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Building capability of meso-level leaders for CBME implementation: a mixed-methods evaluation of a faculty development programme

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Abstract

Introduction

Competency-based medical education (CBME) requires effective implementation at the meso-level of clinical training units, where educational supervisors translate policy into practice. Yet supervisors are often appointed for clinical expertise rather than educational preparation, creating a capability gap that undermines CBME implementation. This study evaluated a structured faculty development programme designed to build supervisory capability across four key domains.

Methods

A mixed-methods study evaluated a 12-week blended learning programme for Supervisors of Training (SOTs) across three postgraduate training pathways in Hong Kong. The programme addressed four competency domains: facilitating competency-based learning, fostering supportive clinical environments, conducting in-training assessment, and supporting trainees in difficulty. Quantitative data were collected using adapted CPD-Reaction Questionnaires, grounded in the Theory of Planned Behaviour, from 15 participants with matched pre- and post-course surveys. Two post-programme focus groups with 17 participants total provided qualitative data analysed using thematic analysis, with findings integrated via a joint display.

Results

Quantitative findings showed large self-reported effect size estimates for self-efficacy across three competency domains (Cohen's d = 0.83–0.96) and for social influence across two domains (d = 0.84–1.04); scores for moral norm and beliefs about consequences showed more modest increases, consistent with high pre-course baseline scores. Seven qualitative themes described acquisition of structured supervisory frameworks, reconceptualisation of assessment as formative, heightened awareness of the clinical learning environment, broadened perspectives on trainee difficulty, and calls to extend training beyond designated supervisors to build capability for cultural change.

Discussion

The preparation gap appeared to reflect limited capability rather than limited motivation — a distinction favouring structured frameworks and experiential learning in programme design. The cohort-based design appeared to shift perceived collegial norms, suggesting faculty development may strengthen shared professional expectations alongside individual capability. Sustainable CBME implementation nonetheless requires coordinated strategies aligned across institutional, supervisory, and frontline levels of the training system.

Introduction

Competency-based medical education (CBME) has become a widely adopted framework for postgraduate training, shifting emphasis from input-based curricula towards the achievement of defined competencies.[1,2] Its implementation operates across three interconnected levels: macro-level regulatory bodies and professional organisations that set policy and standards; meso-level clinical training units and the educational leaders who oversee them; and micro-level daily trainer–trainee interactions where learning activities, feedback, and workplace-based assessments occur.[3,4] Across many jurisdictions, including Hong Kong, these principles have been formalised through competency frameworks and certification requirements.[5,6]

Achieving this alignment across levels is, however, rarely automatic. While CBME depends on coherence across the system, it is at the meso-level that policy must be translated into local educational practice — and where implementation often falters.[3,4] These failures of meso-level translation are often reflected in daily trainer–trainee interactions at the micro-level, where learning may be inadequately scaffolded, feedback inconsistently exchanged, workplace-based assessments insufficiently integrated with progression decisions, and trainees in difficulty unrecognised or unsupported.[7–13]

Bridging this gap requires attention to the meso-level: clinical training units, departments, and the educational leaders who oversee them.[3,4] At this level, training activities must be aligned with competency expectations, assessments integrated with progression decisions, and trainees in difficulty identified and supported.[3,14] These educational leaders occupy designated roles as clinical supervisors — known internationally as programme directors, educational supervisors, supervisors of training, or training coordinators.[14,15] In the programmes from which participants were drawn, this role is termed Supervisor of Training (SOT), responsible for overseeing training quality, trainee progression, and compliance with accreditation standards. The term SOT is used here for consistency, while recognising equivalent roles across jurisdictions.

Despite these responsibilities, SOTs are often appointed primarily for their clinical expertise rather than formal preparation in medical education.[14,15] A needs analysis conducted through a structured discussion at the HKCA Annual Scientific Meeting in November 2023, attended by approximately half of all active SOTs, supported this observation: participants identified challenges in four core supervisory domains — facilitating competency-based learning, fostering supportive clinical learning environments, conducting in-training assessment, and supporting trainees in difficulty — which later formed the basis of this programme (HKCA, unpublished data). These domains were subsequently aligned with the HKAM draft Framework for Faculty Development for Supervisors of Training, itself informed by established models of clinical educator competence.[16,17] Together, these findings point to a meso-level preparation gap: while macro-level policy mandates CBME implementation, the SOTs responsible for translating it into practice may not be adequately prepared for this role.

To address this preparation gap, a faculty development programme was developed for SOTs to build supervisory capability across these four core domains. This mixed-methods study evaluated the

programme by examining changes in participants' self-reported competence and behavioural intentions, exploring their learning experiences, and identifying implications for building meso-level capability for CBME implementation.

Methods

Study design

This convergent mixed-methods study with explanatory integration evaluated a faculty development programme designed to build the capacity of clinical supervisors to lead CBME implementation within their training units. Drawing on the macro–meso–micro framework of CBME implementation,[3,4] the study conceptualised clinical supervisors as meso-level leaders who translate policy into practice. Two complementary theoretical frameworks informed the study: Merrill's First Principles of Instruction[18] guided programme design, while the Theory of Planned Behaviour (TPB),[19] operationalised through the validated CPD-Reaction Questionnaire,[20,21] guided construct selection and measurement of behavioural intentions and their determinants. Quantitative data captured changes in these constructs; qualitative data explored participants' learning experiences and illuminated how and why these changes occurred. Qualitative findings were additionally used to explain patterns observed in the quantitative strand, consistent with explanatory integration in mixed-methods research.[22,23]

Setting and context

The study was conducted within Hong Kong's postgraduate medical education system, where specialist training is overseen by the Hong Kong Academy of Medicine (HKAM) — the statutory postgraduate training authority for specialist medicine in Hong Kong — through 15 constituent colleges. Clinical training occurs in accredited hospital-based units led by designated educational supervisors — termed Supervisors of Training (SOTs) in the programmes from which participants were drawn.[14]

Participants were recruited from SOTs across three training pathways: anaesthesiology, intensive care medicine, and critical care medicine, spanning two constituent colleges of HKAM. These pathways share close clinical relationships and patient populations, and SOTs across all three faced comparable CBME implementation challenges, making cross-pathway faculty development both feasible and educationally coherent. Central to the SOT role across all three pathways is the conduct of in-training assessments (ITAs) and workplace-based assessments (WBAs) — ITAs being six-monthly evaluations contributing directly to decisions about trainees' eligibility for the Final Fellowship Examination, underscoring the high stakes of supervisors' educational judgements and the preparation gap this programme aimed to address.[24,25]

The intervention

The intervention

The programme addressed four core competencies identified through a prior needs analysis and aligned with Outcomes 1–4 in HKAM's draft Framework for Faculty Development for Supervisors of Training (HKAM, under review): facilitating competency-based learning (Competency 1), fostering supportive clinical environments (Competency 2), conducting in-training assessment (Competency 3), and supporting trainees in difficulty (Competency 4). This framework draws on established models of clinical educator competence[16,17] and has been informed by iterative feedback from faculty development initiatives including the present course.

The 12-week blended learning programme was designed prospectively according to Merrill's First Principles of Instruction,[18] selected because its problem-centred, activation–demonstration–application–integration cycle maps directly onto the supervisory competency domains targeted. The principles posit that learning is promoted when learners engage with real-world problems, activate prior experience, observe demonstrations, apply new knowledge, and integrate it into practice. The programme comprised three sequential components: an orientation session, four self-paced online modules, and a full-day face-to-face workshop. Each online module presented structured frameworks applied to real-world supervisory problems, followed by an assignment requiring participants to apply the framework to a challenge from their own context. The face-to-face workshop provided opportunities for small-group discussion, role-play of supervisory conversations, structured debriefing, and action planning for daily practice. A detailed programme outline is provided in Table 1 and Additional file 1.

Table 1
Faculty Development Programme Structure and Alignment with Merrill's First Principles of Instruction

Phase	Competency Domain	Component	Merrill's Principle(s)
Orientation	Introduction	90-min Zoom session: course overview, faculty introduction, small-group discussion of prior supervisory experiences	Activation
Online (Weeks 1–2)	Facilitating competency-based learning	Modules 1–3: 4 videos (51 min); assignments on learning objectives, WBA resistance, and learning activity design	Demonstration, Application
Online (Weeks 3–4)	Fostering supportive clinical environments	Module 4: 5 videos (67 min); assignments on clinical learning environment, burnout, and bullying	Demonstration, Application
Online (Weeks 5–6)	Conducting in-training assessment	Module 5: 2 videos (35 min); assignments on improving ITA and role-play preparation	Demonstration, Application
Online (Weeks 7–8)	Supporting trainees in difficulty	Module 6: 3 videos (56 min); assignment on supporting trainees in difficulty	Demonstration, Application
Face-to-face workshop	All four competency domains	Small-group discussions, case-based discussions, role-play with structured debriefing, action planning	Problem-centred, Application, Integration

Participants

Invitations were sent to Supervisors of Training (SOTs) across the three training pathways described above, with a maximum course capacity of 24. Participants included both appointed SOTs and assistant SOTs (specialists working towards SOT appointment). Their inclusion reflects the programme's developmental focus on building supervisory capability before formal appointment. In total, 23 participants enrolled and completed the online learning components.

Two participants were unable to attend the face-to-face workshop. Of the remaining 21 attendees, 15 (71%) provided complete matched pre- and post-course survey data, forming the quantitative sample. The six excluded cases reflected administrative rather than systematic loss: four had unmatched or absent pre-course codes and two submitted incomplete post-course surveys; review of participant codes confirmed no systematic pattern in missingness. One apparent code mismatch was resolved through cross-referencing with email records, confirming a data entry error rather than a distinct participant. Separately, seventeen participants took part in two post-course focus groups, all drawn from those who attended the face-to-face workshop.

Quantitative methods

Instrument

A tailored 12-item questionnaire was developed for each competency domain based on the validated CPD-Reaction Questionnaire.[20,21] Following the detailed adaptation guidance in the instrument's User Manual,[21] the behaviour specified in each item was replaced with the relevant supervisory task for each domain. Grounded in the TPB,[19] the instrument measured four constructs: intention, self-efficacy, social norms, and outcome beliefs. Items were rated on 7-point Likert scales (1 = strongly disagree to 7 = strongly agree), with some items using anchored scales (e.g., 1 = extremely difficult to 7 = extremely easy). The full questionnaires are provided in Additional file 2.

Data collection

Participants completed questionnaires before and after each module. Responses were paired using anonymous participant-generated codes to enable within-subject comparison while maintaining anonymity.

Data analysis

For each competency domain, composite scores were calculated by averaging the 12 questionnaire items. Paired *t*-tests compared pre- and post-course composite scores. Effect sizes were calculated using Cohen's *d* (0.2 = small, 0.5 = moderate, 0.8 = large).[26] Internal consistency was assessed using Cronbach's α.[27] Statistical significance was set at $p < 0.05$. Analyses were conducted using Jamovi (The Jamovi Project, version 2.5, 2025).

Qualitative methods

Data collection

Two focus groups were conducted at the end of the face-to-face workshop, each lasting around 60 minutes. Sessions were facilitated by trained staff independent of the teaching team (C.M., M.P., C.F.C.), who had no teaching role in the programme, to minimise social desirability bias. A semi-structured discussion guide explored participants' experiences of the programme, perceived learning outcomes, anticipated changes in supervisory practice, and suggestions for improvement (Additional file 3). Sessions were conducted in person, audio-recorded, and transcribed verbatim, with participants identified only by participant numbers.

Data analysis

Qualitative data were analysed using Braun and Clarke's six-phase thematic analysis approach.[28] Two researchers independently coded the first transcript to develop an initial coding framework, which was

then applied to the second transcript with iterative refinement; disagreements were resolved through discussion. Analysis was primarily inductive while remaining attentive to the study's focus on supervisory competence, learning processes, and barriers to engagement. Data were managed using NVivo 14.

Integration

Quantitative and qualitative findings were integrated using a joint display approach, allowing systematic comparison of patterns across data sources and facilitating examination of convergence, divergence, and expansion between strands.[23]

Rigour and trustworthiness

Strategies to enhance trustworthiness included investigator triangulation during coding, peer debriefing through discussion of emerging themes with colleagues outside the research team, and the use of illustrative participant quotations to provide contextualised interpretation.[29] The lead researcher maintained a reflexive journal throughout to acknowledge potential assumptions arising from their role in course design.

Results

Quantitative Findings

Reliability of questionnaires

The adapted CPD-Reaction Questionnaires demonstrated excellent internal consistency across all four competency domains, with Cronbach's α values ranging from 0.91 to 0.95 pre-course and 0.91 to 0.93 post-course (Additional file 4: Supplementary Table 1). These values indicate reliable measurement of the targeted constructs, though two caveats apply: reliability estimates are sample-dependent and should be interpreted with consideration of the modest sample size;[28] and alpha values in this range may partly reflect item redundancy inherent in the instrument's design, given that multiple items address closely related facets of each construct.

Changes in theoretical constructs across competencies

Overall composite scores were higher post-course across all four domains. Table 2 presents mean changes and effect sizes for each theoretical construct across the four competency domains. Given the modest sample size (n = 15), effect sizes are emphasised as the primary indicators of practical significance, with Cohen's d ≥ 0.8 interpreted as large.[26] Statistically significant increases in self-efficacy scores ($p < 0.05$) were observed across Competencies 1, 3, and 4, and in social influence across all four competencies. Full statistical details for all constructs, including confidence intervals, are provided in Additional file 4: Supplementary Table 2.

Table 2
Mean Change (Δ) and Effect Sizes (Cohen's *d*) by Construct Across Four Competencies

Construct	Competency 1: CBME	Competency 2: Environment	Competency 3: ITA	Competency 4: Difficulty
Intention	Δ = +0.60 *d* = 0.72	Δ = +0.03 *d* = 0.04	Δ = +0.53 *d* = 0.56	Δ = +0.50 *d* = 0.50
Social Influence	Δ = +0.60 *d* = 0.61	Δ = +0.60 *d* = 0.79	Δ = **+1.00** *d* = **1.04**	Δ = **+1.00** *d* = **0.84**
Beliefs about Capabilities	Δ = **+0.87** *d* = **0.96**	Δ = +0.27 *d* = 0.33	Δ = **+0.80** *d* = **0.86**	Δ = **+1.00** *d* = **0.83**
Moral Norm	Δ = +0.53 *d* = 0.62	Δ = -0.17 *d* = 0.28	Δ = +0.60 *d* = 0.69	Δ = +0.43 *d* = 0.50
Beliefs about Consequences	Δ = +0.33 *d* = 0.46	Δ = -0.03 *d* = 0.04	Δ = +0.57 *d* = 0.74	Δ = +0.40 *d* = 0.50

Note: Competency 1 = facilitating competency-based learning; Competency 2 = fostering supportive clinical environments; Competency 3 = conducting in-training assessment; Competency 4 = supporting trainees in difficulty.

Effect sizes (Cohen's d) interpreted as small (0.2), moderate (0.5), and large (0.8). Bold indicates large effects (d ≥ 0.8). Detailed pre- and post-course scores with standard deviations, t-statistics, and p-values for each competency are provided in Supplementary Table 1.

Before the programme, participants reported notably lower scores for social influence (pre-course means 4.47–5.27) compared with **moral norm** and **beliefs about consequences** (5.77–6.60), indicating that perceived collegial norms around supervisory practice represented the construct with greatest room for change. The largest and most consistent increases were observed in beliefs about capabilities (self-efficacy), with effect size estimates indicating large effects in Competency 1 (Δ = +0.87, d = 0.96), Competency 3 (Δ = +0.80, d = 0.86), and Competency 4 (Δ = +1.00, d = 0.83). **Social influence** also showed substantial increases, with effect size estimates indicating large effects in Competency 3 (Δ = +1.00, d = 1.04) and Competency 4 (Δ = +1.00, d = 0.84), and a moderate-to-large effect in Competency 2 (Δ = +0.60, d = 0.79). **Intention** scores were higher across three of four competencies, with moderate effects for Competency 1 (Δ = +0.60, d = 0.72) and Competency 3 (Δ = +0.53, d = 0.56); the confidence interval for Competency 4 included zero (Δ = +0.50, 95% CI [− 0.03, 1.03], d = 0.50), indicating uncertainty around this estimate.

Moral norm and **beliefs about consequences** showed more modest changes. Pre-course means for these constructs ranged from 5.77 to 6.60 on a 7-point scale across all competencies, suggesting limited room for improvement. Most confidence intervals for these constructs included zero, with the exception of moral norm in Competency 1 (95% CI [0.06, 1.00]) and Competency 3 (95% CI [0.12, 1.08]),

and beliefs about consequences in Competency 3 (95% CI [0.14, 1.00]). A small decrease in moral norm was observed in Competency 2 (Δ = −0.17), likely reflecting measurement variability at ceiling rather than a meaningful decline.

Qualitative Findings

Seventeen participants took part in two focus groups conducted after the face-to-face workshop. Thematic analysis identified seven themes describing participants' learning experiences, perceived changes in understanding, intended practice changes, barriers encountered, and suggestions for future development.

Theme 1: Structured approaches to supervision

Participants described moving from knowing what their supervisory role required to having a clear how — an evidence-based framework for enacting it. This was evident across multiple domains, including competency-based education concepts such as EPAs and WBAs, as well as specific tools for supervisory conversations.

"If we just look at the syllabus, it might be very vague. Now it seems there is a framework to design some learning activities and how to assess competency-based learning." (FG1, P1)

"Use R2C2." (FG1, P9)

Theme 2: Conceptualising assessment as formative

A conceptual shift occurred in how participants understood ITA, moving from viewing it as an administrative task to recognising its formative, diagnostic, and educational value. The richness of this shift was captured in participants' own language:

"ITA... it's not just about filling out a form. It also has a diagnostic, therapeutic, and prognostic function. If we really want to do ITA, we should know more about how to plan the trainee's subsequent education." (FG1, P3)

"ITA is about collecting pixels at multiple time points for the trainee's growth eventually." (FG1, P9)

The second quote is particularly notable — the "pixels" metaphor reflects a shift from viewing ITA as a single summative judgement to understanding it as a longitudinal process of building an evidential picture of trainee development over time.

Theme 3: Attending to the learning environment

Participants developed a heightened awareness of their role in shaping workplace culture, identifying specific issues such as bullying and psychological safety while acknowledging the challenge of systemic change.

"At least I can recognize that this is bullying, and what things can improve or destroy the clinical learning environment. In the future, I have more understanding and more confidence to build and maintain it." (FG1, P3)

"Creating a good clinical environment is very important. But it requires efforts on multiple levels — beyond just individual effort, it needs systemic or cultural change." (FG1, P1)

Theme 4: Broadening perspectives on trainee difficulty

Participants developed a more nuanced view of trainees in difficulty, moving beyond individual deficit models to consider systemic and contextual factors. They also identified resource limitations as a barrier to effective support.

"Learn to look at the reasons for difficulty from multiple angles. Don't assume the problem lies with the trainee. We need to look at the training environment we provide, and how we teach them." (FG2, P1)

"If we are not empowered to make any improvements, diagnosing is useless." (FG1, P5)

The second quote signals an important tension: participants recognised their expanded analytical capacity but felt constrained by the limits of their institutional authority — a finding with direct implications for how meso-level capacity is understood.

Theme 5: Intentions to change supervisory practice

Participants described specific changes they intended to make to their everyday supervisory practice. Several focused on more structured and frequent feedback, with one participant stating an intention to give trainees more feedback in day-to-day settings (FG1, P2), and another planning to provide regular evaluations regarding the training programme (FG1, P5). Others described applying specific tools acquired during the programme, including R2C2 for feedback conversations (FG1, P9). One participant extended this thinking to the departmental level:

"We should consider introducing a mentorship programme — for example, assigning each new trainee a mentor annually." (FG2, P4)

This suggests that for at least some participants, learning translated into thinking about how training could be restructured at the unit level — a finding that connects directly to Theme 7's call for broader cultural change.

Theme 6: Tensions between course design and clinical realities

Despite valuing the programme, participants described tensions between the self-paced online format and the rhythms of clinical work. Several completed assignments earlier than intended due to workload pressures, finding that content felt less fresh by the time of the face-to-face workshop.

"Too much homework, so I had to do the homework very early. By the time of the class, I had forgotten what the videos were about." (FG1, P3)

This suggests a potential misalignment between the asynchronous online format and the clinical schedules of participants, with implications for how the sequencing of online and face-to-face components is designed in future iterations.

Theme 7: Extending training beyond designated supervisors

Participants recognised that the programme's impact could not be sustained through individual SOTs alone. They called for training to be offered to colleagues at all levels of seniority to build the critical mass needed for cultural change.

"Changing culture involves people at different levels — from the most senior to the most junior — all need to understand what we learned today." (FG2, P9)

This theme points towards a systemic understanding of faculty development: sustainable change at the meso-level requires not only equipping designated supervisors but cultivating shared educational values across the clinical unit as a whole.

Integration of findings

Table 3 presents a joint display integrating quantitative outcomes with qualitative themes by competency domain. Convergence was strongest in Competency 3, where large quantitative increases aligned with qualitative descriptions of a fundamental conceptual shift in how participants understood ITA. Divergence was most notable in Competency 2, where minimal quantitative change contrasted with qualitative evidence of substantially deepened awareness of environmental factors — suggesting the quantitative instrument did not fully capture the nature of this change. Themes 5–7 expanded beyond the competency framework, describing intended practice changes, barriers arising from clinical workload, and calls for broader cultural change across training units — dimensions not captured quantitatively but with direct implications for programme design and meso-level implementation.

Table 3
Joint Display of Quantitative and Qualitative Findings by Competency Domain

Domain	Quantitative Finding	Qualitative Theme	Integration
Competency 1: Facilitating competency-based learning	Large effect on self-efficacy (*d* = 0.96); moderate-to-large effect on intention (*d* = 0.72)	Theme 1: Structured approaches to supervision—participants valued frameworks like EPAs, WBAs, R2C2	Frameworks provided the *how*, building confidence and motivation to apply structured approaches
Competency 2: Fostering supportive clinical environments	Highest baseline scores (ceiling effect); social influence showed meaningful gain (*d* = 0.79)	Theme 3: Attending to learning environment—participants developed awareness of bullying, psychological safety	High baseline reflects existing commitment; qualitative data show new *specificity* about what constitutes a supportive environment
Competency 3: Conducting in-training assessment	Large effects on self-efficacy (*d* = 0.86) and social influence (*d* = 1.04)	Theme 2: Conceptualising assessment as formative—shift from "filling a form" to diagnostic, educational tool	Confidence and perceived norms shifted as participants reimagined ITA's purpose
Competency 4: Supporting trainees in difficulty	Large effect on self-efficacy (*d* = 0.83); moderate effect on intention (d = 0.50)	Theme 4: Broadening perspectives on trainee difficulty—from individual deficit to systemic factors	Confidence grew, but intention modest due to recognition that systemic barriers limit individual action

Discussion

This study examined how faculty development may help build the capability of meso-level leaders required for CBME implementation within clinical training units. Participants reported higher post-course self-efficacy scores across three competency domains and higher perceived social influence across all four. Large effect sizes were observed for self-efficacy in three domains and for social influence in two domains. Social influence showed the lowest baseline scores and the largest increases, suggesting that the cohort-based design may have shifted perceived collegial norms alongside individual supervisory capability. Qualitative findings provided insight into how participants interpreted these changes, describing the acquisition of structured supervisory frameworks, reconceptualisation of assessment as a formative process, heightened awareness of the clinical learning environment, and broader perspectives on trainees in difficulty.

Together, these findings suggest that targeted faculty development may help build supervisory capability as one necessary precondition for organisational capacity, though whether individual gains translate into sustained change at the unit level remains an important question for longitudinal research. Participants described greater confidence in supervisory roles while also recognising the complexity of translating

CBME into practice within clinical environments. Their reflections highlighted the importance of alignment across institutional, supervisory, and frontline levels of the training system.

Building meso-level leadership capacity

The meso-level — clinical training units led by SOTs — is where CBME policy must ultimately be translated into practice. Van Melle and colleagues' core components framework identifies this layer as critical, arguing that successful implementation requires leaders who can interpret policy, coordinate training activities, and support clinicians in adopting new educational approaches.[3]

However, appointment to these roles does not automatically confer readiness to perform them effectively. SOTs are often selected on the basis of clinical expertise rather than preparation for educational leadership.[14,15] This creates a meso-level preparation gap which, as our findings suggest, may reflect limited capability rather than limited motivation. Participants entered the programme with high scores for moral norm and beliefs about consequences, indicating that they already viewed the targeted supervisory behaviours as important and beneficial. By contrast, self-efficacy was substantially lower, particularly in assessment and supporting trainees in difficulty, suggesting that a key barrier was not role commitment but confidence in enacting these responsibilities in practice. This distinction has practical implications: where the gap is one of capability rather than motivation, faculty development should prioritise experiential learning and structured frameworks over persuasive approaches.

Qualitative findings reinforced this interpretation. Participants described moving from knowing what their role required to understanding how to enact it through structured frameworks and practical tools. CBME concepts such as entrustable professional activities (EPAs) and workplace-based assessments (WBAs) provided shared language for designing assessments, while tools such as R2C2 offered practical frameworks for feedback conversations. The higher self-efficacy scores reported by participants across multiple supervisory competencies are consistent with Bandura's theory that mastery experiences are among the most powerful sources of self-efficacy beliefs.[30]

Beyond individual skill acquisition, the findings point to a broader dimension of meso-level leadership: educational supervisors not only implement CBME requirements but also act as local change leaders who influence unit-level culture. Participants described developing a stronger sense of shared professional purpose, reflected in substantial reported increase in social influence and in qualitative calls to extend training beyond designated supervisors. This suggests that faculty development may help cultivate not only individual supervisory capability but also the collegial influence needed to shift local norms and sustain educational change. Cohort-based learning, shared problem-solving, and deliberate attention to collegial norms may therefore strengthen this change leadership function.

These findings align with scholarship emphasising that organisational capacity is critical for translating macro-level policy into micro-level practice.[3,13] In implementation terms, SOTs act as local translators of reform — sometimes described as 'street-level bureaucrats'[31,32] — interpreting policy expectations and

adapting them to the realities of clinical work. By building supervisory capability and strengthening their influence within training units, faculty development may help support this translation process and contribute to broader organisational change.

Developing awareness of systemic influences on supervision

Beyond skill acquisition, one of the most notable qualitative findings was a heightened awareness of the systemic and contextual factors shaping supervision. Participants described moving away from viewing trainee difficulties primarily through an individual deficit lens and instead considering how trainee characteristics, teaching practices, and the clinical learning environment interact to influence learning.

This shift may reflect an important feature of meso-level leadership: recognising how organisational structures and workplace culture shape trainee development. SOTs who adopt this perspective may be better positioned to identify systemic barriers affecting learning and to advocate for improvements within their training environments. As one participant observed, *"If we are not empowered to make any improvements, diagnosing is useless"* (FG1, P5), highlighting that identifying problems must be accompanied by the capacity to address systemic constraints.

Similar challenges have been reported internationally. In Norway, Birkeli and colleagues found that educational supervisors often navigate their roles without adequate organisational support, often creating their own tools while remaining uncertain of their adequacy.[33] In Indonesia, supervisors similarly reported that CBME implementation surfaced organisational barriers while strengthening their identity as local change agents.[34] These parallels suggest that the systemic challenges identified in this study may extend beyond Hong Kong, although their precise forms are likely shaped by local training structures and institutional contexts.

Faculty development within a broader implementation strategy

The findings of this study point to a reconceptualisation of faculty development for meso-level leaders: not simply as a means of improving supervisory practice, but as a strategy for cultivating educational leaders who can actively drive CBME implementation within their training units and beyond. Participants consistently recognised that improving supervision requires engagement beyond designated supervisors, calling for training to extend across levels of seniority in order to build the critical mass needed for cultural change.

This highlights an important challenge in CBME reform. While policy changes originate at the macro-level, implementation depends on the collective practices of clinicians across the training system. Meso-level leaders occupy a strategic position at the interface between policy and practice, and faculty development that equips them to act as change leaders may therefore represent an important leverage point for wider implementation.

Canada's national experience with Competence by Design offers an instructive parallel. Recognising that local programme change could not rest on designated supervisors alone, the Royal College established dedicated CBME Leads at each medical school to extend implementation capacity and support local co-creation of solutions.[35] This illustrates how meso-level leadership development can be deliberately scaled through institutional design rather than left to individual initiative.

Faculty development scholarship has increasingly framed faculty development as a strategy for organisational capacity building rather than merely individual skill enhancement.[36,37] Our findings offer partial support for this reframing: participants reported increased self-efficacy in supervisory roles, developed greater awareness of systemic influences, and reported shifts in perceived collegial norms — changes that may represent early conditions for organisational capacity if sustained and reinforced through institutional structures. Sustainable CBME implementation is likely to require the kind of coordinated, multi-level effort that Kotter describes as essential for institutional transformation, aligning leadership vision, organisational structures, and frontline practice across levels of the system.[38]

Implications for CBME implementation

These findings point to several practical considerations for faculty development and CBME implementation. First, programmes for meso-level leaders should prioritise structured frameworks and experiential learning — such as EPA design, R2C2 for feedback conversations, and role-play of supervisory scenarios — over didactic or persuasive approaches. Second, programmes should cultivate the change leadership role of SOTs, equipping them not only to enact CBME requirements within their units but also to advocate for alignment across macro-, meso-, and micro-levels of the training system. Third, programmes should address systemic and contextual barriers to effective supervision and support SOTs to act as local advocates for incremental improvements within their spheres of influence. Finally, practical barriers to engagement — including workload pressures and misalignment between asynchronous content and clinical schedules — should be addressed in programme design to improve participation and maximise transfer to practice.

Limitations

Several limitations should be noted. The quantitative sample was modest (n = 15), limiting statistical power; however, the consistency of effect sizes across constructs supports some confidence in the direction of change.[26] A ceiling effect in Competency 2 also points to a broader limitation of the CPD-Reaction Questionnaire in this context: the instrument appears better calibrated to detect changes in perceived capability than the kind of conceptual reframing described qualitatively. Future evaluations may therefore benefit from complementary measures sensitive to shifts in understanding as well as confidence.

The study was conducted within a single training context in one jurisdiction. Although parallels with international literature suggest that the challenges identified may not be unique to this context, differences in training structures and institutional cultures limit direct transferability.

Outcomes were assessed immediately post-programme using self-report measures, and whether reported increase in self-efficacy and behavioural intentions translate into sustained practice change remains unknown. Longitudinal follow-up incorporating observational or trainee-reported outcomes would strengthen future evaluations.

Volunteer sampling and the timing of end-of-workshop focus groups may also have introduced bias. Participants were likely more engaged than non-attendees, and immediate post-workshop responses may have been influenced by positive response bias despite independent facilitation. High baseline moral norm scores — which support the 'capability not motivation' interpretation — may also partly reflect social desirability, as supervisors may feel professionally obliged to endorse these responsibilities.

The informal needs analysis, representing approximately half of active SOTs, limits precision in characterising the pre-intervention gap. Finally, while TPB guided construct selection, the model was not tested analytically, and relationships between constructs could not be examined because of sample size. Future studies with larger samples could explore predictive pathways to better understand behaviour change mechanisms.

Conclusions

This study suggests that faculty development targeting clinical supervisors may help build the capability of meso-level leaders required for CBME implementation. The preparation gap appeared to reflect limited capability rather than limited motivation — a distinction favouring structured frameworks and experiential learning over persuasive or normative approaches, and one with direct implications for programme design. Participants reported greater confidence in key supervisory roles, intentions to adopt more structured approaches to supervision, and heightened awareness of systemic and contextual influences on trainee performance and the learning environment. Sustainable implementation is nonetheless likely to require coordinated strategies aligning policy, supervisory leadership, and frontline teaching practice across all three levels of the training system. Faculty development for clinical supervisors represents an important and actionable component of this broader effort — and longitudinal research incorporating trainee-reported outcomes, observational measures, and unit-level indicators of the learning environment will be needed to determine whether the changes observed here translate into sustained improvements in postgraduate training.

Abbreviations

CBME
Competency-based medical education
CPD
Continuing professional development
EPA

Entrustable professional activity
HKAM
Hong Kong Academy of Medicine
HKCA
Hong Kong College of Anaesthesiologists
ITA
In-training assessment
SOT
Supervisor of Training
TPB
Theory of Planned Behaviour
WBA
Workplace-based assessment.

Declarations

Clinical trial number: not applicable.

Ethics approval and consent to participate

Participation was voluntary, and written informed consent was obtained from all participants prior to commencing the online learning modules. The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was granted by the Survey and Behavioural Research Ethics Committee of the Chinese University of Hong Kong (Reference No. SBRE-25-0157).

Consent for publication

Not applicable. The manuscript does not contain identifiable individual participant data.

Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available because they contain qualitative focus group data and participant-level educational evaluation data that could compromise participant confidentiality, but anonymised data may be available from the corresponding author on reasonable request and subject to institutional approval.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

HYS and AKMC conceptualised the study. HYS, AKMC and AKHL developed the methodology. All authors contributed to the investigation and to the delivery or implementation of the faculty development programme. HYS performed the formal analysis, with input and interpretation from AKMC and AKHL. HYS conducted the software-based analyses and managed project administration. All authors contributed resources supporting programme delivery and study implementation. AKMC, AKHL and BS contributed to validation of the analysis and interpretation. HYS drafted the original manuscript. All authors reviewed and edited the manuscript, approved the final version, and agreed to be accountable for the work.

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