

Flow as an Optimal Learning State for Clinical Reasoning in Nurse Practitioner Training: A Concept Analysis

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Abstract

Background

Nurse practitioner (NP) clinical training requires learners to integrate advanced knowledge, role transition, clinical reasoning and performance under uncertainty. Flow has been described as an optimal state of absorption, challenge-skill balance and intrinsic motivation, but its meaning in NP clinical training remains unclear. This concept analysis aimed to clarify flow state in NP clinical training and provide a foundation for curriculum, simulation and assessment design.

Methods

Walker and Avant's eight-step concept analysis approach guided a purposive review of literature on flow theory, flow measurement, nursing work-related flow, clinical simulation, NP role transition, cognitive load and technology-supported OSCEs. PubMed/MEDLINE, CINAHL, Scopus, PsycINFO and Google Scholar were searched for English-language sources published from 1990 to 2026.

Results

Flow state in NP clinical training was defined as a transient, task-bound optimal learning state in which an NP learner perceives a fit between evolving clinical challenge and developing capability, becomes absorbed in patient-centred clinical reasoning, uses goals and feedback to regulate action in real time and experiences intrinsic motivation to continue deliberate practice. Four defining attributes were identified: dynamic challenge-capability fit, absorptive clinical reasoning, goal-feedback-action coupling and autotelic professional agency. Antecedents included foundational knowledge, graduated authentic challenge, psychological safety, clear goals, timely feedback and protected attention. Consequences included efficient cognitive engagement, self-directed deliberate practice, confidence calibration and professional identity formation.

Conclusions

Flow offers a theory-informed learning-process indicator for NP clinical training. Future research should validate NP-specific flow measures and test whether adaptive simulation and AI-supported feedback increase flow while preserving assessment validity, psychological safety and clinical competence standards.

Background

Clinical training is the developmental centre of NP education because it asks learners to move from knowing about illness to acting responsibly in ambiguous patient situations. This transition is not simply

the acquisition of more content. NP learners must reorganize prior registered nurse expertise, assume greater diagnostic and management responsibility, tolerate uncertainty and justify decisions in real time. Role-transition literature describes this movement as a demanding developmental period that may involve loss of confidence, novice-like feelings and a need for structured preceptorship and competency assessment [3, 4]. Competency-based NP models and OSCEs respond to this challenge by making performance visible and remediable [5–7].

A conceptual gap remains: what learning state enables NP learners to use challenging clinical experiences well? Conventional indicators such as case volume, course completion, correct answers and OSCE scores do not describe the moment-to-moment quality of attention, challenge appraisal, feedback uptake and intrinsic motivation during clinical reasoning. Flow theory offers a precise language for this gap. Flow has been defined as an optimal experience in which a person becomes deeply absorbed in a task, perceives a balance between challenge and skill, receives clear feedback and finds the activity internally rewarding [1, 2].

Flow has been measured in sport, work and education. In nursing, recent studies and reviews have examined flow at work among nurses and flow during immersive skills simulation among nursing students [8–11]. However, flow has not been conceptually specified for NP clinical training, where learners are simultaneously developing advanced clinical judgement, managing role transition and performing under evaluation. Without conceptual clarity, flow may be reduced to a vague synonym for engagement, enjoyment or technological immersion. It may also be mistakenly tied to artificial intelligence (AI) or virtual simulation as if technology were the concept itself rather than a possible support for flow-relevant learning conditions.

This concept analysis aimed to clarify flow state as it applies to NP clinical training. The analysis identifies defining attributes, antecedents, consequences, empirical referents and illustrative cases, and proposes implications for NP curriculum design, simulation, OSCE feedback and future measurement research.

Methods

Walker and Avant's concept analysis approach was used because it supports systematic clarification of concepts that are important to nursing but insufficiently differentiated in a specific context [12]. The eight steps are: selecting the concept, determining the purpose of analysis, identifying uses of the concept, determining defining attributes, constructing a model case, constructing additional cases, identifying antecedents and consequences and defining empirical referents. Contemporary nursing methods literature emphasizes that concept analysis intended to guide education or practice should make its conceptual boundaries and context explicit [13].

A purposive literature review was conducted to identify theoretical, empirical and applied sources relevant to flow in NP clinical training. Databases and sources included PubMed/MEDLINE, CINAHL, Scopus, PsycINFO and Google Scholar. Search terms combined flow-related terms, including "flow", "flow

state", "optimal experience", "challenge-skill balance", "autotelic" and "work-related flow", with nursing and education terms, including "nursing education", "nurse practitioner", "advanced practice nursing", "clinical training", "clinical reasoning", "simulation" and "objective structured clinical examination". The search emphasized English-language sources from 1990 to 2026, beginning with foundational flow theory and extending to current work on nursing simulation, NP clinical education, cognitive load and AI-supported OSCEs.

Sources were selected when they contributed to at least one analytic element of the concept: uses of flow, attributes of flow, antecedents, consequences, empirical measurement or the NP clinical training context. The analytic corpus was organized into five bodies of evidence: foundational flow theory [1, 2], flow measurement [14, 15], nursing work and simulation studies [8–11], NP clinical education and role transition literature [3–7] and cognitive load, psychological safety and technology-supported learning literature [16–20].

Generative AI tools were used after the analytic structure had been specified to assist with language editing, translation, organization and journal-format alignment. The author(s) reviewed all AI-assisted text, verified cited sources and retained responsibility for conceptual decisions, source selection, interpretation and the final manuscript. No generative AI tool is listed as an author.

Results

Flow state in NP clinical training is defined as a transient, task-bound optimal learning state in which an NP learner perceives a fit between evolving clinical challenge and developing capability, becomes absorbed in patient-centred clinical reasoning, uses clear goals and feedback to regulate action in real time and experiences intrinsic motivation to continue deliberate practice. This definition locates flow at the level of the learner's situated experience while recognizing that training design can make the state more or less likely.

The first defining attribute is dynamic challenge-capability fit. In NP training, challenge is not generic task difficulty; it is the learner's perceived demand of a clinical situation relative to current diagnostic reasoning, communication, prioritization and management capability. Flow is most likely when a case stretches the learner at the edge of capability without producing cognitive overload or boredom. This attribute is dynamic because NP competence changes rapidly across placements, specialties and role-transition stages.

The second attribute is absorptive clinical reasoning. Flow in NP training is not mere immersion in a screen, mannequin or simulated patient. It is deep absorption in the patient problem: gathering cues, generating differential diagnoses, prioritizing risk, selecting management actions and explaining decisions. External self-consciousness, grade anxiety and role insecurity recede enough for the learner's attention to remain on clinical meaning.

The third attribute is goal-feedback-action coupling. Flow requires clear proximal goals and feedback that can be used while the task is unfolding. In NP training, this may involve explicit station objectives, patient cues, preceptor prompts, standardized patient responses, rubric-based feedback or AI-supported learning analytics. The attribute is not the mere presence of feedback; it is the learner's ability to use feedback to adjust clinical reasoning and action without losing task absorption.

The fourth attribute is autotelic professional agency. Autotelic experience means the activity becomes rewarding in itself. In NP training, this takes a professional form: the learner voluntarily seeks additional cases, asks for more targeted feedback and experiences clinical reasoning as part of becoming a trustworthy NP. This attribute distinguishes flow from compliance with assessment requirements or externally driven performance.

Antecedents are conditions that must be present before flow can occur. NP learners need sufficient foundational knowledge and early clinical schemas so that a task can be challenging rather than incomprehensible. The learning task must provide graduated authentic challenge. Cases should be clinically meaningful and adjusted to the learner's developmental level, especially during role transition when confidence and competence may not progress at the same pace. Psychological safety is required because flow is unlikely when learners interpret the environment primarily as punitive or humiliating. Prebriefing, ground rules, transparent objectives and safe-failure simulation reduce unproductive anxiety and help learners invest attention in the clinical problem [16]. Clear goals, timely feedback and protected attention are also necessary. Interruptions, excessive documentation burden, poorly designed digital interfaces or unnecessary cognitive load can fragment the attentional continuity needed for absorptive clinical reasoning [17, 18].

Expected consequences of flow include efficient cognitive engagement, self-directed deliberate practice, confidence calibration and professional identity formation. In a flow state, attention is allocated to the clinical task rather than to distracting self-monitoring, boredom or excessive anxiety. This may support richer cue recognition and more flexible diagnostic reasoning, although causal effects on NP performance still require empirical testing. Because flow is intrinsically rewarding, learners may seek additional cases or request repeated practice at a similar or slightly higher level of difficulty. Flow should not be equated with overconfidence; timely feedback may help learners experience progress while remaining aware of clinical limits. Repeated experiences of absorbed, meaningful clinical reasoning may also help learners move from performing for evaluation toward thinking and acting as an NP.

Empirical referents are observable or measurable indicators of the concept. Existing instruments such as the Flow State Scale and Flow State Scale-2 can inform measurement of challenge-skill balance, concentration, clear goals, feedback, control, time transformation and autotelic experience [14, 15]. NP-specific referents should include immediate post-case ratings of perceived challenge-capability fit, task absorption, feedback usability, cognitive load and willingness to continue practice. Behavioural indicators may include voluntary practice frequency, choice of progressively more difficult cases, uptake of feedback in subsequent attempts, interruption recovery time and reflective statements showing

intrinsic professional motivation. In digital or AI-supported OSCEs, learning analytics may record case-difficulty adjustments, response latency, revision after feedback and repeated practice patterns. These indicators should be interpreted alongside performance outcomes, not as substitutes for competency evidence. The conceptual structure of flow state in NP clinical training is summarized in Table 1.

Table 1
Conceptual structure of flow state in nurse practitioner clinical training

Component	Definition in NP clinical training	Examples of indicators
Defining attributes	Dynamic challenge-capability fit; absorptive clinical reasoning; goal-feedback-action coupling; autotelic professional agency.	Post-case flow ratings; observed cue integration; feedback uptake; voluntary targeted practice.
Antecedents	Foundational knowledge, graduated authentic challenge, psychological safety, clear goals, timely feedback and protected attention.	Prebriefing quality; case-difficulty alignment; timely rubric feedback; low distraction load.
Consequences	Efficient cognitive engagement, self-directed deliberate practice, confidence calibration and professional identity formation.	Repeated practice requests; improved reasoning patterns; calibrated confidence statements; identity-oriented reflection.
Empirical referents	Flow scales adapted for NP training, event-based ratings, behavioural indicators and learning analytics.	FSS/FSS-2 items; challenge-capability visual analogue scale; response revision after feedback; adaptive case logs.

Concept cases

Model case. An NP learner with several years of acute care nursing experience enters a simulated clinic station involving an older adult with diabetes, fever, abdominal pain and atypical symptoms. The case is designed at the learner's current edge: familiar enough to be approachable but complex enough to require revised differential diagnosis. The prebrief clarifies objectives and emphasizes safe learning. During the station, patient responses and brief faculty prompts provide usable feedback. The learner becomes absorbed in the clinical problem, stops focusing on being evaluated, integrates each cue into the differential diagnosis and adjusts management. After the station, the learner asks for another similar case to practise distinguishing abdominal and urinary sources of infection. All four attributes are present.

Related case. Another learner completes a highly immersive virtual reality procedure station. The graphics are vivid and the learner enjoys the experience, but the task is far below the learner's current capability and feedback is mostly decorative. The learner is entertained and engaged but does not experience challenge-capability fit or meaningful feedback-action coupling. This is technological immersion and enjoyment, not flow in NP clinical training.

Contrary case. A novice NP learner is assigned a rare multi-organ failure case with little prebriefing, unclear goals and only a final summative score. The learner's attention is dominated by fear of failure and uncertainty about what the examiner expects. Clinical reasoning becomes fragmented, and the learner avoids further practice afterward. The case lacks challenge-capability fit, absorptive reasoning, usable feedback and autotelic professional agency. The distinctions among the model, related and contrary cases are summarized in Table 2.

Table 2
Cases differentiating flow from related and contrary states

Case type	Present attributes	Interpretation
Model case	All four attributes are present in a challenging but manageable clinical reasoning station.	Flow state in NP clinical training.
Related case	Enjoyment and immersion are present, but challenge-capability fit and usable feedback are weak.	Technological immersion or engagement, not flow.
Contrary case	Challenge overwhelms capability; goals and feedback are unclear; anxiety dominates attention.	Anxiety or cognitive overload, not flow.

Discussion

This analysis contributes a context-specific definition of flow for NP clinical training. The definition moves beyond general engagement by specifying the clinical object of absorption: patient-centred reasoning. It also moves beyond technology-centred accounts by making AI, virtual reality and adaptive OSCEs possible supports rather than defining features. This distinction matters because poorly designed technology can increase cognitive load, distract attention or create entertainment without learning. Conversely, a human preceptor in a low-technology environment can support flow if challenge, safety, goals, feedback and attention are well aligned.

The four attributes refine original flow dimensions for a professional clinical education context. Challenge-skill balance becomes dynamic challenge-capability fit because NP learners' capability includes clinical knowledge, role confidence and decision responsibility. Concentration becomes absorptive clinical reasoning because the relevant focus is not generic attention but sustained interpretation of patient cues. Clear goals and feedback become goal-feedback-action coupling because clinical learning requires feedback to be immediately usable. Autotelic experience becomes autotelic professional agency because intrinsic motivation is connected to becoming a capable NP.

The analysis also cautions against assuming that flow automatically improves clinical performance. Nursing simulation evidence suggests that flow may increase without equivalent gains in every skill outcome [11]. Flow should therefore be treated as a promising learning-process indicator, not as proof of competence. NP programs should test whether flow predicts later diagnostic reasoning, safe management decisions, persistence in deliberate practice or professional identity development.

For practice, NP educators can use this analysis to design clinical learning environments that make flow more likely. Cases should be sequenced around the learner's current capability rather than by content coverage alone. Prebriefing should establish psychological safety, clear expectations and a shared mental model. Feedback should be specific, timely and usable during or immediately after clinical reasoning. Educators should protect attention by reducing unnecessary interruptions and avoiding digital tools that add cognitive load without educational value. AI-supported systems may be useful when they adapt case difficulty, provide traceable feedback and maintain human oversight; however, AI implementation should be governed by transparency, validity evidence, bias monitoring and faculty review, especially when linked to assessment decisions [19, 20].

Limitations

This concept analysis is limited by the scarcity of direct empirical studies on flow among NP learners. The attributes were synthesized from foundational flow theory, nursing work studies, simulation literature and NP education literature; therefore, contextual validation is needed. The purposive review was designed for conceptual clarification rather than effect-size estimation or exhaustive evidence synthesis. Existing flow instruments were developed outside NP clinical training and require psychometric testing before use as high-stakes measures. Cultural and institutional differences in NP roles may also influence how flow is experienced and supported.

Conclusions

Flow state in NP clinical training is a situated optimal learning state characterized by dynamic challenge-capability fit, absorptive clinical reasoning, goal-feedback-action coupling and autotelic professional agency. It is supported by foundational knowledge, authentic graduated challenge, psychological safety, clear goals, timely feedback and protected attention. Its likely consequences include efficient cognitive engagement, self-directed deliberate practice, confidence calibration and professional identity formation. Clarifying this concept gives NP educators a theory-informed language for designing training that attends not only to what learners complete, but also to the quality of attention, feedback use and professional motivation through which clinical competence develops.

Abbreviations

AI
artificial intelligence
FSS
Flow State Scale
NP
nurse practitioner
OSCE
objective structured clinical examination.

Declarations

Ethics approval and consent to participate:

Not applicable. This concept analysis used published literature only and did not involve human participants, human data or human tissue.

Consent for publication:

Not applicable.

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Author Contribution

MXY and YCH contributed equally as co-first authors. MXY was responsible for conceptualizing the research topic, collecting and organizing the literature, drafting the initial manuscript, developing the tables, and revising the manuscript. YCH contributed to the study design, methodological guidance for the concept analysis, refinement of the theoretical framework, critical intellectual input, and substantive manuscript revision. YTC contributed to the review of nursing education and concept analysis content, interpretation of the literature, methodological consistency checks, and manuscript revision. PJY contributed to the review of nursing education and clinical training perspectives, refinement of the conceptual attributes and practice implications, and revision of important intellectual content. HPL contributed expertise in nurse practitioner clinical practice and training, reviewed the clinical reasoning and OSCE-related content, and critically revised the manuscript. CMS served as the corresponding author and was responsible for overall conceptual integration, research supervision, guidance from nurse practitioner education and advanced clinical practice perspectives, final manuscript revision, submission decisions, and correspondence with the journal. All authors discussed the manuscript content, reviewed and approved the final version for submission, and agree to be accountable for the work.

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Availability of data and materials:

No empirical datasets were generated or analysed during the current study. Sources used for conceptual analysis are cited in the reference list, and the draft search strategy is provided as a supplementary file.

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