How do I know if I achieved theoretical saturation? A reflective examination of constructivist grounded theory studies

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How Do I Know if I Achieved Theoretical Saturation? A Reflective Examination of Constructivist Grounded Theory Studies

Abstract

In this full methodological paper, we examine the ambiguous process of determining theoretical saturation in constructivist grounded theory (CGT) studies. Although CGT is widely used in engineering education research (EER) to develop theory from qualitative data, saturation is often treated as a vague endpoint with limited guidance for operationalization, undermining transparency and rigor. Drawing on critiques from qualitative methodology and reflective analysis of two CGT studies, we articulate practical guideposts for assessing when data collection and analysis have yielded theoretically complete models.

Our analysis draws on reflective logs from two contrasting CGT projects. The first study involved semi-structured interviews with 15 practicing engineers across multiple disciplines, analyzed through concurrent initial and focused coding supported by iterative memo-writing. Saturation was assessed through memo-documented indicators such as redundancy in analytic patterns, stabilization of focused codes, and increasing theoretical depth across varied roles. The second study examined unstructured interviews with 20 engineering faculty, using focused coding and in-depth memoing to evaluate category integration and theoretical sufficiency amid narrative variability.

Across both studies, we show how saturation judgments emerged through analytic comparison rather than numeric thresholds. Through a comparative analysis of these two studies, we demonstrate how the nature of the data (semi-structured vs. unstructured) fundamentally changes the indicators used to justify the cessation of data collection. We synthesize these reflections into actionable guideposts that emphasize memo-based monitoring, conceptual completeness, and reflexive team discussion. These guideposts support more transparent and defensible CGT practice in EER and related qualitative research contexts.

1. Introduction

Constructivist grounded theory (CGT) is widely used in engineering education research (EER) to develop theory from qualitative data, particularly in studies of complex socio-professional constructs such as identity and motivation [1]. Central to grounded theory traditions is theoretical saturation, commonly described as the point at which continued data collection no longer meaningfully contributes to theory development [2]. Despite its frequent invocation, saturation remains ambiguously defined and inconsistently operationalized in qualitative research, including CGT-based EER studies [3], [4].

Across methodological and empirical literature, saturation is often treated as a self-evident endpoint rather than a reflexive analytic judgment. Researchers routinely claim saturation without specifying how it was assessed or how analytic decisions evolved over time [3], [4]. This ambiguity presents a practical challenge, particularly for researchers new to CGT, who must determine when data collection is theoretically sufficient while navigating diverse participant populations and implicit expectations around sample size. In EER, these challenges are intensified by the heterogeneity of engineering contexts and the interpretive complexity of the phenomena under study [5].

CGT addresses these challenges by framing theory construction as an iterative, reflexive process grounded in meaning-making and constant comparison [1], [6]. Rather than relying on numeric thresholds, saturation in CGT is an analytic determination that categories are conceptually complete, theoretically integrated, and stable in relation to one another [2], [6], [7].

The purpose of this paper is to provide transparent, practical guideposts for determining saturation, grounded in reflective analysis of two CGT studies in engineering education. We illustrate how saturation judgments emerged over time and how researchers distinguished between redundancy, nuance, and incomplete theoretical integration [8], clarifying saturation as a methodological process rather than a procedural endpoint tied to interview counts.

The two studies were selected purposefully to support this examination. Although conducted independently by the first and second authors, both were advised by the same faculty member (third author), providing a shared methodological foundation while allowing variation in participant populations, interview structures, and analytic challenges. One study examines practicing engineers using semi-structured interviews [16], while the other focuses on engineering faculty through unstructured interviews [17], enabling comparative reflection across distinct forms of qualitative complexity within EER. By situating these reflections within CGT and engineering education research, this paper offers contributions that extend beyond the specific studies examined. The guideposts presented are intended to support more explicit, defensible, and reflexive saturation judgments, advancing methodological rigor while preserving the flexibility central to constructivist qualitative inquiry [1], [4].

2. Conceptual Background

CGT conceptualizes theory development as an iterative, reflexive process in which researchers co-construct analytic meaning through sustained engagement with data [1]. Core CGT practices—initial and focused coding, constant comparison, memo-writing, and theoretical sampling—jointly support the development of abstract, integrated categories and inform judgments about theoretical saturation [2], [9]. Within this tradition, saturation is not a function of sample size or code frequency, but an analytic determination that categories are sufficiently developed in terms of their properties, dimensions, and relationships such that additional data no longer substantively extend the emerging theory [1], [10].

Despite its central role, saturation has been widely critiqued in qualitative methodology for its conceptual ambiguity and inconsistent application. Reviews of qualitative studies repeatedly demonstrate that saturation is often invoked without clear definition, operational criteria, or analytic evidence, limiting transparency and undermining claims of quality [3], [4]. Methodological scholars have further identified multiple forms of saturation—including data, thematic, meaning, and theoretical saturation—which are frequently conflated despite reflecting different analytic endpoints and epistemological assumptions [8], [11]. In grounded theory specifically, theoretical saturation requires not merely the repetition of codes, but the analytic specification and integration of categories within a coherent explanatory framework [1], [12].

Several authors have questioned whether saturation should be understood as a definitive endpoint or as a judgment of analytic sufficiency, particularly within constructivist paradigms that emphasize interpretation, reflexivity, and context [7], [10]. These critiques have prompted calls for researchers to explicitly document how saturation is assessed, including the use of memos, constant comparison, and category-level analysis to justify claims of theoretical completeness [9], [13]. Recent methodological work emphasizes that saturation decisions are inherently

evaluative and should be demonstrated through analytic processes rather than assumed or implied [4], [14].

Determining saturation is particularly challenging in engineering education research (EER), where qualitative studies often examine complex socio-professional constructs—such as identity, motivation, and affect—across diverse participant populations and institutional contexts. Variability in disciplinary backgrounds, professional roles, and career stages complicates assessments of redundancy and raises questions about when variation represents conceptual differentiation versus contextual nuance. Prior EER scholarship has noted that while qualitative engineering studies frequently claim saturation, few articulate how analytic judgments were made or how theoretical integration was evaluated [5]. These challenges underscore the need for methodologically aligned, transparent guideposts for saturation in CGT-based EER studies.

In this paper, we use *theoretical saturation* to denote the point at which analytic categories are well specified, theoretically integrated, and no longer meaningfully altered by new data [1], [9]. *Redundancy* refers to repeated conceptual patterns that do not introduce new properties or relationships, while *conceptual completeness* reflects the depth, coherence, and explanatory reach of the emerging theory. By grounding these terms in CGT methodology and existing critiques, we position saturation as an explicitly documented analytic judgment rather than an implicit or assumed outcome.

3. Overview of the Two Studies

This methodological reflection draws on two ongoing CGT studies that were conducted independently but were advised or co-advised by the same faculty member, providing a shared methodological foundation, yet they differ in participant populations, interview structures, and analytic emphases. The first author led Study 1, while the second author led Study 2; accordingly, the enactment of CGT varied slightly across studies while remaining grounded in the same constructivist epistemology.

CGT emphasizes meaning-making and theory co-construction through iterative analytic practices, including coding, constant comparison, and memo-writing. Using two distinct CGT projects allows us to examine how theoretical saturation is assessed across different qualitative designs and forms of analytic complexity while holding the broader methodological framework constant. The studies were selected to surface contrasting saturation challenges: Study 1 examines practicing engineers using semi-structured interviews that evolved iteratively, while Study 2 focuses on engineering faculty and employs unstructured interviews that generate broader narrative variation.

3.1 Study 1: Practicing Engineers' Motivations and Professional Identity

Study 1 is CGT investigation aimed at understanding how practicing engineers are motivated in their professional work and how their identities as engineers develop over time [16]. The study focuses on engineers in civil, structural, mechanical, and industrial engineering, attending to how professional experiences and contexts shape ongoing engagement with engineering practice.

Fifteen practicing engineers participated in the study. Participants were recruited purposefully through institutional and professional networks connected to capstone design courses, with sampling designed to capture variation across disciplines, career stages, and professional roles. This variation introduced analytic complexity while supporting the identification of shared conceptual patterns. Data were collected through semi-structured interviews, typically lasting approximately one hour to ninety minutes. The interview protocol included common guiding

questions but allowed flexibility to probe emergent ideas and adapt over time. In line with CGT methodology, data collection and analysis occurred concurrently. Initial and focused coding were accompanied by iterative memo-writing to support category development and theoretical integration. Analytic memos documented emerging patterns, disciplinary nuances, and assessments of whether new interviews extended the developing theory or primarily reinforced existing categories. These practices informed ongoing judgments about theoretical saturation, which are examined reflectively in subsequent sections.

3.2 Study 2: Engineering Faculty

Study 2 is a mixed qualitative method investigation situated in a broader effort to understand faculty experiences with professional shame and connect these emotional experiences to sociocultural expectations of what it means to be an engineer within their academic programs. To better understand these experiences, we utilized two different methods. We conducted an interpretative phenomenological analysis (IPA) on ten interviews to generate understanding of faculty's lived experiences of professional shame. In the present study, we focus on the connection between engineering faculty's lived emotional experiences and their surrounding cultural engineering context using CGT [17].

In the CGT portion of the study, twenty participants were purposefully sampled from three distinct universities across the US. Data was collected through unstructured interviews of engineering faculty. In line with study 1 and other CGT studies, we conducted initial coding of all 20 interviews utilizing constant comparison to create a relevant abstraction of the interview data. Alongside our initial codes, we utilized analysis from the IPA portion of the study to develop focused codes that will allow us to develop theoretical patterns from the interview data. Throughout this process we have been conducting extensive memo-writing by maintaining an active reflective log of our sense, making both in our initial coding process as well as during focused coding. These memos documented emerging themes both within individual transcripts as well as in focused codes and form our basis for understanding of the saturation of the study.

4. Reflective Approach to Analyzing Saturation

To examine how theoretical saturation was assessed in practice, we engaged in a systematic, reflexive analysis of analytic artifacts generated during each study. Consistent with CGT, reflection on saturation was embedded within ongoing data collection and analysis rather than treated as a retrospective endpoint. Our reflective approach drew on three primary sources: coding logs, analytic memos, and research team discussions, each of which supported iterative analytic judgment regarding conceptual completeness and redundancy.

For Study 1, the first author maintained coding logs in spreadsheet form and organized them by participant. These logs documented initial and focused coding decisions, emergent patterns, and analytic observations over time. We wrote analytic memos continuously throughout the data collection process, typically following the analysis of each transcript or every one to two transcripts. Memos focused on category development, relationships among emerging concepts, and assessments of whether new interviews extended analytic understanding or primarily reaffirmed existing categories. These memo-based reflections served as the primary mechanism for tracking theoretical development and monitoring saturation in line with CGT analytic practices.

Reflective discussions occurred both informally and in more structured settings. Ad hoc conversations and regular research meetings provided opportunities to interrogate analytic

decisions, particularly judgments related to saturation. Saturation was explicitly discussed between the primary researcher and advisors, often as part of sense-checking analytic interpretations and evaluating whether additional data were contributing new conceptual insight. These discussions supported reflexive accountability while preserving the interpretive nature of CGT analysis.

For Study 2, the second author maintained coding logs through the use of Atlasti, a qualitative data analysis software tool. These logs documented initial and focused codes for all study participants. In addition, we engaged in memoing throughout our data analysis. During initial coding, we wrote analytic memos that captured our sense making for each transcript. After conducting initial coding and constructing focused codes, we then wrote reflective memos on each focused code documenting emerging patterns and relationships between focused codes. These memos-based reflections alongside discussion between researchers served as the main way to monitor saturation and theoretical development while also promoting reflexivity and preserving the interpretive nature of CGT analysis.

For both studies, reflection on saturation occurred concurrently with data collection and analysis and continued through later analytic phases while the study was still ongoing. Importantly, reflections for each study were conducted independently by the respective lead researcher, allowing saturation judgments to emerge within each analytic context. Cross-case reflection was conducted after independent analyses, using primarily informal comparative discussions supplemented by semi-structured meetings. These meetings involved comparing analytic memos and preliminary theoretical models and explicitly discussing convergence and divergence in saturation reasoning, including the extent to which new data introduced novel concepts or deepened existing categories. This comparative reflection provided the basis for the joint methodological examination presented in subsequent sections.

5. Study 1's Approach to Saturation

In Study 1, assessments of theoretical saturation were embedded within an iterative CGT workflow characterized by concurrent data collection and analysis. We conducted initial coding shortly after each interview, followed by focused coding and iterative category development through constant comparison and memo-writing. We placed analytic emphasis on conceptual development and theoretical integration rather than code accumulation, consistent with CGT methodology.

5.1 Analytic Workflow and Monitoring Saturation

We monitored saturation through coding logs and analytic memos that tracked the emergence, refinement, and integration of focused codes over time. As analysis progressed, focused coding stabilized, and categories became increasingly well specified in terms of their properties and internal variation. After approximately eight interviews, new data primarily reinforced existing analytic patterns rather than generating new focused codes. This redundancy—defined as repetition without the introduction of new analytic properties or dimensions—served as an early indicator that the core conceptual structure of the emerging theory was well developed.

We assessed redundancy at the level of focused codes and categories rather than surface narrative similarity. Participants continued to offer diverse examples across engineering disciplines and professional roles; however, these accounts typically added contextual nuance rather than prompting the creation of new categories. Our analytic memos explicitly documented this distinction, supporting reflexive judgments about saturation.

5.2 Theoretical Depth, Integration, and Near Saturation

As analysis continued, categories demonstrated increasing theoretical depth and integration across civil, structural, mechanical, and industrial engineering contexts. Our analytic attention shifted from identifying new categories to refining relationships among existing ones. At this stage, we assessed the study as approaching theoretical saturation. Core categories were internally coherent and theoretically robust, and additional interviews contributed primarily elaborative or confirmatory insight. Saturation, however, was not treated as a binary endpoint. Remaining conceptual gaps were identified, primarily at the level of relationships between categories rather than within the categories themselves. These gaps were characterized as edge cases—important for achieving conceptual completeness but not central to the core theoretical claims. Accordingly, the study was positioned as near saturation rather than fully saturated.

5.3 Methodological Challenges and Decisions

A central challenge in assessing saturation involved managing participant variability across disciplines, roles, and career stages. While this variability increased analytic complexity, it also strengthened the emerging theory by testing category stability across contexts. Distinguishing analytically meaningful variation from contextual nuance required sustained memo-writing and reflexive judgment.

Research group discussions played a critical role in supporting saturation decisions. Both ad hoc conversations and scheduled meetings with advisors (third and fourth authors) were used to interrogate analytic interpretations, sense-check judgments of redundancy, and evaluate the need for continued data collection. These discussions informed the decision to pursue additional interviews despite strong indicators of redundancy.

Finally, decisions about continued interviewing were guided by analytically identified conceptual gaps rather than expectations around interview counts. Follow-up interviews were designed as theoretical sampling, with semi-structured questions explicitly linked to underdeveloped category relationships identified through memoing, to refine these relationships and achieve full theoretical saturation.

6. Study 2's Approach to Saturation

In Study 2, assessment of theoretical saturation was integrated into the CGT analytic workflow. Initial coding was conducted for each interview, followed by the iterative development of focused codes. These focused codes were repeatedly refined and systematically reapplied across all transcripts using constant comparison. Throughout this process we conducted memo-writing by using a reflective log of our sense-making as well as conducting analytical memos of our focused codes.

6.1 Analytical Workflow and Monitoring Saturation

We monitored saturation through the use of analytic memos for each individual transcript during initial coding as well as memos documenting each of the focused codes. Using these memos allowed us to understand the relationship between categories. As the analysis continued and focused codes became increasingly well defined, we found that our current sample provided an in-depth understanding of the individual lived experience of faculty members. However, we found through examining our focused codes that we lacked a deep understanding of the ways in which faculty experience expectations and how those expectations might translate to their teaching. Due to this we are currently engaging in mapping our focused codes onto our

theoretical framework of professional shame to understand areas in which more data is needed with the eventual goal of conducting more interviews with faculty.

6.2 Methodological Challenges and Decisions

While the use of IPA in conjunction with CGT allowed us to develop a rich understanding of the individual cases as well as an understanding of the broader culture surrounding participants, this mixed method approach did create challenges in assessing theoretical saturation as these two approaches rest on different analytical goals [17]. IPA is idiographic and phenomenological and as such focuses on prioritizing depth of lived experience rather than theory development [15]. This in turn means that IPA typically does not operate with theoretical saturation as a stopping criterion. In contrast, CGT is explicitly theory-building and relies on theoretical saturation to determine when categories are sufficiently developed. This divergence creates tension in sampling decisions, as data collection may appear theoretically saturated within the CGT analysis while still yielding new experiential nuances relevant to the IPA analysis.

To address the methodological tension between IPA and CGT, we monitored theoretical saturation exclusively within the CGT component through constant comparison, focused coding, and memo-writing, and used it to guide decisions regarding additional sampling. Further we relied on discussions between the lead analyst (second author) and advisor (third author) to evaluate the need for continued data collection. In contrast, the IPA component did not seek saturation but prioritized idiographic depth and interpretative sufficiency within each case.

At present, we note that our data offers robust insight into faculty members' emotional experiences of what they felt to expected of them, but they offer scant insight into what they expect of others. Recognizing this gap, we realize that we need to conduct additional interviews that focus particularly on what faculty *expect* of others (rather than what they feel to be *expected of them*). Thus, the gaps that keep us from claiming theoretical saturation have informed our next round of data collection with engineering faculty participants at the three institutions of Study 2.

7. Cross-Study Insights

By examining how theoretical saturation was assessed across two CGT studies with distinct designs, populations, and analytic challenges, we identified both meaningful contrasts and shared methodological principles. Together, these insights illustrate how saturation judgments are shaped by study design while remaining grounded in common CGT commitments to reflexivity, theoretical integration, and transparency.

7.1 Contrasting Saturation Signals Across Study Designs

A key contrast between the studies involved interview structure and its influence on saturation signals. In Study 1, semi-structured interviews supported consistent coverage of core topics, making redundancy at the level of focused codes more readily observable. As analysis progressed, saturation signals emerged through stabilization of focused codes and increasing coherence among category relationships, with new data primarily adding nuance rather than generating new categories.

In Study 2, unstructured interviews produced variable narratives. While this openness yielded rich insight into lived experience, it complicated assessments of redundancy, as new interviews often introduced novel emphases even when core categories remained stable. Consequently, in Study 2, saturation was assessed less through the absence of new content and more through the degree of theoretical integration and explanatory sufficiency. These contrasts show how interview structure shapes how saturation is recognized, rather than whether it can be achieved.

Population differences further shaped saturation judgments. Study 1 required distinguishing contextual variation across engineering disciplines and roles from analytically meaningful divergence, while Study 2 surfaced variability through differences in faculty experiences and institutional contexts. In both cases, researchers evaluated saturation through the recurrence and stability of conceptual patterns across intentionally varied participants rather than homogeneity.

7.2 Asymmetry, Iteration, and Reflexive Restraint

Although both studies were iterative, they occupied different positions relative to saturation. Study 1 was assessed as approaching theoretical saturation, with core categories well developed but some category relationships still requiring refinement. Study 2, while demonstrating strong conceptual depth in several areas, revealed additional analytic needs as categories were examined in relation to broader theoretical frameworks. This asymmetry shows that saturation is not a uniform or simultaneous outcome, even across studies with similar methodologies.

Across both studies, we exercised reflexive restraint in making saturation claims. Rather than treating saturation as a definitive endpoint, we approached it as an evaluative judgment subject to revision as analysis progressed. This restraint preserved analytic openness while maintaining methodological rigor, particularly given the complexity of the phenomena under study.

7.3 Shared Principles for Assessing Saturation

Despite these differences, several shared principles guided saturation assessment across both studies. First, memo-based monitoring served as the primary mechanism for tracking theoretical development and documenting whether new data extended categories, clarified relationships, or reaffirmed existing understandings. Second, saturation was evaluated in terms of conceptual completeness rather than redundancy alone, emphasizing theoretical integration and explanatory power over repetition. Third, team reflexivity played a critical role, with research group discussions supporting sense-checking, challenging assumptions, and evaluating the need for continued data collection. Finally, purposeful variation functioned as an analytic resource, strengthening confidence in emerging categories by testing their stability across contexts.

Taken together, these cross-study insights reinforce saturation as an analytic milestone rather than a procedural stopping rule. They informed the development of the practical guideposts presented in the following section, which translate these reflections into actionable strategies for CGT researchers in engineering education and related fields.

8. Practical Guideposts for Determining Saturation

Based on reflective analysis across two CGT studies, we propose a set of practical guideposts to support transparent and theoretically grounded judgments about saturation:

8.1 Establish Early Memo Checkpoints

Begin memo-writing early and use memos as intentional checkpoints for monitoring theoretical development. In both studies, memos documented emerging categories, relationships, and analytic questions, supporting ongoing assessment of whether new data extended the theory or reaffirmed existing ideas [1], [10].

8.2 Track When New Data Adds Nuance Rather Than New Categories

A key indicator of approaching saturation is a shift from generating new categories to elaborating existing ones. Researchers should explicitly note when interviews add contextual nuance or

illustrative detail without introducing new analytic properties, rather than assuming variation implies theoretical novelty [1], [8].

8.3 Assess the Integration and Stability of Focused Codes

Beyond repetition, evaluate whether focused codes are theoretically integrated and stable within the emerging model. In our studies, saturation judgments depended on the coherence, specificity, and connectedness of categories, not simply their recurrence [9].

8.4 Confirm Repetition Across Purposeful Variation

Saturation should be assessed across intentionally varied participants rather than within homogeneous groups alone. In both studies, redundancy was evaluated by examining whether core categories recurred across roles, disciplines, and career stages, strengthening claims of theoretical robustness while preserving contextual sensitivity [5], [11].

8.5 Use Research Team Discussions as Validation

Team discussions provide an important mechanism for interrogating saturation judgments. Across both studies, conversations with advisors and collaborators supported sense-checking interpretations, challenging assumptions about redundancy, and deciding whether additional data were theoretically warranted [1], [3].

8.6 Document Analytic Decisions for Transparency

Researchers should explicitly document how saturation decisions were made, including uncertainty or disagreement. Coding logs, memos, and meeting notes can form an audit trail that addresses critique's that saturation is often claimed without evidence [4].

8.7 Avoid Numeric Rules; Prioritize Theoretical Completeness

Saturation should not be reduced to numeric thresholds or fixed interview counts. While pragmatic constraints matter, decisions about stopping data collection should be grounded in assessments of theoretical completeness rather than sample size alone [2], [7].

Together, these guideposts offer a practical framework for assessing saturation that is consistent with CGT and responsive to critiques of ambiguity and opacity in EER. By foregrounding analytic practices over numerical benchmarks, they support more transparent, defensible, and reflexive applications of grounded theory in engineering education research and related fields.

9. Implications for EER

The findings of this methodological reflection have several important reflections for engineering education research, particularly for strengthening rigor and transparency in studies that use CGT. First, this work demonstrates how structured yet analytic practices, especially the use of memo-based monitoring of category development and theoretical integration, can help inform understanding of saturation levels [1]. Further, by treating saturation as an integrated and documented analytical process rather than just an endpoint, researchers can more clearly show how their theoretical claims are grounded in engagement with their data [2], [7].

Additionally, the contributions of the paper are especially valuable for novice qualitative researchers in EER, who face uncertainty in how to justify stopping or continuing data collection. The guideposts of this paper shift attention away from numeric thresholds and towards conceptual completeness, category integration, and stability across variation [2]. For

novice researchers, this research provides a practical guidepost for navigating saturation decisions in ways that align with CGT best practices.

Finally, this work highlights opportunities for the broader adoption of structured saturation processes within EER. Integrating memo-based checkpoints, coding logs, and team-based reflexive discussions into CGT workflows can improve the transparency and traceability of analytic decisions, particularly in studies involving diverse participants and complex institutional contexts [1], [4], [10]. As qualitative methods continue to expand in EER, adopting these practices can help build shared expectations around how theory-building is evaluated and when analytic sufficiency has been reached. In this way, the guideposts offered here contribute not only to individual studies but also to the maturation of qualitative methodology within engineering education research.

10. Conclusion

In this paper, we examined the challenge of determining theoretical saturation in CGT studies, a concept that is widely invoked in engineering education research yet often ambiguously defined and insufficiently documented. Through reflective analysis of two CGT studies with contrasting designs, populations, and analytic demands, we demonstrated that saturation is best understood not as a numeric threshold or procedural endpoint, but as an analytic judgment grounded in conceptual completeness, theoretical integration, and reflexive evaluation.

Our analysis shows that saturation emerges through sustained engagement with core CGT analytic practices, including memo-writing, constant comparison, and iterative category development. Across both studies, saturation judgments were informed by shifts from generating new categories to elaborating existing ones, increasing stability and integration of focused codes, and the recurrence of conceptual patterns across intentionally varied participants. Central to these this judgment was the ability to distinguish between meaningful nuance and analytically novel insight—an interpretive task that cannot be reduced to interview counts or code frequency.

By articulating practical guideposts derived from our analytic experiences, this paper supports novice qualitative researchers in navigating the ambiguity surrounding saturation while preserving the flexibility essential to constructivist inquiry. At the same time, these guideposts offer a shared set of analytic practices that may also resonate with more experienced CGT researchers and reviewers, supporting clearer communication about how saturation is assessed and justified.

More broadly, this work contributes to methodological quality and transparency in engineering education research by foregrounding saturation decisions as explicit, traceable analytic processes. We hope this paper encourages researchers to approach saturation as a reflexive, memo-driven analytic milestone—one demonstrated through theory-building work rather than assumed through procedural convention.

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