

RESEARCH

Learning

From mechanisms to systems: Reconceptualising supervised workplace learning in postgraduate medical education

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Abstract

Background: Why do the same supervisory mechanisms (feedback, observation, entrustment) produce different learning experiences across clinical settings? Current research treats them as discrete behaviours rather than examining how they interact within local contexts. This study uses realist theory to reframe supervised workplace learning as contextually configured systems, examining how key mechanisms (the processes through which attending physicians and residents interact) couple differently across postgraduate clinical settings.

Methods: We conducted a realist-informed multiple case study across four clinical departments in Ireland (Geriatric Medicine, Surgery, Paediatrics and Infectious Diseases). Semi-structured interviews with residents and attending physicians explored everyday clinical work, learning and supervisory dynamics. Analysis proceeded in two phases: (1) within-case, theory-informed inductive analysis using a realist theory on supervised workplace learning as a sensitising concept; (2) cross-case configurational analysis tracing how six mechanisms (entrustment, support seeking, monitoring, modelling, meaning making and feedback) patterned differently by context.

Results: Fifty participants (38 residents, 12 attending physicians) were interviewed. All six mechanisms appeared in every setting but were organised into distinct patterns shaped by local conditions. Geriatric medicine: continuous monitoring and narrow entrustment produced high oversight with limited autonomy progression (shaped by patient frailty, strong continuity, containment culture). Surgery: tightly coupled entrustment-monitoring-feedback drove staged procedural progression (shaped by observable performance, resource scarcity, competitive selection). Paediatrics: fluid, overlapping mechanisms enabled relational negotiation (shaped by family-facing work, small teams and psychological safety). Infectious diseases: fragmented, reactive mechanisms produced discontinuous supervision (shaped by severe discontinuity, high workload, frequent roster changes). What distinguished settings was not mechanism presence but mechanism coupling (how mechanisms reinforced or constrained one another), producing systematically different outcomes.

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Discussion: Supervision operates as a contextually adapted configuration of interdependent mechanisms, not a set of discrete behaviours. The same mechanisms organise into different patterns depending on local conditions (continuity, patient complexity, resources, culture), producing different learning experiences. These context-dependent patterns (not specialty templates) challenge policies that audit mechanism presence rather than mechanism function, positioning supervision as an emergent practice that requires both enabling structural conditions and skilful pedagogical enactment within those conditions.

1 | INTRODUCTION

The same supervisory mechanisms (feedback, observation, entrustment) produce different learning experiences across clinical settings.^{1,2} Current research has yet to fully explain why. This study argues that the answer lies not in whether mechanisms are present, but in how they configure in response to local contexts.

Supervised workplace learning is central to postgraduate medical education. Residents^{*1} develop competence through everyday clinical practice under the supervision of more experienced colleagues, contributing to patient care while developing professional capabilities.^{3,4} Despite this centrality, supervision is often studied in fragmented ways, isolating individual activities without examining how they function together or respond to context.^{5,6} This reductionism obscures how supervision operates as a system and limits our ability to support and evaluate it in meaningful ways.

There is a substantial body of work on supervised workplace learning (how supervision and autonomy are balanced,⁷ entrustment decisions,⁸ feedback,⁹ observation practices,¹⁰ supervisory styles,¹¹ informal learning¹²) across surgery, general practice, paediatrics and emergency medicine.^{13–16} Attending physicians vary their supervisory behaviours in response to contextual and patient factors, often independently of their judgements of resident ability.¹⁷ Supervision is fluid and context-dependent, shaped by tensions between responsibility, competing priorities¹⁸ and institutional structures.¹¹

Conceptual and empirical contributions converge on a common message: context matters. Dornan et al argue that clinical learning is experience-based and relational, supported by networks of situated influences.¹⁹ Wiese et al show that supervised workplace learning emerges through relational processes patterned by clinical dynamics.²⁰ Bates and Ellaway liken context to ‘dark matter’, pervasive yet under-theorised in research and design.²¹ These perspectives motivate a more integrated, systems-oriented understanding of supervised workplace learning in which practices are seen as contextually configured rather than universally transferable.

To understand how and why supervisory processes configure differently across contexts, this study draws on realist theory, which explains how practices work differently in different settings through context-mechanism-outcome (CMO) configurations.²² Context refers

to the backdrop conditions (team structures, workload, institutional cultures) within which mechanisms—the interpretive and relational processes through which supervision unfolds—are triggered to produce outcomes (learning, autonomy development, safety). Emerging evidence suggests that mechanisms do not operate in isolation from each other: entrustment processes can both enable and constrain feedback²³ and entrustment decisions hinge on capacities such as help-seeking and knowing one's limits.²⁴ These findings point to supervisory processes as interdependent and embedded within broader pedagogical configurations.

Wiese et al. conducted a realist synthesis²⁰ that provides the theoretical framework for the current study. The synthesis identified three core processes through which residents learn during supervised clinical work, each underpinned by a pair of mechanisms: supervised participation in practice (entrustment and support seeking), mutual observation of practice (monitoring and modelling) and dialogue about practice (meaning making and feedback). These six mechanisms operate through context-mechanism-outcome configurations and are interdependent; for instance, how entrustment is enacted shapes whether and how residents seek support (see Supplementary file 1 for detailed definitions).

However, although the realist synthesis established which mechanisms matter and recognised their interdependence, it did not systematically examine how they configure together as coherent patterns across different clinical settings. The configurational question—how do these six mechanisms combine into distinct patterns in, for example, continuity-rich versus fragmented teams, in high-oversight versus autonomy-promoting cultures—remain underexplored. Without configurational understanding, educators and policymakers lack guidance on whether interventions targeting single mechanisms (e.g. improving feedback quality) will succeed or fail in local contexts where other mechanisms are operating dysfunctionally, leading to wasted resources and persistent inequity in training quality.

To address this gap, we examine supervised workplace learning as a dynamic configuration of mechanisms—an interdependent system characterised by three properties: interdependence (mechanisms do not operate in isolation but shape each other's expression), contextual adaptation (the same mechanisms stabilise into different functional patterns depending on local conditions) and emergent effects (supervisory quality arises from system-level dynamics that cannot be predicted by analysing individual mechanisms in isolation). We conducted a realist-informed multiple case study across four postgraduate clinical

*For international readability, we use resident to refer to postgraduate doctors in training (trainees) and attending physician for the senior supervising doctor (termed consultant in the Irish context). Participant quotations retain original terminology.

departments in Ireland, asking: *How do supervisory mechanisms configure differently across clinical settings, and what contexts enable or constrain coherent coupling toward developmental ends in postgraduate medical education?*

2 | METHODS

2.1 | Study design and theoretical approach

We used a realist-informed²⁵ multiple case study design²⁶ to examine postgraduate supervised workplace learning across different institutional and specialty contexts. Realist methodology is particularly suited to configurational questions because it explains not just what supervision looks like (description) but how and why it works differently (explanation), treating mechanisms as interpretive processes triggered by context rather than fixed interventions with uniform effects. A case study design complemented this realist approach by enabling in-depth, contextualised investigation of supervised workplace learning as a bounded system, where the interplay between contexts and mechanisms could be traced within and across real-world settings. We use coupling to describe the degree to which mechanisms function in coordinated, mutually reinforcing ways: tightly coupled mechanisms operate interdependently (e.g. feedback directly informs entrustment, which shapes future monitoring); loosely coupled or decoupled mechanisms fire independently without informing each other. Our analytic task was therefore to trace not only which mechanisms were present, but how they coupled, what they responded to and what effects they produced.

2.2 | Setting: postgraduate medical training in Ireland

This study took place in Ireland, where postgraduate medical education combines formal curricula with workplace-based learning overseen by senior physicians. After a one-year internship, doctors typically progress through Basic Specialist Training (often titled SHO posts) and then Higher Specialist Training (Registrar/SpR posts), assuming increasing clinical responsibility under senior supervision. Supervisory structures are team-based, with continuity varying by specialty, rotation length and workload: most learning is embedded in clinical work, informal interactions and modelling. The European Working Time Directive (EWTD) caps resident work hours, requiring rotational structures that often fragment continuity of care and supervisory relationships. See Supplementary File 2 for a description of the Irish postgraduate training structure.

TABLE 1 Cases and settings.

Case	Specialty	Institution	Participants
1	Geriatric Medicine	General hospital	Junior residents (intern/SHO), Senior residents (Registrars/SpR), Attending physicians
2	Vascular & GI Surgery	General hospital	Junior residents (intern/SHO), Senior residents (Registrars/SpR), Attending physicians
3	General Paediatrics	Paediatric hospital	Junior residents (intern/SHO), Senior residents (Registrars/SpR), Attending physicians
4	Infectious Diseases	General hospital	Junior residents (intern/SHO), Senior residents (Registrars/SpR), Attending physicians

2.3 | Case selection and participants

We purposively selected four clinical departments as bounded cases to maximise variation in specialty culture (procedural vs. medical), team continuity (stable vs. fragmented rosters), patient populations (acute vs. chronic complexity) and institutional context (type of hospital) (Table 1). Within each case, we recruited residents (junior and senior) and attending physicians. Initial contact occurred via senior clinicians at each site who were known to the research team and agreed to act as local points of contact (e.g. by circulating information about the study), followed by direct invitations from the research team. Recruitment continued until data sufficiency²⁷ was reached within and across cases. Ethical approval was granted by the Children's University Hospital, Temple Street Ethics Research Committee (R16.010.), the St James' Hospital Research Ethics Committee (R2016-02) and the UCC Clinical Research Ethics Committee (ECM 4 R01.12.15).

2.4 | Data collection

Data were collected through semi-structured interviews, which were chosen to enable comparison across multiple specialties and sites and to link participants' accounts to the existing realist theory, rather than to conduct an in-depth ethnography of a single setting. The interviews were designed to elicit rich descriptions and interpretations of everyday clinical work, supervision and learning, focusing on team functioning, task distribution, perceptions of risk and responsibility and informal teaching or feedback moments. We did not provide predefined definitions of supervision or mechanisms; participants described these in their own terms and through concrete examples. Interviews followed a flexible guide exploring work routines, task distribution, supervisory relationships, autonomy and learning opportunities.

All interviews were conducted in person, audio-recorded, transcribed verbatim, anonymised and managed in NVivo.

2.5 | Data analysis

Analysis proceeded in two phases, combining theory-informed inductive, case-sensitive thematic analysis with cross-case configurational analysis. **Phase 1 (within case):** drawing on the six mechanisms as sensitising concepts,²⁰ we undertook thematic analysis²⁸ within each case. The sensitising concepts served as heuristic anchors, not rigid codes. Coding was iterative and interpretive; the framework was refined as

TABLE 2 Participant characteristics by case.

	Case 1 (geriatric medicine)	Case 2 (surgery)	Case 3 (Paediatrics)	Case 4 (infectious diseases)	Total
Junior Resident (JR)	6	8	2	2	18
Senior Resident (SR)	3	3	7	7	20
Attending Physician (AP)	3	1	5	3	12
Total	12	12	14	12	50

new insights emerged, incorporating inductively derived themes that extended the initial theoretical model. AW independently coded the transcripts and met with DB for iterative comparison to refine the coding framework. **Phase 2 (cross-case):** we compared cases to examine how mechanisms interacted within each case and how those interactions varied by context²⁹ tracing configurations and their relational dynamics shaped by local contingencies (e.g. rhythms of service, team structures, institutional logics) rather than isolating mechanisms.

2.6 | Reflexivity and rigour

AW (non-medical medical education researcher with realist and workplace learning expertise, bringing attention to configurations but risking seeing patterns that resembled existing theory) led coding whereas actively searching for disconfirming examples, then brought provisional interpretations to DB (professor of medical education with clinical experience, bringing familiarity with supervisory practice but potential blind spots around taken-for-granted routines) for critique. For example, early coding of infectious diseases framed thin supervision as mechanism failure; discussions drawing on DB's service experience prompted reinterpretation foregrounding structural discontinuity rather than individual shortcomings. When divergent readings arose (for instance, whether monitoring in geriatrics functioned as scaffolding or as containment), we returned to the full transcripts and explored alternative explanations until reaching a shared account.

3 | RESULTS

3.1 | Participants

We interviewed 50 participants across four clinical departments (Table 2). Across cases, three critical observations were made. First, all six mechanisms appeared in every setting, demonstrating that supervised workplace learning's building blocks are consistent. Second, mechanisms organised into distinct configurations shaped by local conditions. Third, the organising mechanism differed by case. These configurational differences produced systematically different learning experiences. What distinguished cases was not the presence of mechanisms but the mechanism interaction: how each reinforced or constrained others, creating self-stabilising systems with distinct developmental consequences. Table 3 presents the configurational diversity across cases. Supplementary Files 3 and 4 provide extended quotes and full contextual descriptions for each case.

3.2 | Mechanism configurations

3.2.1 | Tight coupling, two divergent orientations

Two cases exhibited tight coupling (geriatrics and surgery) yet produced fundamentally different outcomes (Table 4).

3.2.2 | Geriatrics: containment through monitoring-dominant coupling

Case 1: Geriatrics, Notable Contexts:

- Patient Profile: High complexity (multimorbidity, frailty, narrow error margins)
- Continuity: Strong for senior residents (SPR 6 months), EWTD-fragmented for juniors
- Culture: 40-year tradition valorising attending oversight
- Physical Setup: No teaching spaces; corridor-based learning
- Key Constraint: Throughput pressure prioritised efficiency over delegation

In geriatrics, monitoring became the organising mechanism. Attending physician oversight extended across all clinical domains, creating pervasive 'watchfulness'. One attending physician explained: "I watch how they interact with nurses. If they respond poorly—for example, to a request to update a Kardex—I'll step in and say, 'That matters on this ward.' I'm always observing their professionalism" (AP1, C1).[†] This continuous monitoring locked in narrow entrustment through a self-reinforcing loop: oversight revealed potential gaps, gaps justified narrow entrustment and narrow entrustment necessitated continued monitoring. Even senior residents described minimal autonomy progression: "On ward rounds, consultants are always present, so you learn continuously by seeing different patients. You watch first, and then next time you might do it yourself under supervision" (SR2, C1). Residents described watching performance rather than delegated responsibility.

An attending physician candidly defended the department's 40-year practice of attending physician-written discharge summaries:

[†]Quotations are attributed by participant role and case: JR = Junior Resident, SR = Senior Resident, AP = Attending Physician; C1–C4 = Cases 1–4.

TABLE 3 Configuration summary matrix.

Case	Configuration type	Organising mechanism(s)	Entrustment	Support seeking	Feedback	Monitoring	Meaning making	Modelling	Developmental trajectory
Geriatrics	Tight Coupling: Containment	Monitoring (dominant)	Narrow, non-progressive	Dependency-reinforcing	Immediate correction	Pervasive across all domains	Convergent	Tacit; reinforced oversight	Flat: consistent micro-coaching, minimal autonomy progression
Surgery	Tight Coupling: Progression	Entrustment + Monitoring	Performance-contingent, staged	Amplifies disparities	Intra-operative correction	Continuous during procedures	Bifurcated: robust preop, compressed intra-op	High-volume; tacit cultural transmission	Progressive for engaged learners
Paediatrics	Relational Negotiation	Support seeking	Individualised, variable	Professional norm	Asymmetric: abundant for juniors, sparse for seniors	Dual: clinical + affective	Compressed by time	Integrated: technical + affective	Strong for juniors, variable for seniors
Infectious Diseases	Structural Decoupling	None – fragmented	Situational improvisation	Crisis-triggered	Reactive, error-driven	Defensive surveillance	Instrumental plan alignment	Opportunistic	No coherent trajectory

“Maybe I’m too much of a traditionalist, but in geriatric medicine we’ve kept a system where consultants write discharge summaries promptly...Our GP colleagues over the years have been very happy with that service. It’s old-fashioned, but it works” (AP2, C1).

Feedback operated as immediate correction converging toward attending physician-endorsed conclusions, foreclosing exploratory dialogue. Support seeking, though seamless, reinforced dependency rather than progressive independence. The configuration produced safe care and consistent micro-coaching, yet was developmentally flat: “The supervision is absolutely first class. If I had to criticise it, it’s that sometimes you’d rather just crack on and do it yourself...sometimes you need to be pushed slightly out of your depth to really learn” (SR1, C1).

3.2.3 | Surgery: performance-contingent progression

Case 2: Surgery, Notable Contexts:

- Task Profile: Gradable procedural complexity (decomposable tasks)
- Resource Scarcity: Severe-limited theatre slots, competing priorities
- Performance Observability: High-manual dexterity, technique directly visible
- Stakes: High-errors immediately visible, time pressure paramount
- Key Feature: Protected theatre initiative to preserve operative access

In surgery, mechanisms coupled tightly around performance-contingent entrustment. Monitoring generated performance data that shaped entrustment decisions, which created new monitoring opportunities—an informal but widely understood developmental ladder: “I usually start by letting them do small parts—skin cuts, ports, camera work. Then gradually more ... It’s a stepwise process, not formalised, but progressive” (AP1, C2). Critically, progression depended on visible interest: “If they show interest and a willingness to learn, I’ll invest time in them” (AP1, C2). This created a self-accelerating loop for engaged learners (engagement → opportunities → skill → trust) but risked excluding those who did not signal engagement, whether from cultural unfamiliarity or structural barriers. Feedback was embedded in procedural flow and directly shaped future opportunities: “In theatre...if you were doing something, there will always be feedback...how you could improve it or what you were doing well” (JR6, C2). Meaning making bifurcated strategically. Pre-operatively, it is coupled with entrustment. Residents presented clinical reasoning, attendings questioned and refined and these exchanges informed operative roles: “We would always go through the patient’s clinical picture, their imaging, everything...it will always be a kind of a case discussion” (SR3, C2). Intra-operatively, meaning-making compressed

TABLE 4 Tight coupling divergence—geriatrics vs. surgery.

Feature	Geriatrics (containment)	Surgery (progression)
Primary Coupling	Monitoring → Narrow Entrustment → Reduced Support Urgency → Reinforced Monitoring	Monitoring → Performance Assessment → Entrustment Calibration → Expanded Opportunities
Feedback Function	Confirms attending conclusions; efficient error correction	Shapes future opportunities; drives skill development
Entrustment Logic	Attending control optimises safety + throughput	Staged progression; visible skill + engagement determines access
Self-Reinforcing Loop	Protective triangle: more monitoring → more gaps → narrower entrustment	Progressive cascade: engagement → opportunities → skill → trust
Developmental Outcome	Stable equilibrium resistant to progression	Clear developmental ladder with visible milestones
Systemic Pressure	40-year tradition + complexity + throughput = containment	Theatre scarcity + observability + time pressure = selection
Limitation	Minimal autonomy transfer even for capable seniors	Partial meritocracy: advantages culturally fluent residents

into brief explanatory moments, subordinated to safe procedure completion. During critical moments, discussion ceased entirely: “At some point when there is a deviance...everybody gets quiet and concentrates on that step” (SR1, C2). Residents learned when clinical reasoning could be verbalised versus when silent, focused action was required. The coupling was pedagogically potent, but meritocracy was partial: observable performance mattered, yet so did cultural fluency in signalling engagement.

3.2.4 | Paediatrics: relational negotiation

Case 3: Paediatrics, Notable Contexts:

- Patient Profile: High-vulnerability; rapid deterioration risk
- Family Dimension: Parents present, anxious-communication as critical as technical skill
- Culture: Deliberately cultivated safety and accessibility norms
- Team Size: Small-sustained 6-month relationships enabled personalisation
- Key Feature: Normalised support-seeking as a professional expectation

In paediatrics, mechanisms organised around relational continuity and psychological safety. Support seeking was reframed from weakness to professional responsibility: “Don’t be taking on too much responsibility because the consultants are happy to be called, and just to know that gives people a lot of peace” (SR5, C3). This was powerful for residents transitioning from adult medicine, where calling seniors risked reprimand: “I rang, he got so mad with me that I had asked him” (JR2, C3, describing adult medicine). Entrustment evolved through relational negotiation, with attending physicians aiming to “start with maximum support and come off that a little bit” (AP1, C3). Yet relational depth introduced variability: some attending physicians calibrated autonomy to demonstrated competence whereas others maintained universal oversight as personal philosophy—“We’re all a bit maternalistic...we have to mind everybody, a bit too much maybe”

(AP5, C3). Modelling integrated technical and affective competencies, demonstrating how to manage frightened families, break bad news and navigate emotionally charged child protection cases. Residents absorbed this through observation: “You see how to break bad news, offer support to parents...how different people approach things differently” (SR4, C3). This braiding of clinical and relational skill reflected paediatrics’ family-facing reality, yet remained largely tacit—attending physicians rarely made their emotional labour explicit.

Feedback coupled asymmetrically: abundant for juniors, sparse for seniors, creating a developmental paradox where those entrusted with greater autonomy received diminishing performance data. The configuration produced powerful scaffolding for junior residents (rich support, normalised help-seeking, integrated modelling) yet risked over-protection for seniors. The same relational closeness that enabled individualised support sometimes made it difficult for attending physicians to distinguish “I know this trainee well enough to trust them” from “this trainee has objectively demonstrated readiness for independent practice.” The result: attending-dependent rather than competence-dependent entrustment thresholds.

3.2.5 | Infectious diseases: structural decoupling

Case 4: Infectious Diseases, Notable Contexts:

- Continuity: Severe discontinuity—EWTD “backfill site,” 3–4 month rotations, frequent absences
- Workload: High—no interns; SHOs performed intern-level tasks
- Geography: Beds dispersed across multiple wards
- Engagement: Variable—some highly committed attendings, but structure prevented systematic coupling
- Key Constraint: “Backfill” designation made service vulnerable to resident transfers

In infectious diseases, severe discontinuity and structural fragmentation prevented mechanisms from coupling coherently. Rather

than configuring into a stable system, mechanisms fired opportunistically in response to immediate triggers (acute illness triggered support seeking, errors triggered reactive feedback, chance encounters enabled brief modelling moments) but could not cohere into a developmental system. The service's designation as an EWTD "backfill site" compounded rapid rotations and frequent absences: "We chop and change on the wards...I don't know the current bunch at all" (SR4, C4). Support seeking narrowed into a crisis mechanism, triggered by acute illness rather than developmental inquiry: "As soon as you have a patient who is very sick, you would call someone senior to help" (SR3, C4). The exploratory "Can I run this by you?" conversations that couple support seeking with meaning making in functional configurations were squeezed out. Monitoring became defensive surveillance born of uncertainty rather than pedagogical intent. Without sustained contact to calibrate oversight to individual capability, attending physicians defaulted to verification: "I have worked with doctors who I couldn't trust...I felt that I had to go and see the patient myself" (AP2, C4). Entrustment operated as situational improvisation disconnected from any developmental trajectory. Feedback decoupled from routine practice and recoupled with error, triggered by mistakes or formal presentations rather than embedded in ongoing work: "In any serious error, there is feedback to the doctor who is involved as a learning experience" (SR5, C4). Meaning making compressed into instrumental plan alignment: "It's more going to someone senior...usually telling them what your plan would be and getting advice" (SR4, C4). Residents received clear guidance but rarely engaged in extended dialogue that fostered independent reasoning. Modelling occurred sporadically when attending physician availability, resident presence and interesting cases converged—a rare alignment. The absence was not of mechanisms (all six were present) but of coupling: no learning loops connected experience to growth, no feedback systems informed subsequent entrustment, no relational continuity enabled individualised calibration. What looked like thin supervision was systematic decoupling - a configuration made incoherent by context.

3.3 | Cross-case contextual patterns

Three higher-order contextual patterns, comprising the seven features detailed in Supplementary File 5, emerged across cases. Firstly, temporal and relational continuity (shaped by rotation length, team size and physical co-location) was the master variable determining whether mechanisms could couple at all: strong continuity in geriatrics and paediatrics enabled sustained coupling; moderate, theatre-protected continuity in surgery permitted episodic coupling; and severe discontinuity in infectious diseases, driven by short rotations, geographic dispersal of beds, and the backfill designation, prevented coupling entirely. Secondly, task and patient characteristics (including patient complexity and the observability of clinical work) structured monitoring and entrustment: high multimorbidity and opaque clinical reasoning drove comprehensive oversight in geriatrics; gradable procedural tasks with directly visible technique enabled stagewise entrustment in surgery; high vulnerability combined with dual clinical-

affective observability shaped protective monitoring in paediatrics; whereas variable complexity and limited observability in infectious diseases prevented the calibration on which entrustment depends. Third, institutional and resource conditions (encompassing institutional culture and resource constraints) shaped coupling orientation: geriatrics' 40-year tradition valorising oversight reinforced tight coupling; surgery's severe theatre scarcity created selection pressure that privileged those who signalled interest; paediatrics' deliberately cultivated safety culture supported moderate, relationally attuned coupling; and infectious diseases' high workload without intern support, combined with its backfill identity, actively prevented coupling.

These configurations produced distinct developmental outcomes (Table 5). Tight coupling produced coherence but locked systems into stable states; relational coupling enabled individualisation but introduced inconsistency; decoupling prevented developmental coherence entirely. Across all cases, context exerted stronger configurational pressure than individual pedagogical preferences, suggesting that improving supervision requires addressing structural conditions that shape mechanism coupling, not just individual supervisor behaviour.

4 | DISCUSSION

Supervised workplace learning configured differently across all four cases: tight coupling toward containment (geriatrics) or progression (surgery), relational negotiation with variable consistency (paediatrics) and structural decoupling (infectious diseases). Each configuration was locally coherent, shaped by patient complexity, team continuity, resource constraints and institutional culture, yet produced profoundly different developmental consequences. These differences arose not from individual variation or specialty culture alone, but from patterned interactions between mechanisms and contexts. The critical insight: identical mechanisms, present everywhere, produced different learning environments through different coupling patterns. Understanding supervised workplace learning requires examining not just whether mechanisms operate but how they interact. Configuration—how mechanisms couple within context—is the critical unit of analysis for studying supervised workplace learning. This reframes how we conceptualise, evaluate and intervene in supervision in postgraduate medical training.

4.1 | From mechanisms to systems

This finding extends realist approaches, which insist that context-mechanism-outcome configurations are the proper unit of analysis.³⁰ Realist work in medical education typically examines how specific interventions (e.g. supervision,²⁰ supervision training,³¹ clinical competency committees,³² simulation³³) trigger mechanisms in different contexts. Our contribution is different: we treat the components of supervision (monitoring, feedback, entrustment, modelling, meaning making, support seeking) as mechanisms that couple with each other, and demonstrate that it is the coupling pattern (not the presence of individual mechanisms) that produces pedagogical effects. Geriatrics

TABLE 5 Developmental outcomes by case.

Case	Coupling tightness	Coherence	Primary outcome	Strengths	Developmental trade-offs
Geriatrics	Tight	High	Low-error environment, minimal progression	Safe learning, continuous presence, immediate correction	Protection vs Progression: not 'pushed out of depth'
Surgery	Tight	High	Staged skill development	Clear pathway, residents track development, rich exposure	Merit vs. Cultural Fluency: advantages those who signal 'interest'
Paediatrics	Moderate	Moderate	Individualised scaffolding	Psychological safety, normalised	Individualisation vs. Inconsistency: attending physician-dependent thresholds
Infectious Diseases	Decoupled	None	No coherent trajectory	Some committed attending physicians attempt teaching	Structural Fragmentation: no learning loops

and surgery both had frequent feedback, but geriatrics' feedback was decoupled from opportunities to practice autonomy, whereas surgery's was tightly coupled to observable performance. The mechanism (feedback) did not determine the outcome; the configuration (how feedback coupled with entrustment, monitoring and opportunities to practice) did.

This resonates with complexity science, which argues that educational interventions produce emergent, nonlinear effects in complex systems.^{34,35} Our findings specify what this means practically: mechanisms must be understood configurationally (how they couple with each other within enabling or constraining contexts) rather than mechanistically as discrete, portable interventions. Small changes in context (e.g. fragmented continuity via EWTD backfill) can produce non-linear effects (decoupling of mechanisms). Processes that worked in one configuration failed in another. It extends sociocultural learning theory's claim that learning is fundamentally situated^{36,37} by showing how situatedness operates configurationally. Teunissen's experience-trajectories-reifications framework³⁸ explains the stabilising dynamic: recurrent patterns of supervisory activity crystallise into local norms that structure what mechanisms can accomplish. In geriatrics, high patient complexity and strong continuity reified a containment stance; in surgery, resource scarcity and observable performance reified meritocratic progression. Mechanisms do not carry their function across contexts; context determines how mechanisms function by shaping which configurations stabilised and reproduced.

With this configurational lens in place, we could examine how the same mechanisms functioned differently across our four cases. Entrustment illustrates this configurational dependence most clearly. All four cases made entrustment decisions, yet entrustment functioned as performance-staged progression in surgery (enabled by work observability), protective containment in geriatrics (shaped by complexity and tradition), relationally negotiated scaffolding in paediatrics (producing attending physician-dependent variation) and situational improvisation in infectious diseases (forced by structural fragmentation). Monitoring, feedback and meaning making showed identical configurational dependence. All four cases would pass a curriculum checklist, yet they produced profoundly different learning experiences. This reframes the field's basic question. Rather than 'What are the best practices in clinical supervision?'^{39–41} we should ask: Under what conditions do supervisory mechanisms couple

coherently? The first question assumes supervision is about individual behaviours that can be taught and implemented. The second recognises supervision as a configurationally organised system where individual behaviours are necessary but insufficient without enabling structural conditions.

4.2 | Implications for policy and practice

Contemporary medical education policy assumes that implementing specified mechanisms will improve training quality. Competency-based frameworks^{42,43} mandate workplace-based assessments, entrustable professional activities and programmatic assessment. Accreditation standards require documented feedback, direct observation and competency sign-offs. These frameworks acknowledge context in principle, yet these practices operationalise quality through countable proxies (EPAs signed, observations logged) that cannot capture whether mechanisms couple coherently. Infectious diseases had all six mechanisms but lacked configuration. Current policy audits mechanism presence, not mechanism function. However, a configurational conceptualisation of supervised workplace learning suggests that you cannot evaluate training quality by auditing whether mechanisms are 'present'. Meaningful evaluation must assess whether the substrate of clinical work supports mechanism coupling, whether contextual features enable mechanisms to function as a developmental system, and whether structural conditions support intentional pedagogical design or force defensive improvisation. These are configurational questions, yet absent from policy and educational frameworks.

If configuration determines educational quality, the practical task shifts from implementing discrete mechanisms to designing conditions that enable coherent coupling. This requires addressing structural conditions first. In infectious diseases, EWTD backfill arrangements decoupled mechanisms; no individual effort could compensate. In surgery, theatre access constrained pedagogical possibilities; in geriatrics, continuity enabled tight coupling but reified containment; in paediatrics, small teams supported relational negotiation. Foundational interventions include protecting attending physician-resident co-presence, designing rotas that preserve continuity, ensuring appropriate staffing ratios and safeguarding clinical access. When service pressure squeezes out learning opportunities, the remedy is system redesign, not workshops on feedback skills.

Nevertheless, structural conditions alone are insufficient: attending physicians must also enact mechanisms skilfully within those conditions, reading their local configuration and adjusting deliberately rather than implementing decontextualised techniques.

Evaluation should follow function, not frequency. Counting feedback comments or EPA completions tells little about whether the configuration enables developmental supervision. More illuminating are conditions that allow mechanisms to couple: continuity of attending physician-resident pairings, psychological safety for support seeking, equitable distribution of learning opportunities and whether supervisory relationships are sustained long enough for developmental calibration. There is no universally optimal configuration; the task is to design intentionally for local context, making trade-offs explicit.

4.3 | Strengths and limitations

A realist-informed multiple case study enabled us to trace mechanism configurations across diverse contexts, offering explanatory rather than purely descriptive insight. Cross-case variation strengthens transferability, and verbatim accounts support credibility.

Conducted within a single national system, transferability may be constrained. Our design captured configurations at one point in time; configurations likely shift with staffing changes, rota redesigns or policy interventions; therefore, longitudinal tracking is needed. Interviews capture accounts of supervision, not supervision-in-action; observational work would enrich configurational accounts. Using pre-defined mechanisms may have limited surfacing entirely novel constructs, though the configurational approach highlighted meaningful variability. Our focus on attending physician-resident interactions under-theorised the role of peers, senior residents and organisational actors as co-contributors to the supervisory configuration.

These configurations are not specialty templates; the patterns observed here may look different in the same specialties elsewhere. They are context-contingent configurations that show how supervision assembles under particular conditions.

4.4 | Future directions

Longitudinal tracking of mechanism coupling is needed. Our cross-sectional design captured configurations at one moment, but these likely shift with staffing changes, rota redesigns or policy interventions. Prospective studies could illuminate which contextual features are most consequential and whether reconfigurations follow predictable patterns.

Our focus on attending physician-resident supervision is a starting point. Senior residents, peers, allied health professionals and administrative leaders all shape whether conditions for effective supervision can be sustained. Peer-based mechanisms may co-constitute, compensate for or amplify supervisory configurations depending on context. Configurational thinking requires recognising that educational quality emerges from an entire multi-agent system.

Equity implications require urgent attention. If supervisory quality depends on configuration rather than standardised mechanisms, residents experience systematically different developmental opportunities through structural conditions beyond their control. Educational equity cannot be achieved through mandated mechanisms if structural conditions prevent coherent coupling.

Intervention research should test configurational redesign by manipulating structural conditions hypothesised to enable coupling and measuring effects on mechanism integration and developmental progression. Realist evaluation frameworks would be particularly suited to unpacking how, why and for whom such interventions work.

Finally, international comparative work is needed. Our Irish cases operated within specific regulatory and organisational conditions. Cross-national realist research could identify which contextual features are modifiable through policy versus deeply embedded in healthcare system design.

4.5 | Conclusion

This study reframes supervised workplace learning as a contextually configured system. We demonstrate that configuration (how mechanisms couple within context) determines educational outcomes. Those responsible for training quality must be accountable not only for ensuring that mechanisms exist but for creating and sustaining the structural conditions under which those mechanisms can function as developmental systems.

AUTHOR CONTRIBUTIONS

AW: Conceptualisation; methodology; investigation; formal analysis; writing — original draft; writing — review and editing. **DB:** Conceptualisation; methodology; formal analysis; supervision; writing — review and editing. Both authors approved the final version of the manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors have no competing interests to declare.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT

Ethical approval was granted by the Children's University Hospital, Temple Street Ethics Research Committee (R16.010.), the St James' Hospital Research Ethics Committee (R2016-02) and the UCC Clinical Research Ethics Committee (ECM 4 R01.12.15).

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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