

Supplementary Material S4: Detailed Coding Procedures and Full Codebook

Coding Process

Thematic analysis followed Braun and Clarke's six-phase approach. The first author inductively coded all 90 reflective essays. Initial open coding generated 19 primary codes, which were further refined into 56 sub-codes. Through iterative comparison and discussion among the research team, codes were aggregated into six final themes. Trustworthiness was ensured by data triangulation (student surveys, faculty surveys, reflective essays), peer debriefing, and member checking. An audit trail documented all analytic decisions. The full codebook is presented below.

Table S4- 1 Full Codebook

Primary Code	Sub- code	Representative Quote
1. Role Transition Awareness	1a Passive→Active	“This role transition allowed me to stand from the perspective of instructional design.” (TY14)
	1b Consumer→Creator	“Transitioning from case learner to case writer brought not merely a change in tasks but a deep reconstruction of thinking and cognition.” (BM02)
	1c Critic→Builder	“From ‘critic’ to ‘builder’—I became the one building the house.” (BM19)
	1d Puzzle- solver→Puzzle- setter	“From puzzle- solver to puzzle- setter.” (BM08)
2. Perspective Shift	2a Learner→Teacher perspective	“Thinking from the teacher's perspective: how to guide learners through plot design?” (BM03)
	2b Learner→Physician perspective	“As writers, we simultaneously played the dual roles of ‘physician’ and ‘teacher’.” (TY17)
	2c Interpreter→Designer	“The shift from ‘student’ to ‘question- setter’ awakened everyone's sense of responsibility.” (TY06)
3. Professionalism Awareness	3a Medical accuracy	“We repeatedly verified diagnostic criteria to ensure every detail was accurate.” (TY18)

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4. Logical Coherence	3b Data precision	“Repeatedly verifying the clinical significance of ASO titers and complement C3.” (BM21)
	3c Guideline adherence	“Consulting the Chinese Guidelines for the Diagnosis of Acute Pancreatitis.” (BM26)
	4a Plot continuity	“We deliberately designed turning points to naturally guide learners toward discovery.” (TY08)
	4b Causal chain	“From chronic cough to dyspnea to altered consciousness—strictly following the pathophysiological chain.” (TY56)
5. Knowledge Integration	4c Reasoning pathway	“All clues interlinked, guiding learners through the complete clinical reasoning process.” (TY17)
	5a Multidisciplinary integration	“Weaving together neurology, genetics, ethics, and other disciplines.” (BM12)
	5b Knowledge synthesis	“Mastering anatomy, physiology, and pathology together.” (BM23)
6. Appropriate Challenge	5c Systems thinking	“This shift from fragmented knowledge to systematic understanding gave me a dynamic view of disease.” (TY08)
	6a Difficulty calibration	“Avoiding cases that are too simple, while also preventing content that is overly complex.” (TY18)
	6b Cognitive conflict	“We designed the plot twist of treatment failure to help learners experience clinical complexity.” (TY19)
7. Narrative Engagement	6c Differential diagnosis	“Designing reasonable differential diagnosis scenarios to guide learners' thinking.” (BM23)
	7a Narrative design	“Like writing a mystery—the process was both a review of knowledge and a refinement of teaching logic.” (TY20)
	7b Character development	“Using the character ‘Xiaoya’ to give the case emotional resonance.” (BM05)

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8. Systematic Learning	7c Situational authenticity	“Incorporating life- like scenarios such as ‘body image anxiety’ and ‘online consultation’.” (BM03)
	8a Disease panorama	“Case writing pushed me toward panoramic learning—no longer just memorising diagnostic criteria.” (TY34)
	8b Disease progression	“Gaining a holistic understanding of how a disease develops.” (BM11)
	8c Pathophysiology	“Deeply exploring pathogenic mechanisms and inflammatory processes.” (BM19)
9. Active Inquiry	9a Problem- oriented	“This ‘output- driven input’ model—its depth far exceeded passive reading. I had to understand the disease's complete narrative from beginning to end.” (TY25)
	9b Literature review	“Consulting latest guidelines and clinical teachers.” (BM06)
	9c Mechanism exploration	“To accurately describe the mechanism, I needed to relearn adenosine receptors.” (BM24)
10. Knowledge Networking	10a Knowledge networking	“I no longer memorised isolated points—I connected pathogenesis, staging, and workflow into a complete system.” (TY29)
	10b Cross- disciplinary connection	“From ‘etiology–pathology–symptoms–diagnosis–treatment–follow- up’ complete chain.” (BM18)
	10c Clinical correlation	“Case writing allowed me to precisely match abstract mechanisms with specific clinical symptoms.” (TY33)
11. Physician Role Identification	11a Clinical reasoning	“Simulating physicians' diagnostic decision- making processes.” (BM32)
	11b Therapeutic	“Every diagnostic decision concerns patients' health

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12. Teacher Role Identification	responsibility	and even their lives.” (BM26)
	11c Patient- centredness	“Medicine is not only science but also the study of humanity—integrating patients' social and psychological contexts.” (TY14)
	12a Instructional design	“My core goal shifted from ‘answering correctly’ to ‘designing effective learning pathways’.” (TY17)
	12b Guiding responsibility	“The responsibility to guide rather than directly provide answers.” (BM03)
13. Enhanced Responsibility	12c Knowledge transmission	“I began to adopt a teacher's mindset—thinking about how to make knowledge understandable to others.” (TY15)
	13a Content accuracy responsibility	“Realising that what I write may affect others' understanding of disease.” (BM04)
	13b Learning outcome responsibility	“A case with unclear logic could misdirect the entire group's learning—so I was more cautious than ever.” (TY03)
	13c Patient safety responsibility	“The case is not for the teacher to grade—it is for countless future patients to rehearse life- and- death decisions.” (BM30)
14. Team Collaboration	14a Division of labour	“Drafting → collective discussion → integration and revision.” (BM30)
	14b Cognitive collision	“Small- group collaboration was an enjoyable process of cognitive collision.” (BM10)
	14c Consensus building	“Through candid debate, we reached consensus based on what best served the learning objectives.” (TY32)
15. Communication	15a Divergent views	“Initially, we had differing views: some wanted to emphasise emergency care, others pathophysiological

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ion and Negotiation		analysis.” (TY56)
	15b Discussion- based resolution	“Breaking through through division of labour, repeated deliberation, and multi- role discussion.” (BM12)
	15c Mutual learning	“Learning different ways of thinking from team members.” (BM21)
16. Learning Reflection	16a Learning approach transformation	“Shifting from ‘receiving knowledge’ to ‘applying knowledge’.” (BM33)
	16b Depth vs. breadth	“This output- oriented learning greatly enhanced my knowledge internalisation and clinical thinking.” (TY27)
	16c Output orientation	“Output- driven input required me, like a real clinical detective, to understand the disease's complete narrative.” (TY25)
17. Understanding of Teaching	17a Instructional design complexity	“Medical education is not only knowledge transmission but also the shaping of thinking and cultivation of responsibility.” (TY23)
	17b Educational value	“A good case is like a carefully crafted instructional design, balancing objectives, cognition, and emotion.” (BM09)
	17c Legacy and transmission	“Those plot designs I had taken for granted—they embodied so much effort from previous teachers.” (BM32)
18. Writing Challenges	18a Knowledge limitations	“The process revealed my shortcomings: insufficient foundation and shallow understanding of some molecular mechanisms.” (TY26)
	18b Logical construction	“Difficulty organising fragmented knowledge into logically coherent case narratives.” (TY44)
	18c Balancing trade- offs	“How to present a complete disease progression without becoming a dry medical record.” (BM29)

Primary Code	Sub- code	Representative Quote
19. Solution Strategies	19a Literature consultation	“Through consulting guidelines and repeated discussions, we gradually refined the case structure.” (TY23)
	19b Teacher consultation	“We were grateful for the teacher's guidance—offering insights we would not have noticed on our own.” (TY13)
	19c Team discussion	“Through multiple group discussions, we mapped logical pathways and produced a case with clear logic and solid content.” (TY34)

Table S4- 2 Theme–Code Correspondence

Theme	Primary Codes	Brief Definition
1. Cognitive Reconstruction through Role Reversal	1, 2	Students experienced a fundamental shift from passive consumers to active creators.
2. Holistic Understanding of Case Quality	3, 4, 5, 6, 7	Students developed integrated understanding of professionalism, logic, integration, challenge, and narrative.
3. Output- Driven Deep Learning	8, 9, 10, 18, 19	Role reversal activated an output- driven input mechanism, with challenges serving as drivers of growth.
4. Dual Identity Formation as Physician- Educator	11, 12, 13	Students identified with both physician and teacher roles, developing a dual identity.
5. Collaborative Learning Communities	14, 15	Small- group collaboration created learning communities through division of labour, cognitive collision, and consensus.
6. Meta- cognitive Awakening of Teaching- Learning Reciprocity	16, 17	Students achieved meta- cognitive reflection on how learning occurs and how to teach effectively.