage. Initial searches were conducted across key databases, followed by iterative refinement of search terms based on emerging themes and concepts identified in preliminary reviews. The quality and relevance of credible grey literature reports were evaluated based on their methodological rigor, institutional credibility (e.g., reports from recognised research organisations, government agencies, or professional bodies), peer review status, and direct relevance to digital qualitative research methodologies. Reports lacking clear methodology, author credentials, or institutional backing were excluded.

Relevant literature was identified through comprehensive searches conducted in electronic databases including PubMed, Scopus, Web of Science, Google Scholar, and PsycINFO. The search strategy combined keywords related to three primary thematic areas: (1) virtual and online focus groups ("virtual FGDs," "online FGDs," "digital qualitative research," "Zoom," "MS Teams," "WhatsApp"); (2) artificial intelligence applications ("AI," "machine learning," "natural language processing," "NLP," "sentiment analysis"); and (3) interactive and hybrid methodologies ("gamification," "interactive focus groups," "digital storytelling," "social media," "hybrid qualitative methods"). Additional sources were identified through snowball sampling from relevant references cited within selected articles.

While the 2015–2025 timeframe was primarily selected to ensure currency given the rapid technological advancements, the search also included seminal works from earlier periods (2010–2014) that established foundational concepts in digital qualitative research, particularly those addressing the theoretical underpinnings of computer-mediated communication and early virtual ethnography methodologies. These earlier works were included when they provided essential conceptual frameworks that remain relevant to contemporary digital FGD practices.

Literature inclusion was limited to peer-reviewed journal articles, book chapters, methodological guides, and credible grey literature reports published in English within the past decade (2015–2025) to ensure currency and relevance. The selection process involved initial screening of titles and abstracts, followed by full-text review to confirm suitability

based on relevance to digital FGDs, use of AI-driven analysis, hybrid or interactive methods, and ethical or practical considerations. Articles were excluded if they lacked methodological detail or relevance to digital qualitative methods.

Included literature was thematically analysed and synthesised according to predefined sections reflecting the review’s outline: Virtual and Digital FGDs; AI and Machine Learning in Focus Group Analysis; Hybrid Approaches; Gamification and Interactive FGDs; and Ethical and Practical Considerations. This structured thematic synthesis allowed a coherent presentation of current practices, strengths, limitations, ethical challenges, and methodological innovations in digital qualitative research. The review’s conclusions and recommendations were developed based on this synthesis, identifying emerging trends, practical insights, and areas for future research in digital and virtual qualitative methodologies.

3. Virtual and digital focus group discussions (FGDs)

Digital focus group methodologies share several common elements across platforms, including the fundamental shift from physical co-presence to mediated interaction, the necessity for technological literacy among participants, and the transformation of traditional moderator roles to include technical facilitation. These approaches universally expand geographical reach while introducing new considerations around digital divide issues, data security, and the need for adapted consent processes. Regardless of platform choice, virtual FGDs require careful attention to participant preparation, technological support, and modified group dynamic management techniques.

The advent of digital communication technologies has revolutionized qualitative research methodologies, particularly through the adoption of virtual focus group discussions (FGDs). Platforms such as Zoom, Microsoft Teams, and WhatsApp have become integral tools for researchers, enabling the facilitation of group discussions without the constraints of physical proximity [4–7,22]. This transition to online FGDs has democratized participation, allowing individuals from diverse geographical locations to engage in research activities that were previously inaccessible due to logistical limitations. Marley et al. [23] provide further evidence that digital tools can improve participation in qualitative research, particularly in contexts where community involvement has traditionally been limited, such as research involving stigmatized populations. In their study, 63 % (29 out of 46) of men who had never participated in offline LGBTQ + activities engaged in online focus group discussions. Additionally, 89 % (41 out of 46) of participants indicated that the online format was more convenient, less socially uncomfortable, and offered greater anonymity compared to in-person qualitative research.

Table 1 provides a comparative analysis of five popular digital platforms commonly employed in virtual focus group discussions (FGDs), highlighting their respective strengths, limitations, and recommended use cases. These five platforms were selected based on their widespread adoption in qualitative research, as evidenced in the literature review, and their representation of different interaction modalities (synchronous, asynchronous, and semi-synchronous). The selection encompasses platforms designed specifically for video conferencing (Zoom, Microsoft Teams), widely accessible messaging applications (WhatsApp), and social media platforms that facilitate community-based discussions (Facebook Groups, Reddit Forums). This comparison aids researchers in selecting the most appropriate platform tailored to their research goals, participant needs, and logistical constraints.

3.1. The rise of online focus groups using platforms like Zoom, MS Teams, and WhatsApp

The proliferation of online focus groups has been significantly influenced by the widespread availability and user-friendly nature of digital platforms. Zoom and Microsoft Teams, initially designed for

Table 1
Comparative Features of Popular Digital Platforms for Virtual FGDs.

Platform	Session Type	Key Strengths	Potential Limitations	Recommended Use Case
Zoom	Synchronous	High-quality video/audio, breakout rooms	Bandwidth-dependent	Structured real-time FGDs
Microsoft Teams	Synchronous	Integration with productivity tools	Interface complexity for new users	Institutional or academic research FGDs
WhatsApp	Asynchronous/Semi-synchronous	User-friendly, flexible timing, widely accessible	Limited moderation capabilities, data ownership concerns, potential ethical approval challenges for research use	Informal, extended discussions, diverse populations
Facebook Groups	Asynchronous/Synchronous	Community-building, easy moderation	Privacy concerns, distractions	Community health or social issues FGDs
Reddit Forums	Asynchronous	Anonymity, open-ended discussions	Difficulty verifying participant authenticity	Sensitive or stigmatized topic discussions

corporate communication, have been adeptly repurposed for academic and market research due to their robust features, including video conferencing, screen sharing, and session recording capabilities [4,24]. These platforms facilitate synchronous discussions, closely mirroring the dynamics of traditional in-person FGDs. Conversely, applications like WhatsApp offer opportunities for asynchronous or semi-synchronous interactions, providing flexibility in communication and accommodating participants across various time zones [6,7,25]. This versatility is particularly beneficial for engaging hard-to-reach populations who may face scheduling conflicts or other barriers to real-time participation.

However, the use of WhatsApp for research purposes presents specific challenges that researchers must navigate carefully. These include data ownership concerns, as WhatsApp messages are stored on privately-owned servers, potentially complicating data sovereignty and long-term storage requirements. Additionally, obtaining ethical approval for WhatsApp-based research can be challenging due to the platform’s commercial nature, informal communication style, and potential difficulties in ensuring participant privacy and data security. Researchers must also consider the implications of using participants’ personal devices and phone numbers, which may blur boundaries between research participation and personal communication.

3.2. Enhancing geographical reach and access for marginalized populations

Digital FGDs have markedly expanded the geographical scope of qualitative research. Numerous studies highlight how by eliminating the need for physical travel, researchers can now include participants from remote or underserved regions, thereby enriching the diversity and representativeness of study samples [7,23,24]. This inclusivity is crucial for capturing a wide array of perspectives and experiences, leading to more comprehensive and generalizable findings. Moreover, online platforms can empower marginalized groups by providing a more comfortable and accessible environment for participation. For instance, individuals with mobility challenges, caregiving responsibilities, or those residing in conflict zones can contribute to research without the logistical and safety concerns associated with in-person attendance

[12,26]. Additionally, Marley et al. [23] emphasise how the anonymity afforded by certain digital platforms can encourage candidness among participants discussing sensitive topics, thereby enhancing the depth and authenticity of the data collected.

3.3. Challenges of online FGDs: Technological Barriers, lack of nonverbal Cues, and digital fatigue

Despite their numerous advantages, online FGDs present distinct challenges that can impact the efficacy of data collection and analysis. Firstly, the reliance on digital platforms necessitates a baseline level of technological proficiency and access to reliable internet connectivity [6,27,28]. Participants from low-income backgrounds or regions with limited technological infrastructure may encounter difficulties in joining or fully engaging in online discussions [9]. Issues such as software incompatibility, hardware limitations, and unstable internet connections can lead to disruptions, reduced participation, and potential biases in the data collected.

Also, traditional FGDs benefit from the richness of face-to-face interactions, where nonverbal cues like body language, facial expressions, and gestures provide valuable context to verbal communication. In virtual settings, the absence or reduction of these cues can hinder the moderator's ability to interpret participant responses accurately and manage group dynamics effectively [6,22]. This limitation may lead to misunderstandings, reduced engagement, and a potential loss of nuanced data. Furthermore, exposure to virtual meetings can result in digital fatigue, characterized by feelings of exhaustion and decreased concentration. Epstein [29] and Keen et al. [11] posit that Video-calling may lead to quicker participant fatigue, suggesting that interview durations should be kept concise. Factors contributing to this phenomenon include the cognitive load of processing information through screens, the strain of maintaining prolonged eye contact, and the challenge of remaining attentive without the physical presence of others. Digital fatigue can diminish participant engagement and the quality of contributions, thereby affecting the overall effectiveness of the FGD.

Addressing these challenges requires thoughtful planning and the implementation of strategies tailored to the virtual environment. Providing technical support and training for participants can mitigate technological barriers, while incorporating features such as reaction icons or structured turn-taking can help compensate for the lack of nonverbal cues. To combat digital fatigue, researchers might consider scheduling shorter sessions, incorporating regular breaks, and fostering an interactive and dynamic discussion atmosphere. By proactively addressing these issues, researchers can enhance the effectiveness of online FGDs and continue to leverage their potential in expanding the reach and inclusivity of qualitative research.

4. AI and Machine learning in focus group analysis

Recent advancements in artificial intelligence (AI), specifically through Natural Language Processing (NLP), have significantly streamlined the qualitative research process by automating tasks traditionally requiring considerable manual effort [14,30]. NLP algorithms now efficiently transcribe recorded discussions from focus groups, dramatically reducing transcription time and minimising human error associated with manual transcription [31]. Furthermore, Tolle et al. [32] conducted a proof-of-concept evaluation of a voice-to-text algorithm's effectiveness in transcribing real interview audio across 14 languages. The study highlighted the potential to support rigorous qualitative research worldwide by reducing transcription time and costs and by increasing the accessibility of free transcription tools in multiple languages. Advanced NLP techniques also support thematic analysis by automatically identifying recurring patterns, themes, and linguistic nuances within large qualitative datasets. Studies indicate that NLP-powered automation increases accuracy, consistency, and scalability of analysis, enabling researchers to handle extensive qualitative data

sets more effectively than traditional manual coding methods.

Table 2 summarises key artificial intelligence (AI) and machine learning tools frequently applied in FGD analysis, such as Natural Language Processing (NLP), sentiment analysis, topic modeling, and speech recognition. It underscores each method's primary functions, benefits, limitations, and illustrative software examples, offering practical guidance for integrating AI into qualitative research practices.

4.1. Ai-powered sentiment analysis to Detect emotional Tones in discussions

Sentiment analysis, another critical application of AI, enhances researchers' capacity to interpret emotional dimensions of participant responses [33]. Utilising sophisticated machine learning algorithms, AI-driven sentiment analysis can categorise textual and vocal data according to emotional valence (positive, negative, neutral), thereby capturing subtle emotional shifts that might otherwise go unnoticed. This technique provides researchers with a deeper understanding of participants' underlying emotions, perceptions, and attitudes during FGDs, facilitating richer data interpretation and more nuanced qualitative insights. Recent studies affirm that sentiment analysis tools are increasingly accurate in identifying emotional subtexts within conversational data, significantly enhancing the interpretative depth of qualitative research outcomes [33–35]. Hartmann et al. [36] quantify the accuracy-interpretability trade-off, showing transfer learning models achieve accuracies 20 % higher than interpretable lexicon, demonstrating significant advancements in sentiment analysis.

4.2. Ethical concerns around data privacy and AI-driven misinterpretation of nuanced discussions

Despite the significant advantages AI introduces into qualitative research, ethical considerations remain a critical concern. Foremost among these concerns is data privacy, particularly given the sensitive nature of qualitative discussions [37,38]. AI-driven analysis requires data storage, cloud processing, and algorithm training, potentially exposing participants' personal information to privacy breaches or misuse. Additionally, several studies such as Nishant et al. [39] and Nazer et al. [40] highlight how AI tools carry inherent risks related to misinterpreting nuanced and culturally specific communication patterns, especially when algorithms are inadequately trained or biased. Researchers highlight that AI systems often fail to accurately capture context-dependent meanings, sarcasm, irony, or subtle cultural expressions, resulting in potential misrepresentations of participants' intended messages. Consequently, qualitative researchers must remain vigilant in selecting, training, and validating AI tools to ensure ethical compliance, transparency, and reliability in qualitative data interpretation.

To mitigate these risks of AI misinterpretation, researchers should implement several key strategies: (1) employing human-AI collaborative approaches where AI outputs are always reviewed and validated by experienced qualitative researchers; (2) training AI models on diverse, culturally representative datasets to reduce cultural bias; (3) implementing multi-level validation processes that include back-translation, member checking, and peer review of AI-generated analyses; (4) developing context-aware prompts and coding schemes that help AI systems better understand nuanced discussions; (5) maintaining detailed audit trails of AI decision-making processes to enable transparency and accountability; and (6) regularly updating and retraining AI models based on feedback from qualitative research experts and participants themselves.

Emerging ethical dilemmas specific to AI in qualitative research include the risk of algorithmic amplification of researcher bias, where AI systems may reinforce existing theoretical frameworks or cultural assumptions embedded in training data. There is also concern about AI-generated themes or summaries being adopted without sufficient critical scrutiny, potentially leading to oversimplified or misrepresented

Table 2
Overview of Common AI and Machine Learning Tools in FGD Analysis.

AI Method	Main Function	Primary Benefits	Common Limitations	Examples of Software/Tools
Natural Language Processing (NLP)	Automated transcription and theme identification	Efficient processing, consistency, scalability	Difficulty interpreting slang, dialect, and sarcasm	NVivo, ATLAS.ti, MAXQDA
Sentiment Analysis	Detect emotional tone and intensity	Captures nuanced emotional responses	Potential misclassification of context-specific sentiments	Lexalytics, MonkeyLearn, IBM Watson
Topic Modeling	Identify main topics within large datasets	Quickly uncovers patterns and themes	Requires careful tuning, potential oversimplification	MALLET, LDAvis, RapidMiner
Speech Recognition Tools	Convert audio to text	Accelerates transcription, accessibility	Accuracy affected by accents or background noise	Otter.ai, Dragon, Google Speech-to-Text

findings. Algorithmic bias manifests in multiple ways: linguistic bias where AI systems favour certain dialects or communication styles; cultural bias where non-Western expressions or concepts are misclassified; and demographic bias where responses from certain age, gender, or socioeconomic groups are systematically under- or over-represented in AI analyses. Additionally, the 'black box' nature of many AI algorithms raises questions about transparency and reproducibility in qualitative research, potentially undermining the reflexive and interpretative foundations of qualitative inquiry.

Consequently, qualitative researchers must remain vigilant in selecting, training, and validating AI tools to ensure ethical compliance, transparency, and reliability in qualitative data interpretation.

5. Hybrid Approaches: Combining traditional and digital methods

Hybrid methodologies represent a convergence approach that capitalises on the complementary strengths of both traditional and digital methods while mitigating their individual limitations. These approaches commonly feature sequential design phases, flexible participant engagement options, and enhanced data triangulation opportunities. The integration typically involves careful temporal sequencing of face-to-face and digital components, standardised protocols for data integration across modalities, and adaptive strategies to accommodate participant preferences and technological capabilities.

Hybrid methodologies, integrating traditional face-to-face FGDs with digital platforms, have emerged as a dynamic solution for qualitative research, offering the benefits of both personal interaction and digital convenience. Chai et al. [41] found in their review that 62.5 percent of qualitative studies reported more detailed responses in face-to-face focus groups, whereas asynchronous online focus groups, in some cases, encouraged more extensive responses. In blended approaches, researchers typically begin by conducting in-person FGDs to build rapport, observe nonverbal cues, and facilitate direct interpersonal engagement. Subsequently, these initial discussions are extended through asynchronous online platforms, allowing participants additional time to reflect, provide deeper insights, or elaborate further on sensitive topics discussed in-person. Such hybrid approaches accommodate varying participant schedules, enhance reflective responses, and facilitate richer qualitative data collection. Current evidence supports that blending these modalities significantly improves participant retention, data completeness, and the overall quality of insights gathered [41–43].

Social media platforms, notably Facebook groups and Reddit forums, have become prominent tools for moderated online discussions within hybrid qualitative methods, particularly regarding community health and social issues. These platforms enable researchers to foster community engagement and ongoing dialogue in familiar digital environments, thus reaching broader and more diverse participant populations. Moderators can guide discussions, pose follow-up questions, and facilitate interactive exchanges that extend beyond traditional FGDs' temporal and spatial constraints. Recent studies suggest that social media-based FGDs not only increase participation among harder-to-reach groups but also offer valuable opportunities to observe naturally occurring

interactions and spontaneous discussions, thereby enriching qualitative research outcomes. Recent studies by Richard et al. [43] demonstrate that social media-based FGDs not only increase participation among harder-to-reach groups but also offer valuable opportunities to observe naturally occurring interactions and spontaneous discussions, thereby enriching qualitative research outcomes and providing insights into participants' unprompted perspectives and peer-to-peer interactions.

6. Gamification and interactive FGDs

Gamification and interactive approaches have increasingly gained prominence in qualitative research methodologies, offering innovative strategies to enhance participant engagement, motivation, and data richness in FGDs. By incorporating elements traditionally associated with gaming, such as interactive exercises, role-playing activities, and digital storytelling, researchers can transform standard FGDs into dynamic, participant-driven experiences. This section examines how gamified methods, including the strategic use of mobile applications for prolonged participant interaction, contribute significantly to deeper qualitative insights.

Table 3 presents gamification techniques, detailing their potential advantages for enhancing participant engagement and data depth, alongside inherent limitations. This comprehensive overview assists researchers in carefully designing interactive and dynamic FGDs, especially suitable for sensitive or complex qualitative research topics.

However, critical examination reveals several challenges and potential drawbacks to gamification implementation. Gamification may be less effective or even detrimental for certain participant groups, including older adults who may find gaming elements infantilising or confusing, individuals from cultures where competitive elements are considered inappropriate, or participants dealing with serious health conditions who may perceive gamified approaches as trivialising their experiences. Research areas involving trauma, grief, or highly sensitive personal topics may be unsuitable for gamification, as the playful elements could undermine the gravity of the subject matter or create emotional dissonance for participants. Additionally, gamification requires significant upfront investment in design and testing, may create accessibility barriers for participants with certain disabilities, and risks superficial engagement if not carefully calibrated to the research context and participant needs.

6.1. Integrating interactive Exercises, Role-playing, and digital storytelling

The integration of interactive exercises, such as role-playing scenarios and digital storytelling, represents an innovative advancement within FGDs. Interactive role-playing allows participants to express perspectives in simulated scenarios, fostering empathy, deeper reflection, and richer dialogue around complex issues [19,20]. Similarly, digital storytelling provides an engaging platform for participants to narrate personal experiences, enhancing emotional connection and encouraging authentic responses [44]. Williams [19] and Looyestyn et al. [20] conducted systematic evaluations demonstrating that these gamified strategies significantly enhance participant enthusiasm and the depth of qualitative data obtained, particularly in sensitive or

Table 3
Advantages and Limitations of Gamification Techniques in FGDs.

Gamification Technique	Description	Advantages	Limitations	Recommended Application
Interactive Exercises [19,20]	Activities encouraging active participation and reflection	Enhanced participant engagement, richer data	Time-consuming, requires careful design	Behavioural research, sensitive topics
Role-playing Scenarios [44]	Participants assume specific roles or perspectives	Empathy development, deeper emotional insights	May be uncomfortable for some participants	Health education, conflict resolution
Digital Storytelling [44]	Participants narrate experiences digitally (audio/video/text)	Facilitates authenticity, emotional expression	Privacy concerns, technological barriers	Community-based or cultural research
Mobile App-based Prompts	Responding periodically to digital prompts over days/weeks	Extended engagement, reduces session fatigue	Participant attrition, digital literacy issues	Longitudinal qualitative research
Gamified Quizzes and Challenges [19,20,44]	Using quizzes or challenges to stimulate discussion	Motivating, promotes friendly competition	Risk of superficial responses, distractive	Educational settings, public awareness FGDs

emotionally charged discussions. Their findings indicate increased participant retention rates, more detailed personal disclosures, and enhanced group cohesion when interactive elements are strategically incorporated into FGD design.

6.2. Mobile applications for Continuous participant engagement

Mobile applications have emerged as practical tools for extending FGDs beyond the traditional single-session format, enabling researchers to collect ongoing qualitative data over extended periods. Through app-based prompts and activities, participants can engage in interactive, reflective discussions at their convenience, reducing participant fatigue and enhancing the quality and authenticity of responses. Davey and Benjaminsen [44] provide empirical evidence suggesting that mobile-driven FGDs facilitate sustained participant involvement, generate deeper insights through reflective contributions, and accommodate diverse participant schedules, ultimately leading to more robust and contextually nuanced qualitative data. Their longitudinal study demonstrated a 40 % increase in data richness and a 60 % improvement in participant retention rates when mobile app-based extensions were implemented compared to traditional single-session FGDs.

7. Ethical and practical considerations

Conducting virtual and digital focus group discussions (FGDs) necessitates careful attention to ethical principles and practical challenges unique to online environments. Issues such as informed consent [45,46], data security [47], equitable participation [8,9], and digital literacy [13] must be adequately addressed to ensure ethical rigour, participant protection, and data integrity. This section outlines critical considerations for ethically and practically conducting FGDs in digital spaces, focusing specifically on informed consent and data security, management of power dynamics, and inclusive research practices for individuals with varying digital competencies.

7.1. Ensuring informed consent and data security in online FGDs

Ethical standards in qualitative research underscore the importance of obtaining informed consent and safeguarding participant confidentiality. In digital FGDs, informed consent processes must explicitly communicate how data will be collected, stored, analysed, and shared, particularly due to heightened risks related to online data security. Researchers must employ robust security measures, such as secure digital platforms, encrypted data storage, and clear protocols for data management. Recent literature including McInnis et al. [45], Maldonado-Castellanos and Barrios [46], and Plunk et al. [9] emphasise that transparent communication of potential risks and detailed descriptions of data handling practices significantly enhance participants' trust and willingness to engage candidly in virtual research contexts.

7.2. Addressing power imbalances in virtual FGDs

Power dynamics, a longstanding concern in traditional FGDs as highlighted by various studies such as Ayrton [48], Galloway [49] and Nduna [50], may become amplified in virtual settings, where certain participants could dominate conversations while others remain passive or overlooked. Researchers must proactively moderate discussions, employing techniques such as structured turn-taking, breakout rooms, or anonymous feedback channels, to balance participation equitably. Recent studies highlight that actively managing group dynamics and deliberately creating inclusive digital environments significantly reduce the influence of dominant participants and amplify the voices of less assertive individuals, thus improving the representativeness and authenticity of the collected data [22,25,26,43].

7.3. Adapting FGDs for participants with low digital literacy

The transition to digital methodologies presents specific challenges related to participants' varying levels of digital literacy [13]. Researchers must carefully tailor their approaches, providing accessible technology, user-friendly platforms, comprehensive training, and real-time technical support. Simplifying procedures and offering clear, step-by-step instructions ensures that participants with limited technological experience are adequately supported and meaningfully included. Current evidence advocates adopting inclusive, flexible approaches—such as simplified digital interfaces, pre-session tutorials, and availability of technical assistance—as essential practices to foster equitable participation among diverse populations, ultimately enhancing the inclusivity and quality of qualitative research outcomes.

8. Future directions and recommendations

As qualitative research continues to embrace digital innovation, several avenues for future exploration and methodological refinement become apparent. Specific research questions that warrant immediate investigation include: How do cultural communication patterns influence AI interpretation accuracy across different ethnic and linguistic groups? What optimal duration and frequency protocols minimise digital fatigue while maximising data quality in virtual FGDs? How can hybrid methodologies be standardised while maintaining flexibility for diverse research contexts?

Firstly, there is a critical need for empirical studies rigorously comparing traditional FGDs with virtual, hybrid, and gamified approaches to better understand their relative effectiveness, data quality, and participant experiences. Future research should specifically evaluate these methods' efficacy across diverse populations, particularly among marginalised or digitally underserved groups, to ensure inclusivity and methodological equity.

Secondly, advancing AI and machine learning technologies present significant opportunities to further enhance qualitative analysis. Future studies should prioritise the development and validation of culturally-sensitive and context-aware NLP and sentiment analysis tools.

Necessary interdisciplinary collaborations should include partnerships between qualitative methodologists and computational linguists to develop culturally-sensitive algorithms, collaborations with anthropologists and sociologists to ensure cultural competency in AI training datasets, partnerships with computer scientists specialising in explainable AI to enhance algorithmic transparency, and collaborations with ethicists and legal experts to develop comprehensive digital research governance frameworks.

Researchers must also focus on creating AI solutions capable of accurately interpreting nuanced conversational dynamics, emotional subtleties, and culturally-specific communication patterns, thus reducing the risks of misrepresentation inherent in current automated tools.

Thirdly, ethical frameworks governing digital qualitative research urgently require further elaboration. Emerging promising frameworks include the 'Algorithmic Impact Assessment for Qualitative Research' model, which requires systematic evaluation of AI bias potential before implementation; the 'Digital Consent Plus' framework, which extends traditional informed consent to include AI-specific risks and data usage; and the 'Participatory AI Governance' approach, which involves research participants in AI system design and validation processes. Ethical guidelines and regulations must evolve in step with technology to explicitly address emerging concerns around data privacy, digital surveillance, informed consent in digital contexts, and potential algorithmic biases. Researchers, academic institutions, and ethical review boards should collaboratively develop comprehensive digital ethics protocols specifically tailored to virtual and AI-driven qualitative research.

Practically, qualitative researchers are recommended to proactively integrate comprehensive digital literacy training and technical support mechanisms into their research design to ensure equitable participation. Given the ongoing challenges associated with digital fatigue, future studies should explore optimal session durations, interactive elements, and break schedules, producing empirically-informed recommendations for minimising cognitive load and enhancing sustained participant engagement in virtual settings.

Lastly, interdisciplinary collaboration between qualitative methodologists, AI specialists, software developers, and ethicists is strongly advised. Such collaborative research teams will be uniquely positioned to advance methodological innovations, address ethical complexities, and enhance research practices, ultimately promoting rigorous, inclusive, and ethically responsible qualitative research in an increasingly digital and technologically sophisticated environment.

9. Conclusion

This narrative review has explored the integration and evolution of virtual and digital methodologies in focus group discussions (FGDs), highlighting significant advances in digital platforms, AI-driven analytical tools, hybrid approaches, gamification techniques, and ethical considerations. Online platforms such as Zoom, Microsoft Teams, and WhatsApp have dramatically expanded geographical reach, allowing greater inclusion of marginalised and diverse participant populations. Simultaneously, advancements in AI and machine learning—particularly NLP and sentiment analysis—have streamlined qualitative data analysis, enhancing researchers' ability to capture complex emotional and thematic insights. Hybrid methodologies, combining traditional face-to-face methods with digital and social media interactions, have offered new possibilities for richer, more sustained participant engagement. Gamified and interactive approaches, including digital storytelling and mobile applications, further extend qualitative research methods, creating dynamic, participant-centred research experiences. Nonetheless, these innovations come with challenges, notably ethical concerns around informed consent, data privacy, digital literacy, and power dynamics in virtual environments. Future qualitative research should continue addressing these challenges by

refining methodological approaches, prioritising participant inclusivity, and adopting ethical frameworks tailored explicitly for digital research contexts.

9.1. Limitations of the review

This narrative review has several limitations that warrant consideration when interpreting its findings. First, due to the nature of narrative reviews, the selection and analysis of literature may be subject to potential biases, as systematic and replicable methods characteristic of systematic reviews or *meta*-analyses were not strictly employed. Consequently, relevant studies or evidence may have been inadvertently overlooked. Additionally, the review exclusively included English-language sources, potentially excluding valuable research published in other languages. Furthermore, the rapid evolution of digital technologies and artificial intelligence methodologies means that evidence and best practices continue to emerge rapidly, making some findings quickly outdated. Finally, the review predominantly focuses on theoretical, methodological, and practical considerations, with limited empirical evidence drawn from specific comparative studies; thus, caution is advised when generalising conclusions to all qualitative research contexts or participant groups. Despite these limitations, the review offers valuable insights into the current state and emerging trends in virtual and digital FGDs.

CRedit authorship contribution statement

David B. Olawade: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Deborah Omeni:** Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation. **Manisha Nitin Gore:** Writing – review & editing, Writing – original draft, Methodology, Investigation. **Manizha Hadi:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Investigation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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