

METHODOLOGICAL CHALLENGES OF USING EMPIRICAL RESEARCH TOOLS IN THE DIGITAL COMMUNICATION ENVIRONMENT: TOWARD A CRITICAL UNDERSTANDING OF EMERGING CHALLENGES AND RESEARCH TRENDS

التحديات المنهجية لاستخدام أدوات البحث العملي في البيئة الاتصالية الرقمية: نحو فهم نقدي للتحديات والتوجهات البحثية الصاعدة

FOURAR Ahmed amine

University of BISKRA

Laboratory of Political and Social Communication

a.fourar@univ-biskra.dz

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ABSTRACT

This article examines the methodological challenges involved in using empirical research tools within the digital communication environment. It argues that digital communication research requires more than simply transferring conventional tools such as interviews, observation, focus groups, and content analysis into online settings. Rather, it requires rethinking the relationship between the research question, the platform, the unit of analysis, data validity, ethics, and institutional infrastructure. The article reviews the principal challenges related to sampling bias, the loss of context, the governance of platforms, the post-API crisis, and the practical limits facing digital research in developing contexts. It also discusses the developing world in general and Algeria in particular as a case that reveals how logistical, material, and scientific constraints shape the feasibility of research tools and the interpretation of findings. The article concludes by highlighting major emerging trends, including multi-method designs, user-centered approaches, fine-grained behavioral data, and participatory ethics.

Keywords: *Algeria; Digital communication; Digital trace data; Empirical research tools; Methodology.*

ملخص

تناول هذه المقالة التحديات المنهجية المرتبطة باستخدام أدوات البحث العملي داخل البيئة الاتصالية الرقمية وتذهب إلى أن البحث في الاتصال الرقمي لا يقتصر على نقل أدوات البحث التقليدية، مثل المقابلة والملاحظة، ومجموعات التركيز وتحليل المحتوى، إلى الفضاءات الرقمية، بل يستدعي إعادة التفكير في العلاقة بين سؤال البحث والمنصة، ووحدة التحليل، وصدق البيانات، والأخلاقيات، والبنية المؤسسية.

وتعرض المقالة أبرز الإشكالات المتعلقة بتحيزات العينة، وفقدان السياق، وحوكمة المنصات، وأزمة ما بعد واجهات البرمجة، كما تتناول القيود اللوجستية والمادية والعلمية التي تواجه البحث الرقمي في العالم النامي عمومًا وفي الجزائر خصوصًا. وتخلص المقالة إلى إبراز أهم التوجهات البحثية الصاعدة، مثل التصميمات متعددة الأدوات، والمقاربات المتمحورة حول المستخدم، والبيانات السلوكية الدقيقة، والأخلاقيات التشاركية.

الكلمات المفتاحية:

أدوات البحث العملي؛ الاتصال الرقمي؛ الجزائر؛ البيانات الأثرية الرقمية؛ المنهجية.

1. INTRODUCTION

The digital communication environment is no longer merely a technical extension of traditional communicative spaces. It has become a sociotechnical domain with its own logic for producing, circulating, archiving, and reconfiguring messages through platforms, algorithms, and interactive interfaces. Consequently, empirical research tools such as interviewing, observation, focus groups, and content analysis can no longer be transferred mechanically from face-to-face settings to digital environments without rethinking their epistemological and methodological assumptions. Research on digital communication confronts not only a new medium, but also a transformed notion of the field, a new data structure, a different researcher-participant relationship, and shifting boundaries regarding what counts as a valid context for interpretation. Recent scholarship suggests that analyzing digital communication requires careful alignment between the research question, the medium, the platform, and the unit of analysis, because many digital phenomena

cannot be understood through visible content alone, but rather through the conditions under which such content is produced and circulated, and through its relation to broader, cross-platform contexts (Strauss et al., 2025, pp. 3143-3144; Forberg & Schilt, 2023, p. 6).

This article examines the principal methodological challenges involved in using empirical research tools in the digital communication environment. It focuses on the transformations that have affected data collection and data analysis tools, as well as on the new questions that digital environments raise concerning representation, validity, context, ethics, and data access. It also addresses the logistical, material, and scientific challenges that emerge more clearly in the developing world in general, and in the Algerian case in particular, before discussing the most important emerging research trends in this field.

2. Aligning the research question with the digital medium

One of the most prominent methodological challenges lies in conflating what is technically available with what is scientifically appropriate. Digital environments provide an abundance of data, but the ease of accessing certain platforms or archives may push the researcher to choose what can be collected rather than what ought to be studied. This creates a double methodological risk: on the one hand, the research question may be reduced to the boundaries of the platform; on the other hand, the communicative phenomenon may be interpreted on the basis of fragmentary data that do not capture its full trajectory. The literature stresses that the research question itself should be the true starting point, after which the medium, platform, and tool are selected on the basis of their ability to represent the phenomenon under study rather than on the basis of extraction or tracking convenience alone (Strauss et al., 2025, pp. 3143-3144).

This problem becomes more acute when the phenomenon is inherently cross-platform, such as digital campaigns, the circulation of misinformation, reputation

building, or engagement with public issues. In such cases, text alone is insufficient for understanding meaning, because significance is distributed across the post, the comment, the image, the timing, the interaction pathway, and sometimes even the device or display interface itself. Hence, recent scholarship increasingly advocates multi-platform and multimodal research designs, not simply to gather more data (Strauss et al., 2025, pp. 3143-3144; Ohme et al., 2024, p. 125), but to reconstruct the full communicative architecture of the phenomenon under study.

3. Redefining the "Field" in Digital Ethnography

Digital environments have redefined the research field itself. In conventional research, the field is often a place whose geographical or institutional boundaries can be identified with some clarity. In digital ethnography, however, the field is constituted through networks, accounts, virtual communities, pseudonymous participants, and movement across platforms. Accordingly, the methodological question is no longer limited to where one observes. It also concerns how the researcher appears within the field, how they present themselves to participants, and what degree of participation or digital co-presence they adopt. Forberg and Schilt emphasize that two decisions remain central in this type of research: the degree to which the researcher discloses their identity (Forberg & Schilt, 2023, pp. 6, 12), and the degree of their presence or participation within the digital environment, because these decisions shape both the form of the data collected and its ethical and epistemic limits.

The importance of this issue is not merely ethical; it also extends to the nature of the knowledge produced. Silent observation or the collection of public posts may provide useful material for discourse or interaction analysis, but such practices do not necessarily generate ethnographic knowledge in the thick sense, that is, knowledge produced through sustained engagement, negotiation with social actors, and the capacity to understand what does not appear directly in the digital archive.

For this reason, contemporary digital ethnography insists that the researcher's presence, position, and degree of involvement with participants are not minor procedural details but methodological choices that must be explicitly stated and justified (Forberg & Schilt, 2023, pp. 6, 12).

4. Sampling Bias and the Problem of Representation

A fundamental methodological problem in digital research is that the platform population does not necessarily equal the study population, and that a digital account does not always correspond to an individual as the unit of analysis. The literature on digital trace data identifies two salient forms of error in this regard: coverage error, when platform users are not representative of the target population, and unit error, when the data are available at the level of the account or device rather than the person, or when a single individual has multiple accounts (Ohme et al., 2024, pp. 134-135). These issues directly affect generalizability and explanatory strength, especially when digital data are treated as though they were a transparent mirror of social behavior.

This bias also extends to digital interviews and online focus groups, since individuals do not participate equally in digital environments. People with lower digital literacy, less trust in platforms, or weaker internet connectivity may be implicitly excluded from the sample even without any explicit procedural decision to do so. Under such conditions, the digital tool is no longer a neutral means of data collection; it may become a selection mechanism that reshapes the study population from the very moment of recruitment. This warning becomes especially important when the study targets populations characterized by unequal access to technology (Maldonado-Castellanos & Mondragón Barrios, 2023, p. 3; Ohme et al., 2024, pp. 134-135).

5. Data Validity Between Digital Abundance and the Loss of Context

The abundance of digital data may suggest that researchers are in a better position than ever before, yet this same abundance may constitute a deep methodological problem. Much of the data available on platforms was not originally generated for research purposes, and therefore does not naturally align with the researcher's concepts, hypotheses, or variables. This requires additional conceptual work to connect the platform's records or indicators to what the researcher actually wants to measure, such as exposure, interaction, or effect. Moreover, although automated analysis is highly useful, it cannot always capture irony, tone, speaker intention, or the situational context surrounding digital texts (Strauss et al., 2025, pp. 3143-3144; Ohme et al., 2024, pp. 124-126). Reconstructing context therefore becomes essential before making broad interpretive claims.

In the same context, crude aggregate indicators such as screen time have been increasingly criticized because they do not precisely reveal what people do, with what type of content, in which context, or with what interactional patterns. This has encouraged a move toward studying digital patterns, or fine-grained behavioral profiles, that seek to understand the communicative experience through usage trajectories, content types, and sequences of interaction rather than through gross, aggregate indicators alone (Sultan et al., 2023, pp. 1, 6; Strauss et al., 2025, p. 3144). Even so, this shift does not fully remove the problem, because it generates new challenges related to sorting, organizing, and interpreting this vast flow of data, as well as to its ethical and privacy implications.

6. Digital Interviews and Focus Groups Between Flexibility and the Loss of Cues

Digital interviews have become more common and more legitimate in contemporary qualitative research, and they are no longer treated merely as a secondary or emergency substitute. Yet this transformation does not mean that digital interviewing is identical to face-to-face interviewing. Rather, each format has

its own conditions and affordances. Online interviews may provide temporal and spatial flexibility and may facilitate access to geographically dispersed or busy participants, but they can also weaken rapport, reduce nonverbal cues, and introduce technical factors that affect the quality of the data itself. For this reason, recent literature stresses the need to treat digital and face-to-face methods as methodologically equal in legitimacy while acknowledging the different properties of each (Fan et al., 2024, p. 342).

From an ethical and practical perspective, the quality of the digital interview is determined not only by the researcher's skill in managing the conversation, but also by their ability to negotiate with participants regarding the format most suitable for them. The choice between video, audio, and text-based interviewing should not be understood as a purely technical decision. It is also part of respecting the participant's comfort, privacy, and digital capacities (Fan et al., 2024, p. 342; Maldonado-Castellanos & Mondragón Barrios, 2023, p. 3). This issue becomes especially important in sensitive topics or among participants who are uncomfortable on camera or who live in unstable home environments.

Online synchronous focus groups add another layer of complexity because interaction is no longer dyadic but collective, and because the management of time, turn-taking, and attention is harder to maintain in online environments. The literature has identified eight recurring practical considerations in designing such groups, including prior preparation, the number of participants, session duration, the possibility of breaks, platform usability, patterns of interaction, the role of the support team, and privacy concerns (Willemsen et al., 2023, p. 1813). These considerations are not merely technical arrangements; they reveal that group dynamics in digital environments are not replicas of their face-to-face counterparts but distinct interactional forms that require more controlled yet flexible design.

7. Ethics as Part of Methodology Rather Than an Add-On

One of the major transformations in digital communication research is the shift from understanding ethics as a formal procedure that precedes research to understanding it as an ongoing reflexive process accompanying all of its stages. The guidelines of the Association of Internet Researchers do not offer a ready-made recipe so much as they encourage continuous critical questioning about participants' contextual expectations, the limits of consent, the possibility of re-identifying individuals, the risks of reuse, and the amount of data that should be collected in the first place (Franzke et al., 2020, pp. 2, 6). From this perspective, ethics is not an external constraint on methodology but a structural component of its design and justification.

This becomes even clearer in digital interviewing, where confidentiality and privacy are tied not only to the choice of platform but also to the participant's understanding of the platform's technical properties and of the mechanisms of recording, storage, and sharing. Formal consent is therefore insufficient if the participant does not understand what will happen to their data or what participation technically entails (Maldonado-Castellanos & Mondragón Barrios, 2023, p. 3). In this way, the participant's digital literacy becomes both an ethical and a methodological factor, because its weakness may affect the candor of disclosure and the autonomy of the decision to participate.

Institutional infrastructure also affects the quality of ethical review and the consistent application of standards. Recent reports on the ethics of platform research indicate that the most prominent challenges here include the absence of professional consensus regarding procedures, uneven or weak ethics review, and the limited institutional infrastructure that supports this type of research. Accordingly, it is no longer sufficient to rely on the judgment of the individual researcher alone; more explicit and transparent institutional frameworks are needed to achieve a real balance between the demands of open science and the rights and privacy of users (Lukito, 2024, pp. 3, 24-25).

8. Researcher Dependence on Platform Governance and the Post-API Crisis

The boundaries of digital research are no longer drawn solely within the university or within accepted scientific norms. They are also increasingly determined by the companies that own platforms, by their changing policies, and by the access regimes they impose on data. Recent scholarship in this area shows that digital trace data may be collected through application programming interfaces, data donation, or screen tracking, and that each approach offers a different degree of proximity to actual behavior and a different degree of control over data. Yet each method also comes with its own constraints: programmatic access may be interrupted or modified, data donation requires effort from participants and may prove difficult with large and diverse samples, and screen tracking raises additional concerns related to privacy and the enormous scale of the data produced (Ohme et al., 2024, pp. 125, 128, 134-135).

Within this context, what has been called the post-API era has emerged — a situation in which access to platform data can no longer be treated as a presumed research right but rather as a regulatory or commercial privilege that may be restricted or withdrawn. Freelon and colleagues describe four systems that increasingly govern such access: relatively permissive APIs, academic-specific APIs, academic walled gardens that permit limited access under specified conditions, and pay-to-access interfaces (Freelon et al., 2024, pp. 24-26). This classification reveals that the question of what we study has become directly tied to the question of what the platform allows us to study in the first place. This marks a major shift affecting the very core of methodological independence in digital research.

9. Methodological Challenges Related to the Research Context in the Developing World and in Algeria

Methodological challenges in the digital communication environment are not formed within an equal global space. They vary sharply according to geographic, economic, and institutional location. In the developing world in general, the validity of many digital research tools remains conditioned by infrastructure, the cost of connectivity, network stability, and the amount of funding available for scientific research. Data from the International Telecommunication Union indicate that the largest gap between high-income and low-income economies appears in the affordability of fixed broadband internet, with the average performance of high-income economies being 4.1 times that of low-income economies. In addition, the UNESCO science report indicates that about 80 percent of countries still spend less than 1 percent of their gross domestic product on research and development. This means that a significant portion of research environments operate under persistent financial and infrastructural pressure (International Telecommunication Union [ITU], 2024, p. 16; Schneegans et al., 2021, p. 3).

These conditions become a direct methodological problem whenever researchers use tools that presuppose stable digital infrastructure and relatively uniform technical competence among participants. Long video interviews, synchronous focus groups, data donation strategies, and screen tracking all require reliable access, digital skills, and a certain level of trust in tools and platforms. In settings where connection is intermittent, expensive, or unequal, the research tool ceases to be merely an instrument of inquiry; it becomes a sorting mechanism that implicitly excludes specific groups and reshapes the sample before analysis even begins (ITU, 2024, p. 16; Ohme et al., 2024, pp. 128, 134-135). In such cases, the logistical and material dimension acquires genuine explanatory value because it helps determine who can

participate, how they participate, and what type of data can be collected in the first place.

Beyond this material inequality lies an epistemological problem of equal significance. Many digital research tools, platform environments, and dominant theoretical debates have been developed primarily around the experiences, platforms, and usage patterns of the global North. A recent review warns that this situation produces what may be called Northern visibilities, that is, the privileging of cases, platforms, and communities that are more visible within global digital infrastructures, at the expense of global South experiences that are less represented or less amenable to automated extraction (Özkula & Reilly, 2024, p. 1). As a result, researchers in the developing world may face a methodological paradox: they possess tools that appear scientifically advanced, yet these tools do not fully see what is taking place in the local context, or they see it through unbalanced platform and epistemic filters.

In the Algerian case, this discussion becomes more complex because the legal and regulatory framework recognizes, in principle, the importance of supporting scientific research with human, material, and financial resources. The framework law on scientific research and technological development provides for the organization of research entities and the provision of the material and financial means required for them. It also allows for the creation of shared research services in order to pool expertise and scientific equipment. Yet the existence of this legal recognition does not necessarily imply the actual availability of flexible and efficient operating conditions, especially in fields that require constantly updated digital tools, equipment, and software (People's Democratic Republic of Algeria, 2015, pp. 10, 12).

From a logistical and material perspective, official data on internet use in Algeria reveal a highly significant methodological fact: the dominance of mobile

internet. In the fourth quarter of 2024, 89.20 percent of all internet subscriptions in Algeria were mobile subscriptions, compared with only 10.80 percent fixed subscriptions. Peak bandwidth consumption reached 4,330 Gbps. Methodologically, this suggests that a large share of digital interaction in Algeria takes place through mobile phones rather than through highly stable fixed connections. Researchers therefore need to adapt their tools, questions, and modes of communication with participants to this reality instead of assuming ideal connectivity conditions that are not equally available in everyday practice (Autorité de Régulation de la Poste et des Communications Électroniques [ARPCE], 2024, p. 11).

This diagnosis is reinforced by an Algerian study on the funding of university research laboratories, which showed that the difficulties are related not only to the size of funding but also to management and implementation processes. The study recorded significant shortages in qualified personnel, the absence of periodic audits, ambiguity in the distribution of tasks, and insufficient work tools. These factors affect the speed with which projects are implemented, the acquisition of equipment, and the ability to update software and research media at the required pace. In this sense, the material obstacle cannot be separated from the administrative one, because delays in management may transform a resource that is nominally available into one of limited practical value (Rahmouni & Benyahia-Taibi, 2018, pp. 253, 264).

At the scientific level, Algeria's innovation indicators point to the existence of significant human and research capacities, yet converting these capacities into more regular knowledge and technological outputs remains a clear challenge. Algeria's profile in the Global Innovation Index 2025 ranked the country 115th globally, with relatively stronger performance in human capital and research than in knowledge and technology outputs, business sophistication, and market sophistication. The profile also reports 821.67 full-time equivalent researchers per million inhabitants and domestic expenditure on research and development amounting to 0.48 percent of gross domestic product in the dataset used for the profile (World Intellectual

Property Organization [WIPO], 2025, pp. 4, 7). These indicators suggest that the problem lies not only in the number of researchers but in the broader system linking funding, management, equipment, publication, and the conversion of scientific effort into sustainable institutional accumulation.

Accordingly, bringing this context into the article is not a secondary descriptive addition; it is a necessary methodological condition for assessing the possibilities and limits of empirical research tools within the digital communication environment. In the developing world generally, and in Algeria particularly, the validity of a tool cannot be judged solely by the extent to which it is established in the literature. It must also be assessed in relation to its feasibility within a context marked by uneven infrastructure, the dominance of mobile connectivity, procedural complexity, and the global asymmetry of digital knowledge production (Özkula & Reilly, 2024, p. 1; ARPCE, 2024, p. 11; Rahmouni & Benyahia-Taibi, 2018, p. 264). Referring to this context is therefore not an external description of circumstances, but a key entry point for understanding the findings themselves, the limits of their generalization, and the implications of their research use.

10. Major Emerging Research Trends in This Context

Contemporary research on digital communication is moving beyond crude and general indicators toward more precise approaches that focus on patterns of use and the granular contexts of exposure and interaction. This shift has contributed to the rise of the concept of digital patterns, or fine-grained behavioral profiles, as a framework for understanding what individuals actually do on platforms rather than simply measuring time spent or number of logins (Sultan et al., 2023, pp. 1, 6; Ohme et al., 2024, p. 125). This trend is especially important in topics that require precise interpretation of the relationship between digital behavior and well-being, polarization, or exposure to misinformation.

There is also a clear movement toward multi-method and multi-platform designs in which no single tool or single data type is treated as sufficient. Combining digital trace data, interviews, surveys, digital diaries, and qualitative observation has become a way to compensate for the limitations of each tool in isolation, to narrow the gap between what people actually do and what they say about their practices, and to reduce the distance between what the platform reveals and what remains invisible without contextual explanation. This transformation reflects growing awareness that the strength of digital research lies not in the abundance of data alone, but in the quality of an integrative design that connects multiple sources of meaning (Ohme et al., 2024, pp. 125, 128; Strauss et al., 2025, pp. 3143-3144).

A further trend is the rise of user-centered approaches such as data donation, negotiating the interview medium with participants, and involving participants more directly in decisions regarding what they share and how they share it. The significance of these approaches lies not only in their capacity to enhance epistemic precision by getting closer to actual practice, but also in their ethical value because they grant participants a more active role in shaping the data collection process (Fan et al., 2024, p. 342; Ohme et al., 2024, p. 128). From this perspective, respecting the participant's comfort and technical capacities becomes part of good methodology rather than a merely external ethical gesture.

Finally, some recent scholarship has moved toward expanding ethical governance itself so that it becomes more participatory. In the field of social media experiments, calls have emerged to involve users, researchers, platforms, and regulatory bodies in shaping the principles that govern ethical decisions instead of leaving them entirely to traditional institutions or individual judgment (Straub & Burton, 2025, pp. 2-3; Lukito, 2024, pp. 24-25). These calls stem from increasing awareness that platform environments change too rapidly for ready-made ethical templates to remain adequate, and that participatory approaches may give ethical standards greater legitimacy, contextual fit, and practical applicability.

11. Conclusion

The preceding discussion makes clear that the methodological challenges involved in using empirical research tools in the digital communication environment do not concern technology in itself so much as they concern the complexity of the relationship between the scientific question, the platform, the sample, the data, the context, ethics, and institutional infrastructure.

A digital interview is not merely an interview conducted through a screen, digital ethnography is not simply the observation of published content, digital trace data are not a transparent representation of behavior, and access to platforms is not a stable condition or a guaranteed right for researchers. The quality of digital research must therefore be judged by its capacity to reconstruct methodology itself in response to these transformations, not merely by its adoption of newer tools or larger quantities of data.

This reality becomes even clearer when we consider the developing world in general and the Algerian case in particular, where methodological challenges intersect with logistical, material, and scientific conditions that make the validity of a tool dependent on its practical executability as much as on its theoretical legitimacy. For this reason, the most promising orientation is one that combines plural designs, contextual sensitivity, ethical vigilance, and critical awareness of the limits imposed by platforms and infrastructures, so that research on digital communication can continue to produce precise, responsible, and interpretable knowledge.

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