

## Data Saturation in Digital Qualitative Interviews: A Critical Review of Influencing Factors and Methodological Rigor in Educational Research

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### ABSTRACT

Data saturation remains a fundamental yet heavily debated methodological principle in qualitative inquiry due to persistent subjectivism and methodological laxity, a challenge that has intensified with the contemporary transition toward digital and virtual interview modalities. This study examines and contextualizes the critical factors influencing data saturation when digital qualitative interviews are deployed within educational research. Utilizing a critical literature review design, a thematic analysis was conducted on 18 international peer-reviewed articles published between 2010 and 2025 to systematically identify the determinants of data sufficiency in interview-based data collection. The synthesis revealed six primary factors that dictate methodological rigor within virtual educational research environments, including data quality and thickness, the scope and complexity of the research, sampling strategies, the design of research questions and interview guides, the digital-pedagogical skills of the interviewer, and the homogeneity or diversity of the participants. Ultimately, this paper contributes a robust methodological control framework that enables educational researchers to validly operationalize data adequacy indicators, thereby mitigating the risk of premature data saturation when evaluating interactive learning systems and digital educational environments.

**Keywords:** Data Saturation, Digital Qualitative Interview, Methodological Rigor, Educational Research, Interactive Learning



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## 1. INTRODUCTION

Within qualitative research, data adequacy plays a pivotal role in establishing the rigor, validity, and trustworthiness of the study (Bekmezci & Sürücü, 2025; Lim, 2025). Central to this empirical pursuit is the principle of data saturation, which is conceptually defined as the baseline operational parameter where subsequent data collection yields no novel codes, thematic categories, or conceptual insights (Hennink & Kaiser, 2022; Rahimi & Khatooni, 2024). Within the landscape of qualitative educational research, achieving conceptual redundancy is particularly important in studies examining pedagogical paradigms, curriculum transformations, and the experiences of educational stakeholders, as it ensures that the resulting findings are grounded in robust and stable thematic patterns rather than isolated observations (Matta, 2022; Tafese & Kopp, 2025). Without a transparent, verifiable, and systematic operationalization of saturation, qualitative inquiries in education remain highly vulnerable to criticisms of analytical impressionism, unwarranted subjectivism, and methodological laxity (Alam, 2020; Maher, 2025).

Concurrently, contemporary educational research has undergone a profound paradigm shift characterized by the digital turn, wherein traditional face-to-face fieldwork has increasingly migrated to virtual and online environments (Camacho-Zuñiga et al., 2023; Howlett, 2022). Qualitative interviews with vital educational stakeholders, including teachers, students, and institutional administrators, are now

predominantly conducted via synchronous videoconferencing platforms and digital interactive communication technologies. According to De Villiers et al. (2022) and Jarrahi (2025), while these virtual modalities offer unparalleled logistical affordances, broader geographical reach, and significant cost-effectiveness, they simultaneously introduce unprecedented interactional dynamics that fundamentally alter the fabric of qualitative data generation. Researchers operating within virtual educational settings frequently encounter socio-technical constraints such as unstable network connectivity (Abedi, 2025), technical signal disruptions (Saavedra, 2022), and screen fatigue (Oates et al., 2022). Crucially, the medium of the screen causes a distinct dilution of embodied non-verbal cues, micro-expressions, and physical body language, all of which are traditionally vital for building organic rapport and stimulating nuanced, descriptive participant responses (Chadee et al., 2024). Consequently, these digital disruptions fundamentally reshape the depth of data collected and alter the trajectory of how saturation is reached (Mpofu, 2025).

Despite these rapidly shifting operational realities, the existing methodological literature exhibits a conspicuous conceptual lag. Prior scholarly efforts, most notably typified by Mwita (2022) and Hadley et al. (2022), have attempted to map the overarching factors that influence data saturation, yet such frameworks remain deeply bounded within conventional, physical face-to-face interactional models. To date, there is a lack of a comprehensive framework that systematically evaluates how the primary determinants of saturation, specifically data quality, research scope, sampling mechanisms, instrument design, interviewer competency, and participant diversity, manifest and intersect within online educational research environments (Rahimi & Khatooni, 2024; Squire et al., 2024). This theoretical omission creates a severe methodological gap, leaving educational researchers without robust, context-specific guidelines to differentiate between genuine conceptual saturation and premature data saturation induced by digital fatigue or technological communication barriers (Mpofu & Sibanda, 2026). Addressing this critical lacuna is imperative for safeguarding the scientific credibility of qualitative inquiries in an increasingly digitized academic landscape. Therefore, this study seeks to resolve this methodological ambiguity by addressing the following primary research question: What critical factors influence data saturation in digital qualitative educational research, and how do they ensure methodological rigor?

## 2. LITERATURE REVIEW

### 2.1. Conceptual Evolution of Data Saturation

The conceptual paradigm of data saturation was fundamentally introduced into qualitative inquiry through the seminal grounded theory framework (Peters, 2023). Originally operationalized as theoretical saturation, this baseline parameter delineates the field condition wherein continuous data collection yields no novel properties, thematic categories, or dimensional insights to further elaborate an emerging conceptual framework (Naeem et al., 2024; Rahimi & Khatooni, 2024). Over subsequent decades, the concept underwent a significant epistemological evolution, transitioning from an exclusive analytical tool in grounded theory to a universal metric for evaluating thematic completeness, internal validity, and methodological rigor across diverse qualitative designs including case studies, ethnography, and phenomenology (Almusaed et al., 2025; Saunders et al., 2018). As an objective marker of academic completeness, saturation serves as a critical justification indicating that the compiled dataset has achieved empirical adequacy, thereby validating the systematic cessation of active fieldwork (DiStefano & Yang, 2024; Hennink & Kaiser, 2022).

In contemporary methodological discourse, scholars have increasingly bifurcated the saturation construct into two rigid operational dimensions consisting of code saturation and meaning saturation (Daher, 2023; Peters, 2023). Code saturation refers to the quantitative threshold where the complete scope of distinct codes has been successfully identified within the structural analysis of interview transcripts (Guest et al., 2020; Squire et al., 2024). Conversely, meaning saturation demands a significantly higher degree of qualitative depth, occurring when the researcher achieves a holistically profound understanding such that no further nuances, complexities, or semantic dimensions are expressed by participants regarding those existing codes (Mpofu, 2025; Rahimi & Khatooni, 2024). This advanced conceptual differentiation is absolutely paramount to maintaining scientific integrity because a failure to distinguish between structural code replication and deep semantic richness often results in superficial claims of data adequacy that weaken research credibility.

### 2.2. Characteristics of Digital Qualitative Interviews in Education

The contemporary execution of qualitative interviews in the digital era has precipitated transformative structural modifications, particularly within the domains of educational research and instructional technology evaluation (Baker et al., 2024; Buckley et al., 2022). Traditionally recognized as the backbone of primary qualitative data collection, interviews empower investigators to systematically explore the nuanced perspectives, lived experiences, and subjective meanings of educational stakeholders (Subrahmanyam, 2025). When face-to-face fieldwork shifts toward synchronous video-conferencing platforms, the digital medium fundamentally alters the architecture of pedagogical interaction between the

researcher and participants such as teachers, students, and institutional administrators (de Villiers et al., 2022). Within educational technology research, virtual interviews do not merely function as passive data collection mechanisms but instead evolve into digital spaces mediated by instructional tools to gather comprehensive, highly granulated data (Keen et al., 2022).

This virtual screen environment inherently introduces a distinct set of interpersonal dynamics specific to educational settings. On one hand, the complete absence of physical non-verbal indicators, somatic body language, and direct eye contact can dilute emotional intimacy and complicate the immediate cultivation of organic rapport between researchers and educational practitioners (Weller et al., 2018). On the other hand, virtual environments can simultaneously offer a unique psychological safe space for introverted students or educators, enabling them to articulate their perspectives free from the traditional hierarchies of physical classrooms (Geng et al., 2024). However, the specific nature of digital data generation is also uniquely characterized by participant vulnerability to screen fatigue, a socio-technical phenomenon that frequently truncates verbal output and generates thin data comprised of brief, highly repetitive responses (de Villiers et al., 2022; Waugh, 2023). Consequently, the valid attainment of data saturation within digital educational inquiries depends heavily on the researcher's capacity to manage the online ecosystem and design interactive instruments that sustain cognitive engagement throughout the investigation.

### 2.3. Redefining Interview Modalities in Pedagogical Inquiries

Within the framework of digital educational research, conventional interview typologies undergo a critical operational redefinition that directly impacts the stability of data saturation (Bryda & Costa, 2023; Mpofo, 2025). Synchronous structured digital interviews that impose rigid, non-negotiable question standardization frequently mimic formal institutional assessments, thereby constraining the investigator's capacity to initiate flexible, inductive probing (Abedi, 2025; Fan et al., 2024). This restrictive interaction model severely limits the emergence of spontaneous information when complex pedagogical phenomena require a deep, multi-layered understanding (Fan et al., 2024). The linear nature of such digital interactions renders data collection highly predictable (Heiselberg & Stępińska, 2023), meaning that while code saturation might be accelerated, meaning saturation remains largely unfulfilled because participants merely supply normative responses confined to pre-established conceptual categories.

In contrast, semi-structured and unstructured approaches exhibit a highly adaptive utility within virtual educational research spaces (Huff & Brooks, 2024; Keen et al., 2022). Semi-structured digital protocols afford educational researchers the necessary autonomy to calibrate question depth, semantic phrasing, and chronological order based on real-time participant responses mediated through the virtual screen (Hwang et al., 2023). This strategic flexibility is exceptionally vital in evaluations of digital learning tools because it facilitates the active tracking of unexpected, highly innovative pedagogical insights that surface during the conversation. Meanwhile, digital unstructured interviews entirely transfer conversational agency to the participant, permitting narrative trajectories to unfold organically to expose authentic experiences within online learning environments (Fan et al., 2024). While this narrative freedom is uniquely suited for generating rich, thick datasets, it simultaneously demands advanced technical-pedagogical dexterity from the interviewer to ensure that virtual interactions remain scientifically bounded and conceptually aligned without fracturing into unrelated digressions.

### 2.4. Socio-Technical Affordances and Interactional Constraints

The structural transition from conventional face-to-face interviews to virtual modalities engenders a systemic dualism comprising robust socio-technical affordances along with distinct interactional constraints that directly dictate data volume and quality. The primary affordance of digital interview modalities in educational inquiry lies in their capacity to guarantee comprehensive data thickness across vast geographical boundaries (Ouhaichi et al., 2024; Zhao & Li, 2023). Investigators can seamlessly engage marginalized educators and student cohorts from remote or under-resourced regions, granting them an equal platform to articulate their educational realities without incurring prohibitive travel costs (Abedi, 2025). This logistical optimization enables educational researchers to expand participant diversity, which in turn significantly elevates the probability of achieving comprehensive meaning saturation.

An inverse examination reveals that virtual interactional constraints introduce substantial potentials for analytical bias and empirical distortion during data generation (de Villiers et al., 2022; Naidu et al., 2026). Inappropriate tonal modulations or micro-level audio distortions on communication platforms can be easily misinterpreted by educational stakeholders, while researcher interpretation bias may escalate due to visual constraints restricted strictly to the virtual camera frame (Heiselberg & Stępińska, 2023; Oates et al., 2022). Furthermore, research costs are not entirely eradicated but rather redistributed toward infrastructure acquisition, encompassing high-fidelity recording hardware, automated transcription software, and cloud-based analytical applications, which becomes problematic if the target population is scattered across regions with low internet penetration (Cresswell et al., 2022; Keen et al., 2022). Critical temporal management constraints also emerge, wherein abbreviated interview durations precipitated by

online cognitive exhaustion restrict the investigator's capacity for strategic prompting, culminating in superficial data that ultimately impedes genuine saturation.

### 2.5. Digital Ethical Integrity and Educational Data Privacy

The execution of digital qualitative interviews involving educational entities demands strict adherence to rigorous digital ethical protocols (Hakimi et al., 2021). The conventional principle of informed consent undergoes a technological mutation into e-informed consent (Silva & Capucho, 2021), placing an absolute responsibility on the researcher to ensure that teachers, parents, and minor students comprehend the exact purpose of the study, their absolute right to voluntary withdrawal, and the long-term implications of cloud-hosted audio-visual recording prior to executing the interview. Coercive participant involvement lacking complete digital awareness constitutes a severe infraction against academic integrity and ethical research codes. Investigators must also actively minimize digital psychological harm by intentionally avoiding intrusive lines of questioning that trigger anxiety, techno-stress, or emotional discomfort within virtual spaces (Malviya et al., 2026). A failure to establish a dignified, respectful, and secure digital environment inevitably prompts participant resistance, thereby compromising the authenticity of the collected data.

Furthermore, the operationalization of confidentiality and anonymity serves as a vital moral and legal instrument to protect socio-educational data privacy (Mahajan, 2026). Researchers bear an absolute mandate to protect the digital identity, personally identifiable information, and institutional affiliations of teachers and students from internet data breaches or unauthorized surveillance. Preserving these privacy rights requires a high level of researcher commitment to deploying advanced data encryption methods and maintaining secure, access-controlled cloud repositories. Educational researchers must treat all participants with profound respect irrespective of age or institutional status, operating under the explicit epistemological acknowledgment that qualitative success is entirely dependent on the participant's willingness to share deep insights (Subrahmanyam, 2025). The systematic application of these digital ethical principles is a non-negotiable prerequisite to prevent scientific malpractice and ensure that the trajectory toward data saturation is built upon an unyielding foundation of academic integrity (Mwilongo et al., 2024).

## 3. METHOD

To establish a rigorous conceptual framework for assessing data adequacy within digitized pedagogical landscapes, this study adopted a systematic qualitative critical review design utilizing thematic synthesis methodologies (Brunton et al., 2020). Rather than relying on speculative or anecdotal accounts, this empirical approach systematically synthesizes secondary data extracted from peer reviewed methodological literature to uncover the latent structural determinants of saturation. By employing a critical review paradigm, the investigation transcends mere descriptive reporting, allowing for an evaluative synthesis of how established qualitative principles mutate and operationalize when examining digital qualitative interviews within educational research environments.

A comprehensive electronic literature search was systematically executed across three prominent scientific databases comprising Google Scholar, PubMed, and ResearchGate to identify relevant methodological and empirical literature. The search architecture was strictly restricted to specific chronological parameters spanning the years 2010 to 2025 to ensure the capturing of modern developments in digital qualitative research and contemporary educational technologies. To optimize retrieval accuracy, the search protocol employed targeted combinations of keywords and boolean operators, specifically focusing on terms reflecting data saturation, virtual inquiries, digital qualitative interviews, and methodological sufficiency within educational research. This multi database approach ensured a broad epistemological reach, capturing critical insights from both general social sciences and specialized instructional technology literature.

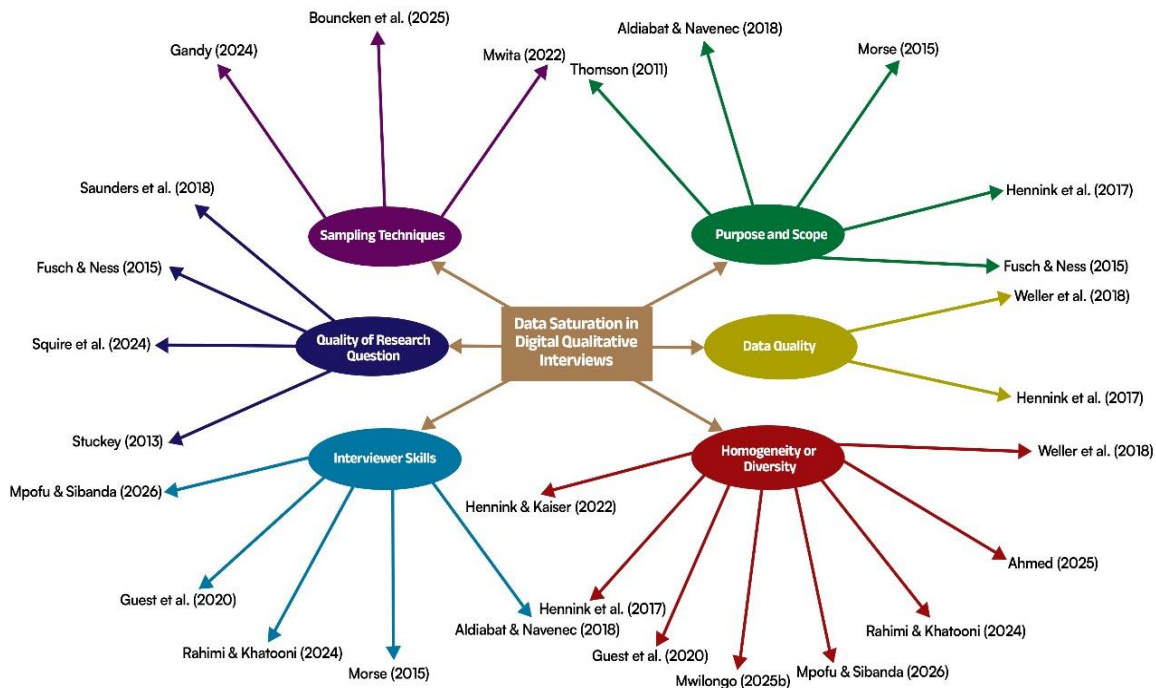
To ensure that only high quality, relevant literature informed the thematic synthesis, strict eligibility criteria were established prior to the data extraction phase. Peer reviewed journal articles were eligible for inclusion if they explicitly evaluated or demonstrated the operationalization of saturation parameters within digital qualitative interviews. Language was utilized as a primary inclusion parameter, wherein only papers published in the English language were selected to guarantee a comprehensible, precise, and rigorous synthesis of the factors influencing data saturation. Conversely, specific exclusion parameters were enacted to filter out gray literature and conceptually weak studies, meaning that articles providing no clear empirical or theoretical justification as to what influences data saturation, as well as those published in languages other than English, were strictly excluded from the final analytical sample.

The initial search yielded a broader pool of literature, which subsequently underwent a rigorous two stage screening process consisting of abstract skimming followed by a thorough, line by line reading of the complete full text documents. Following this multi stage filtration process, a total of 18 articles were determined to be highly relevant to the study topic and were automatically selected for comprehensive qualitative synthesis. The extracted datasets were analyzed using an inductive thematic analysis approach, which facilitated the organic identification, mapping, and clustering of core conceptual themes. This systematic analysis culminated in the development of an integrated narrative framework that maps the six

primary factors governing data saturation within contemporary digital qualitative interviews in educational research.

#### 4. RESULTS

Based on the critical analysis of the systematic literature review, this section presents a comprehensive mapping of the primary factors influencing data saturation in qualitative interviews. The structural relationships, classifications, and interactions among these thematic categories are explicitly delineated within the text and mentioned in Figure 1, which depicts the core indicators of methodological rigor in scientific data collection.



**Figure 1.** A mind Map Showing Factors Influencing Data Saturation in Qualitative Interviews

##### 4.1. Data Quality (Sufficient Data)

The fundamental nature and structural quality of data collected during interview sessions serve as primary benchmarks for establishing data saturation. When an investigator gathers deeply meaningful and contextually rich narrative data, the threshold of saturation can be validly achieved irrespective of the total volume of participants involved in the study. Hennink et al. (2017) emphasize that thick data, characterized by structural complexity and deep semantic nuances, provides substantially more profound insights than thin data, which lacks descriptive value. In other words, data saturation depends inherently on the conceptual adequacy and depth of the information gathered rather than on satisfying rigid numerical targets or quantitative sample densities. Selecting a small, highly targeted cohort of participants through rigorous purposive mechanisms is far more likely to yield rich data than conducting extensive, superficial interviews with a broad array of disengaged respondents from whom conceptual saturation can never be meaningfully achieved. Weller et al. (2018) also demonstrate that researchers can successfully extract a high volume of unique, granulated information per individual within a modest sample size by optimizing interview protocols. This operational reality confirms that the quality of data collected via virtual platforms exerts a direct influence on the determination of the saturation point in qualitative research.

Within the landscape of digital educational research, the methodological rigor required to assess data quality is frequently tested by the phenomenon of artificial or superficial responses from learners (Lim, 2025). When interviewed through virtual platforms regarding the efficacy of an interactive learning tool, students tend to provide uniform, normative responses due to digital anxiety or discomfort associated with the presence of a recording screen. Methodological rigor in qualitative educational inquiries demands that researchers do not prematurely accept such repetitive, shallow statements as evidence of data saturation. Investigators must carefully differentiate between superficial structural replication and authentic meaning saturation, ensuring that the descriptive depth concerning students' cognitive load and learning experiences has been comprehensively explored without virtual psychological barriers.

## 4.2. Purpose and Scope of the Research

The conceptual coverage and systemic boundaries of an inquiry dictate the trajectory toward data saturation when utilizing in-depth qualitative interviews. Fusch & Ness (2015) along with Morse (2015) have established that studies characterized by a narrow, highly focused scope will inevitably reach data saturation much more rapidly than extensive, large scale research initiatives. This divergence occurs because a constrained scope limits the variance of participant responses and reduces the necessary sample size, whereas a broad research agenda introduces multi layered variables that demand additional interviews to explore emerging thematic trajectories. Furthermore, Hennink et al. (2017) identify the core objective of a study as a major operational parameter governing saturation thresholds. If the pedagogical purpose is to explain highly complex educational phenomena or construct an entirely new instructional theory, a larger number of participants will be required as the conceptual boundaries of the data continuously expand during analysis. This operational condition is further supported by Aldiabat & Le Navenec (2018) along with Thomson (2011), who note that multifaceted research designs require investigators to gather extensive, multi dimensional data across diverse modalities, rendering the validation of definitive data saturation a highly demanding analytical process.

## 4.3. Sampling Techniques Used

The strategic choice of sampling methodologies exerted by an investigator heavily influences the pace and validity of data saturation when conducting interviews within virtual learning environments. According to Mwitwa, (2022), the deliberate deployment of purposive sampling significantly increases the probability of achieving genuine saturation because the subjects obtained through this technique possess information rich perspectives directly aligned with the specific pedagogical issues the study intends to resolve. Similarly, Gandy (2024), Ahmad & Wilkins (2025) and Bouncken et al. (2026) support this by demonstrating that purposive sampling stands as the most methodologically efficient mechanism for reaching saturation across all qualitative sampling techniques due to its capacity to exclude irrelevant noise and capture high density data. Conversely, alternative sampling techniques such as convenience, quota, and snowball approaches are highly susceptible to triggering premature or artificial data saturation. This limitation arises because convenience sampling prioritizes digital accessibility over informational relevance, quota sampling restricts participant selection to rigid predetermined criteria that flatten individual narrative variations, and snowball sampling relies on interconnected participant referrals that frequently result in highly insular digital networks that constrain data sufficiency. Therefore, the structural alignment of the sampling framework remains a vital determinant of whether an educational researcher achieves true conceptual saturation or falls into the trap of superficial data replication due to restricted network access.

Furthermore, the methodological implications of sampling framework selection in digital educational research are closely intertwined with the issue of equitable access to technology. Utilizing convenience sampling that relies exclusively on participants with stable internet connectivity or high quality digital devices carries a high risk of generating biased, premature data saturation. Learners residing within well resourced digital ecosystems often provide highly homogeneous feedback, which can mislead researchers into concluding that data saturation has been achieved. To maintain methodological stability, qualitative educational researchers must employ purposive sampling strategies that intentionally encompass a diverse range of subjects, including the perspectives of educators or students located in regions with low internet penetration, thereby ensuring that the resulting interpretive framework possesses high levels of representativeness and validity.

## 4.4. Quality of the Research Question and Interview Guide

This factor encompasses the integration between the overarching research questions and the specific prompts developed within the digital interview guide. Valid data saturation relies fundamentally on how initial research inquiries are formulated, as the descriptive depth of the prompts directly dictates the extent to which an investigator must initiate strategic probing to elicit comprehensive reflections from participants. Saunders et al. (2018) and Rahimi & Khatooni (2024) demonstrated that the operationalization of saturation must be developed in strict consistency and alignment with the core research questions to prevent analytical drift. Furthermore, Fusch & Ness (2015) along with Squire et al. (2024) affirm that securing valid data saturation depends on a highly systematic, well structured interview guide that ensures all respondents are exposed to a uniform core thematic baseline. As highlighted by Stuckey (2013) and Peters (2023), the structural quality and consistency of the questions asked during virtual sessions directly dictate the descriptive value of the text and the subsequent path to saturation. When interview protocols lack logical structure, participants are subjected to inconsistent conversational trajectories where new themes appear not because the stakeholders possess novel insights, but because the conceptual focus continuously shifts due to changing questions, leaving the investigator unable to determine when true data saturation has been achieved.

#### 4.5. Interviewer's Skills, Knowledge, and Expertise

To realize the objectives of qualitative inquiry within digitized educational spaces, a sophisticated configuration of advanced competencies is required from the researcher to successfully navigate the path to data saturation. This multi dimensional competency model encompasses analytical prowess, rigorous methodological understanding, and technical proficiency in communication technologies. For example, the execution of effective data saturation requires an exceptional ability to initiate real time probing and strategic follow up questions, which serve as essential tools for deepening participant responses across virtual interfaces. An interviewer must also possess the analytical sensitivity to know exactly when to provide conceptual clarifications to participants, when to extend complex pedagogical discussions, and when to redirect responses to maintain thematic focus, all of which constitute the core art of interviewing in qualitative inquiry (Mpofu & Sibanda, 2026; Rahimi & Khatooni, 2024). Guest et al. (2020) and Morse (2015) underscore that conversational flexibility during virtual sessions is paramount for reaching data saturation, as it allows investigators to dynamically paraphrase complex prompts when participants experience screen confusion, thereby extracting deep information. An investigator possessing highly developed communication skills, particularly active listening and verbal engagement, successfully fosters a secure virtual space that encourages transparent information sharing among informants to achieve saturation. In addition to these technical attributes, the researcher's professional experiences, academic background, and personal biases heavily shape data interpretation and the cognitive capacity to recognize true saturation (Aldiabat & Le Navenec, 2018; Rahimi & Khatooni, 2024). Conversely, an interviewer lacking these essential skills and methodological knowledge will consistently struggle to sustain engagement, extract substantive narrative depth, and validate data saturation.

In addition to technical proficiency, a crucial dimension of an interviewer's expertise in qualitative digital educational research is the capacity to manage digital empathy and deconstruct virtual power relations. While conventional face to face interactions allow researchers to easily build rapport, the physical separation of a virtual screen often reinforces hierarchical boundaries between the researcher and students, which can cause participants to become passive. Methodological rigor is achieved when the interviewer possesses the digital pedagogical competence to transform the computer screen into an equitable, interactive space for dialogue. Through the adaptive mastery of vocal intonations, sensitive pause management, and the capacity to read indicators of cognitive fatigue in front of the screen, the investigator can transcend virtual formalistic barriers to stimulate deep, thick narrative expressions as a fundamental prerequisite for establishing valid data saturation.

#### 4.6. Homogeneity or Diversity of Participants Involved

The demographic and experiential characteristics of the population involved in an inquiry exert a powerful influence on saturation trajectories within qualitative educational research. Reaching definitive data saturation is often accelerated when the composition of the participant sample is highly homogeneous, as individuals sharing identical professional roles or cultural backgrounds demonstrate aligned perspectives that yield rapid thematic repetition (Hennink & Kaiser, 2022). On the contrary, intentionally integrating a diverse array of stakeholders characterized by variations in age, gender, institutional context, and technological expertise introduces highly multi layered meanings and varied educational experiences, which are essential for achieving robust code and meaning saturation (Hennink et al., 2017; Mwilongo, 2025). Methodological insights from Mpofu & Sibanda (2026) confirm that heterogeneous online populations naturally require larger, more comprehensive sample sizes to fully capture divergent viewpoints and ensure a representative balance of complex socio educational demographic factors. Furthermore, Rahimi & Khatooni (2024) clarify that participant diversity does not obstruct data saturation but instead fundamentally shapes, tests, and validates the precise locus where authentic saturation is finalized. Similarly, Ahmed (2025) emphasizes that conducting digital qualitative interviews with a diverse sample enriches informational thickness, meaning that as the conceptual boundaries expand, the validity of the final data saturation threshold increases. This is supported by empirical evidence from Weller et al. (2018), which confirms that saturation is dictated by the volume of information shared, occurring far more rapidly when cohorts communicate constrained or minimal insights. Therefore, actively engaging diverse participants remains an indispensable strategy for capturing holistic educational realities and avoiding the critical methodological pitfall of premature data saturation.

#### 4.7. Synthesis of Methodological Rigor in Educational Research

In synthesis, the six primary determinants identified within this critical review do not operate in isolation but rather interact dynamically to form a cohesive methodological ecosystem in modern educational research. The structural quality of research questions and the design of consistent instruments serve as the foundational anchor, while the investigator's digital pedagogical skills act as the catalyst for extracting high quality data from a heterogeneous diversity of participants. The conceptual mapping demonstrated in the preceding sections proves that methodological rigor in achieving data saturation during digital qualitative interviews can no longer be measured using conventional, physical parameters.

Educational researchers are required to maintain a high level of methodological awareness, integrating technical dimensions of technology with deep pedagogical substance to produce scientific contributions that are credible, accurate, and entirely free from the traps of data reductionism.

## 5. DISCUSSION

### 5.1. Interaction of Factors and the Dynamics of Digital Empathy in Virtual Spaces

The objective findings of this critical review demonstrate that the point of achieving data saturation in digital qualitative interviews is not determined by a single variable, but rather by a dynamic socio-methodological interaction among six critical factors. Within the context of educational research, the convergence between the interviewer's skills and data quality undergoes a radical redefinition when transitioned into virtual environments. Interactions mediated by computer screens create a physical distance that can reinforce hierarchical power relations between adult researchers and student participants, which in turn can impede the depth of emotional expression among participants.

To overcome these interactional barriers, the investigator's proficiency is no longer limited to conventional verbal communication skills, but instead demands the mastery of digital empathy (Hoter et al., 2024). As articulated by Rahimi & Khatooni (2024), the cognitive capacity of the researcher to read indicators of emotional fatigue through facial expressions on the screen and adjust vocal intonations adaptively serves as the primary key to penetrating digital formalistic barriers. Without robust digital empathy, a well-structured interview guide (Fusch & Ness, 2015; Panyasai & Ambele, 2025) will still fail to generate thick data. Consequently, the methodological rigor of contemporary qualitative research heavily depends on the socio-pedagogical capacity of the investigator to integrate technical instruments with humanistic sensitivity within the virtual ecosystem.

### 5.2. Deconstructing Premature Saturation versus Authentic Meaning Saturation

One of the critical contributions of this discussion is the deconstruction of common researcher errors in interpreting data uniformity within the digital era. In educational technology research, investigators often fall into a methodological anomaly known as premature data saturation (Daher, 2023). This phenomenon occurs when students or teachers provide responses that tend to be brief, similar, and repetitive from the initial interview sessions, leading researchers to incorrectly conclude that data collection has reached the threshold of theoretical saturation.

Through the critical lens of digital methodology, such response uniformity is frequently not an indicator of genuine meaning saturation, but rather a reflection of screen fatigue and digital boredom (Mpofu, 2025). When learners experience a decline in concentration due to prolonged virtual interactions, they instinctively opt for safe, concise, and normative answers to quickly conclude the interview session (Queirós et al., 2017). If investigators halt data collection at this juncture, the resulting socio-pedagogical analysis will be superficial and lose its scientific validity. Educational researchers are required to maintain methodological skepticism by deploying interactive probing techniques (Guest et al., 2020) to ensure that data repetition genuinely represents the exhaustion of conceptual variance in the field, rather than the technical or psychological constraints of digital media.

### 5.3. Methodological Implications and Contributions to Future Educational Research

The critical analysis of the interactivity among the six determining factors carries broad methodological implications for the standardization of future qualitative educational research. The framework generated from this study asserts that the internal validity of an inquiry can no longer be measured using a positivistic paradigm that merely pursues numerical sample size targets (Saunders et al., 2018). Instead, the evaluation of successfully establishing saturation criteria must shift toward assessing the quality of the interaction process and the transparency of data operationalization within virtual spaces.

For investigators focusing on curriculum evaluation and the implementation of interactive learning technologies, this study offers a robust methodological control guideline (Lu et al., 2022; Matos et al., 2023). Researchers are explicitly mandated to document how purposive sampling strategies are managed to encompass the digital literacy diversity of participants (Ahmad & Wilkins, 2025; Samuel & Merkebu, 2026), how the question structure in the interview guide is kept consistent to avoid thematic drift (Janis, 2022; Stuckey, 2013), and how ethical protocols for data privacy protection are transparently administered (Squire et al., 2024). By strictly implementing these principles of rigor, scientific malpractice in the form of data reductionism can be averted, thereby enabling the outcomes of digital qualitative educational research to provide credible theoretical contributions to the development of contemporary pedagogical policies.

## 6. CONCLUSION

In conclusion, this study has successfully synthesized and contextualized six primary determining factors that influence the attainment of data saturation during the execution of digital qualitative interviews within the domain of educational research. The dynamic integration of data quality, research scope,

sampling techniques, the quality of research questions and interview guides, the socio-pedagogical skills of the interviewer, and the diversity characteristics of participants demonstrates that methodological rigor within virtual ecosystems can no longer be evaluated using rigid, conventional physical parameters. The primary scientific contribution of this study is the provision of a comprehensive methodological control framework for educational researchers to validly operationalize indicators of data sufficiency. This framework serves as a practical guide to eliminate the risk of premature data saturation caused by technical constraints or screen fatigue, which frequently mislead investigators when evaluating interactive learning systems and contemporary educational technologies.

Although providing significant theoretical and practical contributions to the advancement of qualitative methodology, this study possesses inherent limitations that must be acknowledged, particularly regarding the scope of its analysis which relies on the secondary synthesis of eighteen international scholarly articles published between 2010 and 2025. This search boundary centered on the Google Scholar, PubMed, and ResearchGate databases opens substantial opportunities for future research agendas to conduct direct empirical investigations in the field. Consequently, future research is highly recommended to apply, test, and validate the efficacy of this six factor framework in evaluations of more specific and cutting edge instructional platforms. Future research focus could be directed toward the implementation of digital qualitative interviews in evaluating artificial intelligence based learning systems or immersive technologies such as augmented reality and virtual reality, thereby reinforcing the reliability and internal validity of educational research in a rapidly evolving era of digital disruption.

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