PEER COLLABORATIVE CLINICAL DECISION-MAKING IN VIRTUAL REALITY

NURSING SIMULATION

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DEDICATION

I dedicate this dissertation to my parents, Teong Beng Ngo and Saw Imm Tan, who have always supported my educational and career journey. Pa, thank you for always instilling hard work in me, demonstrating self-discipline, and advising me to always perform my best in anything I do. Mi, thank you for showing me to be kind to others and tactful in challenging situations. I also want to dedicate this dissertation to my brother, Thye Aun Ngo; my sister-in-law, Bee Bee Ooi; my niece, Sze Jia Ngo; and my childhood friend, Choong Choung Teow for their love and support.

I also want to dedicate this dissertation to all my former and current professors, mentors, and colleagues who believe in me and challenge me in a positive way to obtain my terminal degree. I want to thank all my former and current students who inspire me to venture into nursing education research, stimulating my curiosity to study how they think and collaborate in simulation.

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In nursing education, it is common for students to collaborate and make decisions as a group in simulations. One of the vital nursing competencies is students’ ability to make sound clinical judgments and decision-making in simulation. Teamwork among students in simulation significantly affects their critical thinking and clinical reasoning. However, how students collaborate and make decisions in simulation is a complex phenomenon and not well studied and understood. In addition, most existing decision-making frameworks, such as Tanner’s Clinical Judgment Model and the National Council of State Boards of Nursing’s Clinical Judgment Measurement Model, focus solely on individual decision-making. Alternatively, teamwork and collaboration frameworks, such as TeamSTEPPS®, emphasize interprofessional collaboration rather than intraprofessional or peer-to-peer collaboration. Furthermore, peer collaboration and decision-making cannot be accurately measured without a theoretical framework. Because clinical decision-making in nursing practice is a complex process that involves peer collaboration, more research is needed to explore how nursing students collaborate and make decisions in simulation.

This qualitative study comprises of a hybrid concept analysis and Charmaz’s constructivist grounded theory to explore prelicensure nursing student’s peer collaborative clinical decision-making (PCCDM). The concept analysis develops a comprehensive definition of PCCDM based on theoretical and empirical data. The grounded theory develops the theoretical framework that captures the process of
PCCDM, which consists of the three major domains of group cognition, behavior, and emotion. These domains undergo the peer regulatory process of awareness, communication, and regulation within the individual and collaborative space at various simulation phases. Additionally, a thematic analysis further explores group emotion in PCCDM as the domain is the least studied in nursing simulation. This study provides the framework to support healthcare and nursing simulation involving peer collaboration and decision-making.

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<table>
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<th>Abbreviation</th>
<th>Term</th>
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<tbody>
<tr>
<td>CDM</td>
<td>Clinical decision-making</td>
</tr>
<tr>
<td>CSCL</td>
<td>Computer-supported collaborative learning</td>
</tr>
<tr>
<td>INACSL</td>
<td>International Nursing Association for Clinical Simulation and Learning</td>
</tr>
<tr>
<td>IRB</td>
<td>International Review Board</td>
</tr>
<tr>
<td>NCSBN</td>
<td>National Council of State Boards of Nursing</td>
</tr>
<tr>
<td>P1</td>
<td>Participant #1</td>
</tr>
<tr>
<td>P2</td>
<td>Participant #2</td>
</tr>
<tr>
<td>PCCDM</td>
<td>Peer collaborative clinical decision-making</td>
</tr>
<tr>
<td>PRP</td>
<td>Peer regulatory process</td>
</tr>
<tr>
<td>TeamSTEPPS</td>
<td>Team Strategies and Tools to Enhance Performance and Patient Safety</td>
</tr>
<tr>
<td>VR</td>
<td>Virtual reality</td>
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CHAPTER 1: INTRODUCTION

Clinical decision-making (CDM) is of vital importance to nursing. Recent studies reported that the new graduate nurses’ entry-level CDM competencies have significantly declined over the decade, from 35% (del Bueno D, 2005) to 23% (between 2011 to 2015, Kavanagh & Szweda, 2017), to 14% (aggregated between 2016 and 2020) and 9% in 2020 year-to-date across the nation (Kavanagh & Sharpnack, 2021). The statistics are staggering since nurses comprise the most significant healthcare workforce, with over 4.1 million registered nurses and more than 68% providing direct patient care (Smiley et al., 2021). Since clinical judgment and decision-making take years for new graduates to develop (Lasater et al., 2015), the National Council of State Boards of Nursing (NCSBN, n.d.) has made a concerted effort to develop the Next Generation NCLEX, ensuring new nurses think critically to make the best clinical decisions. More importantly, these competencies are critical to ensure nurses provide quality and safe patient care because healthcare errors are strongly associated with poor CDM (Muntean, 2012).

Teamwork and collaboration are essential prelicensure nursing competencies to prepare future nurses to function competently and effectively within nursing and interprofessional teams (QSEN Institute, n.d.). The American Association of Critical-Care Nurses (n.d.) advocates for “true collaboration” among nurses to promote a supportive teamwork environment while providing efficient and effective patient care. Moreover, collaboration among nurses is positively associated with a healthy work environment and job satisfaction (Ylitörmänen et al., 2019) and empowers professional relationships by sharing their knowledge and skills (Ylitörmänen et al., in press).
Therefore, preparing nursing students to work collaboratively with each other is paramount before they graduate from nursing programs.

**Interrelated Concepts**

The term CDM has been used interchangeably with *clinical reasoning* and *clinical judgment* in nursing. Tanner (2006) defines clinical reasoning as “the processes by which nurses and other clinicians make their judgments,” and clinical judgment is the “interpretation or conclusion about a patient’s needs, concerns, or health problems, and/or the decision to take action (or not), use or modify standard approaches, or improvise new ones as deemed appropriate by the patient’s response” (p. 204). However, CDM has been described more broadly than clinical reasoning and clinical judgment. Standing (2020) defines CDM as applying clinical judgment to choose the best evidence-based option and act upon the decisions to meet the patient’s needs. Thus, CDM encompasses the attributes of the nurse’s cognitive process (clinical reasoning) and informed opinion (clinical judgment) to achieve safe and quality patient outcomes.

Peer collaboration is collaborative learning among peers that involves a socio-cognitive process (Winters & Alexander, 2011). It extends beyond individual knowledge acquisition to participation in the social interaction of co-construction of knowledge and meaning-making (Trausan-Matu et al., 2021). In nursing education, collaborative learning among students in classroom, clinical, or simulation environments can promote knowledge and skills performance, foster a positive learning experience, and improve interpersonal skills (Zhang & Cui, 2018). For example, pairing students in the clinical setting improves self-efficacy (Pålsson et al., 2017) and collaboration and communication skills (Bartges, 2012). The term *collaborative learning* is sometimes used synonymously
with *cooperative learning* in education research. Although both types of learning contribute to the co-construction of knowledge, mutuality among peers in cooperative learning is less than in collaborative learning (Damon & Phelps, 1989). In other words, cooperative learning involves peers dividing tasks to work independently instead of a joint effort in co-creating the products from learning, as in collaborative learning (Stahl & Hakkarainen, 2021).

**Peer Collaborative Clinical Decision-Making**

Peer collaborative clinical decision-making (PCCDM) is a group-level process that involves cognitive and social interaction among peers about a clinical situation. The concept is closely related to collective and collaborative decision-making (Trausan-Matu et al., 2021). However, PCCDM differs from interprofessional collaboration, where clinical decisions are made among different healthcare providers (Parse, 2015), or shared decision-making, where patients are exclusively involved in the process (Aoki, 2020; Park & Cho, 2018).

PCCDM is not directly discussed in nursing literature, especially in nursing education and simulation. Most simulation research focuses on either individual students’ CDM or interprofessional collaboration instead of peer-to-peer collaboration. Also, nursing clinical judgment and decision-making frameworks, including Tanner’s Clinical Judgment Model and the NCSBN’s Clinical Judgment Measurement Model, focus exclusively on individual nurses and do not emphasize intraprofessional collaboration. Because CDM in nursing practice is a complex process that involves peer collaboration (Nibbelink & Brewer, 2018), more research is needed to explore how nursing students
collaborate as peers to make clinical decisions in various learning environments, including simulation.

**Existing Theories, Frameworks, and Models**

**Clinical Decision-Making Theories and Frameworks**

Two essential theories support the process of CDM: (1) information-processing theory and (2) dual-processing theory. The information-processing theory posits that humans process their perceived information by holding, receiving, and organizing it into chunks (Miller, 1956). Based on this theory, Hamers et al. (1994) proposed nursing decision-making in four stages: (1) gathering the patient’s clinical data, (2) generating possible hypotheses based on the data, (3) interpreting and analyzing the data, and (4) evaluating the hypotheses before taking the appropriate actions. The dual-processing theory hypothesizes two different systems of thinking: (1) System 1 of a quick, heuristic, pattern-recognition, and intuitive approach; and (2) System 2 of a slow, deliberate, systematic, and analytical approach (Croskerry, 2009; Kahneman, 2013; Sloman, 2014).

Hammond’s (1980) Cognitive Continuum Theory focuses on the modes of cognition that lie in between *intuition* (System 1) and *analysis* (System 2), which are connected on a continuum between intuition and analysis. Hammond theorizes that human cognition oscillates between intuition and analysis, also known as “quasi-rationality” (p. 7).

The information-processing and dual-processing theories support Tanner’s Clinical Judgment Model and the NCSBN Clinical Judgment Measurement Model. For example, Tanner’s model discusses four aspects of making decisions, from grasping the clinical situations to reflecting during and on their actions. NCSBN’s model explains the cognitive operations, from recognizing and analyzing cues to forming and prioritizing
hypotheses. Also, Tanner’s model posits that nurses use a variety of reasoning patterns, including analytical and intuition. However, Tanner’s and NCSBN’s models focus only on cognitive processes and do not include social and emotional components. Also, these models emphasize individual rather than group cognitive processes. Thus, exploring PCCDM that includes group cognition and socio-emotion provides a more holistic perspective on how peers collaborate to formulate clinical decisions.

Collaborative Learning Theories and Frameworks

Peer collaborative learning can be broadly approached from the developmental, cognitive, and sociocultural perspectives in education research (O’Donnell & Hmelo-Silver, 2013). Because this dissertation focuses on nursing students’ peer collaboration using virtual reality simulation, theories on computer-supported collaborative learning (CSCL) will be discussed. CSCL theories can be broadly divided into (1) subjective theories, (2) inter-subjective theories, and (3) inter-objective theories (Stahl & Hakkarainen, 2021). Subjective theories focus on individual learning within the social context; inter-subjective theories emphasize interactional and collaborative learning; and inter-objective theories focus on a network of learners, artifacts, tools, and practices (Stahl & Hakkarainen, 2021). Thus, inter-subjective theories, such as group cognition, support the concept of PCCDM.

Stahl’s (2006) group cognition theory, aligned with sociocultural and cognitive perspectives, posits that thinking and learning are rooted in social interaction and focuses on the small-group unit of analysis that mediates individual and community learning. His model of collaborative knowledge-building connects personal understanding and small group interaction (e.g., dyads or triads) through various forms of communication (e.g.,
articulation, discussion, argumentation, negotiation) to co-construct knowledge and shared meaning-making, which potentially transcend to community learning (Stahl, 2006, 2021). The group cognition theory and collaborative knowledge-building model are the results of extensive educational research investigating small-group collaboration among pre-college students to solve math problems online; thus, they have not been well studied in nursing education or simulation. Moreover, similar to Tanner’s and NCSBN’s model, Stahl’s model does not exclusively explore group emotional aspects, which are essential in collaborative learning.

**Peer Collaborative Clinical Decision-Making in Simulation**

More research is needed to explore PCCDM among nursing students using various teaching modalities and technologies, including simulation. Healthcare simulation has evolved from manikin-based to computer-based and extended reality simulations over the past decade. The simulation outcomes in nursing practice have been shown to reduce medication administration errors (Hebbar et al., 2018; Sarfati et al., 2019), improve communication and patient teaching skills (MacLean et al., 2018; Shao et al., 2018), and promote teamwork and collaboration among healthcare professionals (Andersen et al., 2018). Nursing faculty use simulations to supplement teaching and learning; evaluate students’ cognitive, psychomotor, and affective skills; substitute for clinical experiences; and introduce interprofessional education (Forneris, 2020).

Virtual reality (VR) simulation uses “a variety of immersive, highly visual, 3D characteristics to replicate real-life situations and/or health care procedures” (Lioce et al., 2020, p. 54). VR simulation differs from standardized patient or manikin-based simulation as it does not require a dedicated space since it is conducted in a virtual
environment. Thus, VR requires special head-mounted displays and handheld devices to allow participants to operate in the virtual world (Kardong-Edgren, 2020). Since VR simulation is still in its infancy in healthcare simulation, literature on nursing student peer collaboration and CDM using VR is still minimal.

**Research Gaps**

A significant gap in peer collaboration and CDM is the lack of theoretical frameworks that explain and support PCCDM in nursing simulation because the concept is multifaceted and not well studied. Therefore, developing a framework that describes the process of prelicensure nursing students’ PCCDM in simulation is vital. Also, the definition of PCCDM is not well defined, which stems from conceptual confusion about CDM with other interrelated concepts. Thus, delineating these concepts in the context of peer collaboration provides a conceptual definition that will be useful in education and simulation research. Although the importance of nursing students’ CDM has been emphasized, especially in the upcoming Next Generation NCLEX in 2023, more robust research is needed to understand how students make clinical decisions through peer collaboration using simulation. Finally, exploring students’ PCCDM in this study will also inform faculty on how to facilitate peer collaboration and decision-making using simulation and prepare students entering the nursing workforce.
CHAPTER 2: LITERATURE REVIEW AND CONCEPT ANALYSIS

A literature review and concept analysis are essential to establish a conceptual definition of PCCDM. Because PCCDM is not well studied in nursing simulation, a thorough exploration of the literature and concept analysis will delineate and define PCCDM in simulation. Furthermore, it helps to clarify the conceptual ambiguity of PCCDM with other interrelated concepts. This chapter explains using a hybrid concept analysis method, combining theoretical and fieldwork, to analyze the concept of PCCDM.

**Purpose and Aims**

The specific aims of the hybrid concept analysis were to (1) describe the current literature’s conceptualizations of PCCDM in simulation, (2) identify potential gaps in conceptualizations between the literature and the participants’ descriptions using VR simulation, and (3) establish a conceptual definition of prelicensure nursing students’ PCCDM in simulation.

**Methods and Design**

Schwartz-Barcott and Kim’s (2000) hybrid concept analysis was conducted by integrating theoretical analysis with empirical observation to synthesize the concept’s definition. This method included nursing students’ perspectives of PCCDM in simulation to generate a more comprehensive and student-focused definition.

The three phases of this hybrid concept analysis were: (1) theoretical, (2) fieldwork, and (3) analytical (Figure 2-1). In the theoretical phase, the investigator searched, retrieved, and analyzed articles related to PCCDM using simulation from the database. In the fieldwork phase, the investigator observed nursing students’ participation
in simulation and conducted semi-structured interviews to define the concept further. The investigator simultaneously entered theoretical and fieldwork phases to offer a constant comparison approach between both data (Schwartz-Barcott & Kim, 2000). Finally, the investigator combined and compared both findings to generate a more refined and comprehensive definition.

**Simulation Design and Software**

The investigator designed and facilitated the simulation by adhering to the International Nursing Association for Clinical Simulation and Learning (INACSL) Standards of Best Practice (INACSL Standards Committee, McDermott, Donna S., et al., 2021; INACSL Standards Committee, Persico, et al., 2021; INACSL Standards Committee, Watts, Penni I., et al., 2021). Each simulation session began with a pre-briefing to prepare the participants for the VR experience. The simulation design ensured that the participant experience was aligned with the learning objectives and facilitated by the investigator, who has the experience and is certified in healthcare simulation.

Since many nursing programs have not adopted VR simulation, the investigator conducted one-hour pre-study training sessions to familiarize the participants with the virtual patient and environment and determine their comfort level and potential cybersickness. Since VR simulation did not require a dedicated space, it allowed the investigator to recruit participants from different nursing programs and allowed easy replication of case scenarios. Dyads took the roles of nurses and cared for an acute and deteriorating virtual patient, allowing them to collaborate and make decisions together. The VR scenarios encompassed medical-surgical nursing case studies appropriate for the participants’ knowledge level. Two subject-matter experts were consulted to review five
clinical scenarios and deemed them suitable for this study’s purpose. Different scenarios were used for each dyad to minimize information sharing among other dyads outside of the sessions.

**Participants and Setting**

The participants were prelicensure nursing students from associate degree nursing programs in one of the western states in the United States. The inclusion criteria were (1) final-year nursing students enrolled in a medical-surgical nursing course and (2) students who agreed to participate in the pre-study training session. The criteria ensured that students have some foundational knowledge of caring for acute and deteriorating medical-surgical patients and sufficient VR training. The exclusion criteria were (1) students who experienced cybersickness when using VR and (2) students enrolled in the investigator’s lecture or clinical course during this study. After obtaining institutional review board approval, 22 participants (11 dyads) from three different nursing schools were recruited, which exceeded the typical sample size of three to six participants for hybrid concept analysis (Schwartz-Barcott & Kim, 2000).

**Data Collection**

*Theoretical Phase*

Articles from Cumulative Index to Nursing and Allied Health Literature (CINAHL), Education Source, Education Resource Information Center (ERIC), and PsycInfo between 2011 to 2022 were retrieved. Thesauri on each database was used to capture all the synonyms of PCCDM and simulation. Additional terms such as “collaborative learning,” “peer group,” “clinical judgment,” “clinical reasoning,” and “critical thinking” were added to expand the literature search. The inclusion criteria were
(1) peer-reviewed articles published in academic journals, (2) articles on simulation in nursing education, and (3) English language. The exclusion criteria were articles on (1) interprofessional education and collaboration, (2) registered nurses and post-licensure nursing students, and (3) collaboration between nursing programs and community partners. A Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) checklist was used to report the search results (Figure 2-2). A total of 19 articles were included in the literature review, and the contents were analyzed and extracted for their significant concepts (Appendix A).

**Fieldwork Phase**

The investigator interviewed 11 dyads after each simulation session. The participants’ verbal and non-verbal communications and their interview narratives were recorded. The think-aloud method was used in which participants spoke aloud any words in their minds during the simulation, exploring their thought processes through language during an action (Charters, 2003). The investigator also recorded the participants’ non-verbal communication, including body movement, posture, and speech characteristics (e.g., intonation, loudness, tempo) corresponding to their clinical actions.

After the simulation, the participants were interviewed individually and in pairs by extracting their narratives and thought processes. The questions focused on at least three significant collaborative decisions for each interview session (Table 2-1): “What was the first important decision you made together?” “What were your thoughts about the decision?” “How did you and (the other student) interact in making the decision?” “Tell me how you came to a mutual decision.” Each interview session lasted between 30 to 40 minutes. All data were transcribed and checked verbatim for accuracy and completeness.
**Trustworthiness**

This study followed the four criteria of trustworthiness proposed by Lincoln and Guba (1985): credibility, dependability, confirmability, and transferability (Table 2-2).

**Results**

**Theoretical Phase**

**Theoretical Framework or Conceptual Model**

Nine out of 19 articles specified a theoretical framework or conceptual model related to PCCDM, including QSEN teamwork and collaboration (Badowski, 2019; Josephsen & Butt, 2014); TeamSTEPPS® (Badowski, 2019); Benner’s novice to expert and Tanner’s clinical judgment model (Hayes et al., 2019); Paige and Daley’s situated cognition learning framework (Himes & Ravert, 2012); cooperative learning theory (McWilliams et al., 2021); Bandura’s social cognitive theory (Owen & Ward-Smith, 2014); constructivist learning theory and Kolb’s experiential learning (Hayes et al., 2019; Rogers, 2011); and Schon’s knowing-in-action, reflection-on-action, and reflection-in-action (Söderström et al., 2014).

**Terminologies Related to PCCDM**

The terminologies related to PCCDM used in the articles that focused on peers were “peer coaching” (Badowski, 2019), “situated peer coaching” (Himes & Ravert, 2012), “peer-to-peer learning” (Fieler et al., 2021), and “near-peer teaching and learning” (Owen & Ward-Smith, 2014). Although not all were clearly defined, these terminologies focused on multiple-level peers working together in simulation without hierarchical status or power. “Collaborative classroom” (Berndt et al., 2015), “teamwork and collaboration” (Crews et al., 2021; Hustad et al., 2019), “liaise and collaborate” (Hayes et al., 2019),
“cross-cultural collaboration” (Kessler & Kost, 2021), and “collaborative training” (Söderström et al., 2012, 2014) were terminologies that emphasized *collaboration*. Other closely related terminologies to collaboration were “cooperative work” (S. J. Lee et al., 2015) and “cooperative learning” (McWilliams et al., 2021). “Collaborative cognition” (Carey et al., 2018) and “collaborative decisions” (Bucknall et al., 2016) encompassed collaboration and CDM in simulation, making them closest to the definition of PCCDM.

**Defining Attributes of PCCDM**

Table 2-3 depicts the significant themes clustered from defining attributes found in the literature. *Group communication* was one-way or two-way verbal or non-verbal interactions among peers during collaboration. These interactions also consisted of speaking up or keeping quiet and listening or providing feedback. *Group awareness* was recognizing peers’ social attributes during collaboration. *Group regulation* was intentional peer interaction to support and promote group cohesiveness by establishing and defining roles, dividing and delegating tasks, developing a trusting relationship, having shared goals, and supporting and engaging in teamwork. *Group reasoning* was thinking as a group to formulate clinical solutions through active participation and observation, including exchanging and expanding information, discussing and negotiating ideas, validating and consensualizing ideas, and co-constructing and processing information. Last, *group emotion* was validating and responding to peers’ positive or negative feelings during collaboration.

**Antecedents**

The antecedents were categorized into (1) individual characteristics, (2) group characteristics, (3) environment, and (4) simulation design. Individual characteristics
included prior foundation knowledge and skills, personal traits, and cultural background; group characteristics were the number and types of learners in the group and familiarity with each other. A safe and supportive environment also influenced PCCDM. Finally, the simulation design consisted of training and tools for learning and simulation duration.

**Consequences**

Individual consequences were sound clinical judgment, improved knowledge and skills, increased confidence in simulation, and overall simulation learning experience. Group consequences included the development of teamwork and collaboration skills, encompassing communication and problem-solving, and positive and healthy working relationships. Quality and safe patient care were the consequences that expanded beyond individual and group levels.

**Working Definition of PCCDM**

Although the literature review sheds some insights into the definition of PCCDM conceptually, its meaning is inherently complex due to multiple overlapping dimensions. Based on the literature review, the working definition of PCCDM is a group-level process that involves cognitive and socio-emotional interactions among peers about a clinical situation. The group regulates these interactions (reasoning and emotion), which are influenced by individual and group characteristics, environment, and simulation design.

**Fieldwork Phase**

The participants were prelicensure nursing students ($N = 22$) from three community colleges in their final year of the associate degree nursing programs. They self-reported their gender as female ($n = 16$) or male ($n = 6$) and race as Asian ($n = 10$), Latinx or Hispanic ($n = 5$), or White ($n = 7$). Both participants in each dyad knew each
other and enrolled in the same program. Except for VR simulation, all participants had prior experience with nursing simulations (e.g., manikin or computer-based).

**Expanding the Defining Attributes of PCCDM**

The PCCDM attributes supported and expanded the ones found in the literature (Appendix B). Five themes emerged from the fieldwork analysis phase: group (1) communication, (2) awareness, (3) regulation, (4) reasoning, and (5) emotion.

**Group Communication.** One salient subtheme missing in the literature review was explicit or implicit communication. Explicit communication was speaking their ideas out loud, while implicit communication assumed their peers knew or understood their thought processes without verbalizing them. Explicit communication was needed in situations when peers wanted to get their message across to avoid ambiguity, confirming that both peers agreed and “[made] sure everything was taken care of [for] a better patient outcome” (P1_G7). Implicit communication occurred when dyads felt comfortable knowing what each other was doing. For example, one participant stated, “I didn’t necessarily verbally validate what P1 was doing in the beginning, but I just thought that by not saying anything that, I was validating by not stopping or interrupting [them]” (P2_G11).

**Group Awareness.** Group awareness could be related to group cognition or socio-emotions. However, the literature mainly focused on group awareness of socio-emotional aspects and did not explicitly reveal group awareness of cognition. Awareness of group cognition included acknowledging and validating their peers’ thought processes and actions. One participant commented, “I knew P1 wasn’t wrong...I want to say I agreed with her like 80%” (P2_G11). Another participant stated, “I was aware of [their]
decision…wanting to call the code” (P1_G10). Awareness of group socio-emotions involves recognizing their peers’ feelings and emotions through communication and interactions.

**Group Regulation.** The subtheme, *taking turns to lead and follow*—alternating between peers to initiate an action while having another peer supporting the action—was less explicit in the literature. The “back-and-forth” interactions (P2_G2, P2_G10, P1_G11) allowed mutual support on tasks required to accomplish. One participant explained, “There’s a lead, and there’s a follower…You might be leading in [the] physical assessment of the patient. I’m going to be leading in reviewing the chart [and] making consolidating information so we can have a simplified plan to execute” (P2_G2). Some participants related such interactions as “flipping a light switch” (P2_G10) or dancing with a partner, “It’s like a dance, and you’re looking for the most efficient [and] fastest way to reach the common goal” (P2_G2).

**Group Reasoning.** The subtheme of *aligning with peers’ thought processes* was an extension of group reasoning not found in the literature. This theme included “having the same train of thoughts or wavelength” (P1_G4) and “sharing a similar thought process” (P1_G3). One participant stated, “We both think in the same way…we know what steps we need to do, but maybe in different ways [and] which order we should do” (P1_G4). Another participant commented, “You also felt the same way I did, right [asking their peer]? We were on the same track. Our thought process was the same” (P1_G9).

**Group Emotion.** The fieldwork further expanded group emotions to cognitive or social-related, in addition to positive or negative feelings. Positive and cognitive-related
emotions included using their feelings to propel them forward in their thinking. One participant mentioned, “Together, it seemed like it worked well because even though we were panicking, [the emotion] made us move faster and act faster” (P2_G3). Most participants experienced positive and social-related feelings, such as feeling supported and comforted working with their peers. However, some dyads experienced negative cognitive and social-related feelings during their collaboration, such as “being panic and anxious” (P1_G3) and feeling “scared” (P2_G7), “lost” (P1_G7), and “frustrated” (P1_G6) which subsequently “impacted [their] decision-making” (P1_G3).

**Analytical Phase**

Comparing the conceptualizations of PCCDM as seen in the literature and participants’ narratives, similarities and differences were noted. The investigator noticed an expansion and addition of data from the fieldwork into the literature, specifically how peers communicated and regulated in a collaborative space.

**PCCDM in Collaborative Space**

One interesting finding in the fieldwork phase was the *collaborative space* in PCCDM, where peers communicated, developed awareness, and regulated their reasoning and emotions together (Figure 2-3). Collaborative space can have a literal meaning (e.g., virtual space in simulation), but the *dimension* of how peers collaborate matters most. Outside the collaborative space lies *individual space*, where peers think and feel on their own, and rarely involves any interaction and communication with peers. Peers alternated between individual and collaborative spaces when working together. However, for PCCDM to truly happen, the collaborative space is where all peers should be.
Dynamic and Situational PCCDM Spaces and Simulation Phases

Although PCCDM ideally stays within the collaborative space, PCCDM can fluctuate based on clinical situations. Thus, interactions among peers shifted away from the collaborative space at times. Both collaborative and individual spaces were influenced by the acuity and stakes of the simulation scenario that predicted peer communication, awareness, and regulation (Figure 2-4). Situations with low acuity and stakes (e.g., assessing a stable patient) involved less verbal communication that was highly implicit (e.g., assuming peer knows what they are doing) and low interactivity among peers while working on individual tasks. This phase is known as the cooperative or independent phase, where tasks are divided and completed individually, and little interaction happens in the collaborative space.

When there was cueing in the scenario (e.g., the patient started to deteriorate), peers started having more two-way conversations by providing and listening to feedback. During this collaborative phase, interactivity and mutuality were high, with one peer initiating while the other supported the action. Also, peers might take turns leading and following each other’s decisions and actions.

When the situation became more acute and high stakes (e.g., the patient was decompensating fast), one of the peers might take charge to lead the situation and dominate the collaborative space. This directive phase involved more explicit communication, such as telling and instructing their peers what to do instead of having a discussion. Because the goal was to prevent further patient deterioration, the interactivity and mutuality between peers were less than in the collaborative phase.
Non-Hierarchical Collaboration

PCCDM is a non-hierarchical group process where equality among peers in their roles, decisions, and actions was highlighted in the fieldwork. The statements from participants revealed that, while at times they must lead an action in a clinical situation, they emphasized that their collaborations were “all equal” because “no one’s better” or “in charge of the other person” (P1_G4), and “no one [was] higher than the other in rank” as “[they were] very much on the same playing field” (P1_G11). However, when the situation got out of hand, one of the peers could take charge and dominate the collaborative space. One participant told their peer, “You could have thought of me as not an equal and delegate,” as they struggled to move forward in the simulation scenario (P1_G3). In this case, although peers shared the same role as nurses, their decisions and actions could overpower their peers in acute and high-stakes situations.

A More Comprehensive Definition of PCCDM

Based on this hybrid concept analysis, the investigator concluded a more comprehensive definition of PCCDM based on theoretical and empirical data: PCCDM is a dynamic, non-hierarchical, group-level process of cognitive and socio-emotional interactions among peers about a clinical situation involving group communication, awareness, and regulation of reasoning and emotion within the collaborative space. Peer interactions (communication and regulation) can extend beyond PCCDM from a cooperative phase on one spectrum to a directive phase on the other, based on the clinical acuity and stakes. Low clinical acuity and stakes promote cooperative work where peers rarely interact within the collaborative space, while high acuity and stakes encourage directive interaction where one of the peers takes charge of the collaborative space.
Discussion

The peer collaborative process consists of visible or invisible actions and interactions among peers at various individual or group levels, involving human-human or human-artifact participation using multiple learning modalities (Cress et al., 2021). The defining attributes of PCCDM can be more or less apparent based on individual, group, and situational factors. When peers share their thoughts aloud through closed-loop communication, they avoid miscommunication based on their assumptions. However, communication is not always explicit in collaboration during simulation. It is especially true in the VR environment because participants do not see their peers’ non-verbal cues, which are critical in collaboration. Furthermore, group awareness and emotion are the least mentioned in literature and empirical data as they are not as observable as other attributes. Thus, future studies should explore the process of group awareness and emotion in PCCDM.

Peer collaborative learning can be approached from the developmental, cognitive, and sociocultural perspectives in education research (O’Donnell & Hmelo-Silver, 2013). This analysis explores cognitive and socio-emotional interactions among peers about a clinical situation, mainly how peers regulate their thoughts and feelings as a group through communication and interaction. Although individual reasoning and emotion play significant roles in peer collaboration and decision-making, PCCDM focuses on peer interaction to achieve the desired patient outcome in simulation. As discussed earlier, although individual clinical judgment and decision-making are emphasized in nursing education, understanding the attributes of PCCDM provides insight into how peers collaborate to promote and develop those cognitive skills, which are critical in nursing
education and practice. Therefore, more studies are needed to develop a theoretical framework for PCCDM before the concept can be measured.

**Limitations**

One of the limitations of this analysis is that the investigator only explored PCCDM among dyads in the fieldwork, as recommended by the software company, excluding the opportunity to explore PCCDM in a larger group. Furthermore, the software does not display participants’ facial expressions in the virtual environment, which is a significant component of group communication and team training (Härgestam et al., 2016). Although the investigator provided one-hour VR training before collecting data, none of the participants had experience in VR nursing simulation. Thus, the novelty VR simulation experience could potentially affect how peers collaborate.

**Potential Gaps from the Concept Analysis**

Although PCCDM is defined conceptually, understanding *how* peers regulate their reasoning and emotion within the collaborative spaces and simulation phases discussed earlier remains elusive and needs further exploration. Therefore, a more comprehensive understanding of PCCDM in different spaces and phases is needed. Also, the literature review and fieldwork provide only a glimpse into the current state of the science of PCCDM, especially group emotion, as it is least mentioned. Thus, exploring nursing students’ emotions as a group during collaboration and decision-making in simulation is warranted.

**Conclusion**

As clinical judgment and decision-making remain the significant focus in nursing practice and education, and nursing students learn from each other by working as a team
to provide safe and quality patient care, there is a clear need to explore how peer collaborative learning influences their cognitive and socioemotional processes in simulation. The literature review provides a broad definition of PCCDM, which encompasses group communication, awareness, and regulation of reasoning and emotion, with limited exploration and explanation of the concept. Empirical data from the fieldwork refine and expand the definition while adding some subtle distinctions to PCCDM found in the literature. By redefining PCCDM using nursing students’ narratives and perspectives, nurse educators can better understand these attributes and provide a more holistic teaching and learning experience in simulation. The findings demonstrate the need to further explore and measure PCCDM in nursing simulation.
Figure 2-1

Hybrid Concept Analysis Method

Theoretical Phase

19 articles from the database were included in the literature review

Fieldwork Phase

11 dyads participated in the VR simulation and were interviewed

Analytical Phase

19 articles were analyzed

33 interview transcripts were analyzed

Definition of PCCDM
Figure 2-2

PRISMA Diagram

Records identified through database searching (CINAHL, ERIC, Education Source, and PsycINFO) 
(n = 119)

Additional records identified through other sources 
(n = 5)

Records after duplicates removed 
(n = 109)

Records screened 
(n = 109)

Records excluded 
(n = 55)

Full-text articles assessed for eligibility 
(n = 54)

Studies included in literature review 
(n = 19)

Full-text articles excluded (n = 35):
- Studies not specific to peer collaboration (n = 21)
- Studies focused on simulation framework, debriefing, and assessment (n = 5)
- Studies involved registered nurses, advanced practice nursing students, high school students (n = 4)
- Studies involved interprofessional collaboration (n = 2)
- Dissertations (n = 2)
Figure 2-3

*Collaborative and Individual Space*

![Diagram showing collaborative and individual spaces with reasoning and emotions](image)
**Figure 2-4**

*Cooperative, Collaborative, and Directive Phases*

<table>
<thead>
<tr>
<th></th>
<th>Cooperative</th>
<th>Collaborative</th>
<th>Directive</th>
</tr>
</thead>
</table>
| **Communication**  | Less verbal communication  
Implicit > Explicit | Two-way (e.g., discussion, dialogue)  
Explicit = Implicit  
Listening and providing feedback | One-way (e.g., telling without asking)  
Explicit > Implicit |
| **Regulation**     | Low interactivity  
Individual tasks | High interactivity, high mutuality  
One person initiates; the other supports  
Taking turns to lead and follow | Moderate interactivity, low mutuality  
One person leads and the other follows |
| **Clinical Situations** | Low-acuity and low-stakes situation  
(e.g., assessing a stable patient) | Moderate-acuity and moderate-stakes situation  
(e.g., the patient starts to deteriorate) | High-acuity and high-stakes situation  
(e.g., the patient is decompensating fast) |
### Table 2-1

**Examples of Participant Responses to Interview Questions**

<table>
<thead>
<tr>
<th>Interview Questions</th>
<th>Interview #1 (individual)</th>
<th>Interview #2 (individual)</th>
<th>Interview #3 (dyad)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can you please walk me through how you made the first decision together?</td>
<td>“[The patient] said he couldn’t breathe. So, I figured, “Let’s get vital signs right away.” And I told P2, “Let’s get some vital signs and get the leads on.”” (P1, G9)</td>
<td>“We just communicated with each other…and make sure that we read the [electronic health record] tablet. And we went over it together so that there were two people looking at the tablet, not just one person.” (P2, G9)</td>
<td>“We need to get a baseline of the patient…[and] see what we need to do next. I think that is why we decided to do the assessment first.” (P1, G9)</td>
</tr>
<tr>
<td>Tell me the second decision that both of you made together.</td>
<td>“We decided to look at what medications the patient was on in the orders. Then see what we had to give. When I saw the elevated potassium…I felt comfortable with giving the furosemide.” (P1, G9)</td>
<td>“We were actually looking at the [monitor] screen, just to make sure what the vitals were looking like for the patient and then calling for the provider as well just to give the provider an update on the patient situation.” (P2, G9)</td>
<td>“[P2] just take my word for it that it was OK for us to give the medication, but she didn’t actually get to see the order, and she didn’t get to see for herself, like the lab results. I felt like maybe I should have given the medication since I was the only one with the [tablet].” (P1, G9)</td>
</tr>
<tr>
<td>What is another decision that both of you made together?</td>
<td>“We gave him medication and then we called the doctor. And I made that decision because I saw the orders. And we were also told in [the] report to call [the doctor]. So, I think we needed help. And</td>
<td>“We looked at the tablet and that’s when we updated the provider on the situation of the patient after medication administration or his blood pressure dropped. And then also the labs were also changed. So, we needed to</td>
<td>“I realized that [P2] couldn’t really call. She didn’t have the tablet. So, she couldn’t really read the lab results…. So, that’s when I got the phone, and I did it…I could just read them off to the doctor and</td>
</tr>
<tr>
<td>so, we called the doctor.” (P1, G9)</td>
<td>give the provider an update on what we did together.” (P2, G9)</td>
<td>talk to the doctor.” (P1, G9)</td>
<td></td>
</tr>
<tr>
<td>Criterion</td>
<td>Evidence</td>
<td></td>
<td></td>
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<td>--------------</td>
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<td></td>
<td></td>
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<tr>
<td>Credibility</td>
<td>Triangulation of data collection and analysis, including journals, interviews, videos, and field notes</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Prolonged engagement of data, including constant data comparison between literature and fieldwork</td>
<td></td>
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<tr>
<td></td>
<td>Debriefing with mentors through meetings and correspondences</td>
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<tr>
<td></td>
<td>Member checking with participants with the last dyad during the interview</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transferability</td>
<td>Description of the study’s implications in nursing education, including how the finding can be applied in nursing simulation and future studies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dependability</td>
<td>Documentation of the entire process using audit trail, including raw data, field notes, transcripts, results and findings, and reflexive notes</td>
<td></td>
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<tr>
<td></td>
<td>Adherence to Schwartz-Barcott and Kim’s (2000) hybrid concept analysis method</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confirmability</td>
<td>Audit trail of the concept via transcribed interviews, journals, and memos</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2-3

Major Themes and Defining Attributes of PCCDM from Literature Review

<table>
<thead>
<tr>
<th>Major Themes</th>
<th>Defining Attributes</th>
<th>Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group communication</td>
<td>One-way or two-way</td>
<td>Berndt et al. (2015); Lee et al. (2015); Pront &amp; McNeill (2019); Rogers (2011)</td>
</tr>
<tr>
<td></td>
<td>Verbal or non-verbal</td>
<td>Lee et al. (2015); Rogers (2011)</td>
</tr>
<tr>
<td></td>
<td>Speaking up or keeping quiet</td>
<td>Badowski (2019); Bucknall et al. (2016); Carey et al. (2018); Crews et al. (2021); Najjar et al. (2015)</td>
</tr>
<tr>
<td></td>
<td>Listening or providing feedback</td>
<td>Bucknall et al. (2016); Himes &amp; Ravert (2012); Najjar et al. (2015); Pront &amp; McNeill (2019); Söderström et al. (2014)</td>
</tr>
<tr>
<td>Group awareness</td>
<td>Recognizing peer’s social attributes</td>
<td>Hayes et al. (2019); Hustad et al. (2019); Kessler &amp; Kost (2021)</td>
</tr>
<tr>
<td>Group regulation</td>
<td>Establishing and defining roles</td>
<td>Bucknall et al. (2016); Carey et al. (2018); Himes &amp; Ravert (2012); Najjar et al. (2015); Pront &amp; McNeill (2019);</td>
</tr>
<tr>
<td></td>
<td>Dividing and delegating tasks</td>
<td>Hayes et al. (2019)</td>
</tr>
<tr>
<td></td>
<td>Developing a trusting relationship</td>
<td>Himes &amp; Ravert (2012); Lee et al. (2015); Söderström et al. (2012)</td>
</tr>
<tr>
<td></td>
<td>Having shared goals</td>
<td>Kessler &amp; Kost (2021)</td>
</tr>
<tr>
<td></td>
<td>Supporting and engaging in teamwork</td>
<td>Hayes et al. (2019); McWilliams et al. (2021); Söderström et al. (2012);</td>
</tr>
<tr>
<td>Group reasoning</td>
<td>Exchanging and expanding information</td>
<td>Bucknall et al. (2016); Fieler et al. (2021); Rogers (2011); Söderström et al. (2014)</td>
</tr>
<tr>
<td></td>
<td>Discussing and negotiating ideas</td>
<td>Bucknall et al. (2016); Carey et al. (2018); Hustad et al. (2019); Söderström et al. (2014)</td>
</tr>
<tr>
<td></td>
<td>Validating and consensualizing ideas</td>
<td>Rogers (2011)</td>
</tr>
<tr>
<td></td>
<td>Co-constructing and processing information</td>
<td>Berndt et al. (2015); Bucknall et al. (2016); Crews et al. (2021); Hayes et al. (2019); Najjar et al. (2015); Rogers (2011); Söderström et al. (2014)</td>
</tr>
<tr>
<td>Group emotion</td>
<td>Positive emotions</td>
<td>Najjar et al. (2015); Rogers (2011); Söderström et al. (2012)</td>
</tr>
<tr>
<td></td>
<td>Negative emotions</td>
<td>Hayes et al. (2019); Söderström et al. (2012)</td>
</tr>
</tbody>
</table>
CHAPTER 3: METHODOLOGY

In nursing education, it is common for students to collaborate and make decisions as a group in simulations. Such collaborative learning can occur during interactions among students and peers, faculty and students, and students across health professions to foster experiential learning, develop essential knowledge and skills, and promote respect and understanding among team members (McAfooes et al., 2012). One of the vital nursing competencies is students’ ability to make sound clinical judgment and decision-making in simulation (J. Lee & Oh, 2015; Sim et al., 2022). Moreover, based on a recent systematic review, teamwork among students in simulation significantly affects their critical thinking and clinical reasoning (Theobald et al., 2021). However, how students collaborate and make decisions in simulation is a complex phenomenon and not well studied and understood. In addition, theoretical frameworks on PCCDM in simulation remain scarce as most existing frameworks focus solely on CDM or interprofessional collaboration. Furthermore, PCCDM cannot be accurately measured without a theoretical framework. Therefore, developing a theoretical framework using a grounded theory method will hopefully fill the research gap.

Emotions are inherently complex in learning, connecting to and influencing cognitive skills, such as memory, reasoning, decision-making, and creativity (Immordino-Yang & Damasio, 2007). Healthcare simulation research has primarily focused on creating an emotionally-triggered environment to engage learners through realism or a psychologically safe learning environment to foster learning—both can significantly impact attention, memory, and learning (LeBlanc & Posner, 2022). Most studies focus on individual learners’ emotions in simulation (Al-Ghareeb et al., 2017;
Cantrell et al., 2017; Shearer, 2016), with limited emphasis on group emotion during collaborative learning and decision-making. Based on the literature and empirical findings in the hybrid concept analysis, group emotion is one of the least explored as it is not as apparent as other group attributes (e.g., communication). Furthermore, little is known about group emotion in different phases of PCCDM. Thus, exploring group emotions using a thematic analysis provides a better understanding of nursing students’ emotions during PCCDM in simulation.

Purpose and Aims

This study aimed to (1) develop a theoretical framework that describes the process of prelicensure nursing students’ PCCDM when caring for an acute and deteriorating virtual patient and (2) explore nursing students’ group emotions during PCCDM in VR simulation. The specific research questions were (1) what was the process of PCCDM in different simulation phases? (2) how was PCCDM different in collaborative and individual spaces? and (3) what types of group emotion emerged in different simulation phases?

Method and Design

Charmaz’s (2014) constructivist grounded theory method was used to develop a theoretical framework to explore prelicensure nursing students’ PCCDM in simulation, while thematic analysis was used to explore nursing students’ group emotions during PCCDM in simulation.

Grounded Theory

Grounded theory is a systematic method of collecting and analyzing qualitative data to construct theories *grounded* in the data (Charmaz, 2014; Draucker, 2021). The
tenets of grounded theory are (1) exploring the psychosocial problem shared by a group of people, (2) focusing on the process and trajectory, and (3) using a constant comparison method to analyze data (Charmaz, 2014; Draucker, 2021). This method allowed the co-construction of data between the investigator and participants situated in time, place, culture, and context, allowing the flexibility of data analysis and the investigator’s reflexivity (Coşkun, 2020; Draucker, 2021). Consequently, the PCCDM theoretical framework was developed from the participants’ perspectives and the investigator’s position and interactions with the participants. Furthermore, PCCDM is a cognitive and socio-emotional process within the social context of peer collaboration, making it suitable to study using the grounded theory method.

**Participants and Setting**

The participants were prelicensure nursing students from associate degree nursing programs in Los Angeles. The study was conducted in a classroom where the investigator was employed after obtaining institutional review board (IRB) approval. Participants completed a brief survey on (1) their demographics, (2) simulation experiences, and (3) experiences working with the other participant in simulation or clinical settings.

**Inclusion and Exclusion Criteria**

Similar to the hybrid concept analysis, the inclusion criteria for this study were (1) prelicensure nursing students in their final year of an associate nursing program enrolled in a medical-surgical nursing course and (2) students who agreed to participate in the pre-study training session. The criteria ensured that students have some foundational knowledge of caring for acute and deteriorating medical-surgical patients and sufficient VR training.
The exclusion criteria were (1) students who experienced cybersickness when using VR and (2) students enrolled in the investigator’s lecture or clinical course during the study. Participants should feel comfortable using VR simulation as a learning modality without cybersickness. Although cybersickness using VR has been reported to be minimal (Samosorn et al., 2020; Servotte et al., 2020), knowing that some participants might experience cybersickness provided information on possible attrition in the study. Additionally, students enrolled in a course taught by the investigator were excluded to prevent potential ethical conflict (West, 2019).

**Sample Size and Sampling Process**

This study’s sample size was determined by the research question, study design, data quality and analysis, and allocated time (Morse, 2000, 2015b). A total of 32 participants (16 dyads) were recruited based on the research question and data quality and adequacy. Since the research question was relatively narrow and focused, the sample size was sufficient to meet the study’s purpose. Moreover, in-depth interviews with the participants allowed elaborative and expressive narrations.

The sampling process started with a convenience sample by recruiting participants from one nursing program, as shown in Figure 3-1. After several rounds of data analyses, a purposeful sample was used to maximize the variation within the sample and adequately determine the scope of the concepts (Morse, 2010), including sampling participants with significant characteristics (Morse, 2007). For example, participants from initial interviews stated that knowing each other helped with PCCDM. Thus, the investigator recruited participants who did not know each other and were from different nursing programs.
For the subsequent theoretical sampling, the investigator revised interview questions based on emerging categories to add, verify, or contribute to a theory (Charmaz, 2014). The investigator revised the interview questions for theoretical sampling based on data analyses (Draucker et al., 2007). For example, a few participants stated that experiencing panic during simulation affected their thought processes. Thus, the investigator added questions to explore the relationships between those concepts (e.g., “Tell me about your emotions and how it affects your thinking”), starting from Group 7 onward, as depicted in Table 3-2.

The investigator used Morse’s (2015a) principles of data and theoretical saturation, linking “adequate and appropriate” data to the “theoretical aspects of inquiry” (p. 588). Thus, saturation can be achieved by describing categories in a broad sense while providing multiple examples to support each category to develop the theory (Morse, 2015a). Ultimately, the sample size was justified based on data adequacy intrinsic to the study (Vasileiou et al., 2018).

**Recruitment Process**

After obtaining IRB approval, the investigator approached nursing program directors of community colleges to seek their permission to recruit their students as participants. The investigator held in-person and video-conferencing sessions to provide information on the study process, including the pre-study training, participants’ roles during the simulation, the time and duration of the study, and the interviewing process. Flyers were distributed to all potential participants, containing the study’s details and the investigator’s contact information. Participants were given a $50 gift card to compensate for their time and effort at the end of the study.
**Ethical Consideration**

The IRB regulations and the Family Educational Rights and Privacy Act (U.S. Department of Education, 2020) were strictly followed to protect the participants’ confidentiality and privacy. The investigator met with individual participants via secured video-conferencing software to explain the study and informed consent. Participants were allowed time to ask questions or clarify any confusion before signing the consent form. Also, the investigator emphasized that participation was voluntary, and the participants had the right to stop at any point during the pre-study training, simulation, and interviewing sessions due to physiological or psychological reasons (J. R. Gray, 2021).

**Simulation Design, Device, and Software**

The investigator continued using the simulation design, device, and software as in the concept analysis study, including adhering to the INACSL Standards of Best Practice, providing pre-study training to the participants, and using the same VR simulation scenarios and devices. The study progression consisted of (1) a one-hour pre-study training to introduce and familiarize the participants with VR simulation, (2) a simulation session that lasted between 10 to 20 minutes, and (3) in-depth individual and dyad interview sessions using video-recording playback (Figure 3-2).

**Simulation Device and Software**

The investigator used Oculus Quest 2 as the VR simulation headset and handheld devices for this study. The premade clinical scenarios from Elsevier’s Simulation Learning System (Elsevier Education, n.d.) remained the same as the hybrid concept analysis, encompassing medical-surgical case studies appropriate for the participant’s knowledge and skills. The cases were acute respiratory distress, myocardial infarction,
anaphylactic reaction, acute renal failure with hyperkalemia, and pulmonary embolism. The cases lasted between 10 to 20 minutes, depending on the scenarios, with specific algorithms of the case progression. Two subject-matter experts certified in healthcare simulation were consulted to review the five clinical scenarios and deemed them suitable for the study’s purpose.

Two participants (the “dyad”) were paired for each session, as recommended by Elsevier for the number of participants. An agreement to use those five cases for this dissertation was obtained between Elsevier and Indiana University’s Office of Research Support.

**Data Collection**

Data collection and analyses were conducted concurrently throughout the process. The data comprised video recordings of (1) participants’ interactions and collaboration during the simulation and (2) their narratives from in-depth interviews with video-recording playback. Figure 3-3 depicts the data collection and analysis process.

**Video Recordings**

The simulation and interview sessions were recorded for data collection and analysis. The investigator video and audio recorded the moderator screen and the virtual patient room. The moderator’s computer screen showed the facilitator’s view of controlling the VR simulation, including the progression of the clinical scenario. The virtual patient room could be viewed from the first (participant) or third person’s (observer) perspective on the computer screen. The recording allowed the investigator to playback the video during the group interview sessions and analyze the transcribed data corresponding to the video (Figure 3-3).
In-Depth Interviews with Video-Recording Playback

After the simulation, the investigator conducted a one-on-one interview with the individual participant before interviewing the dyad. The interview started with questions based on the simulation’s phases, from low acuity and stakes situations (e.g., assessing the relatively stable patient) to moderate (e.g., the patient started to deteriorate) and high acuity and stakes situations (e.g., the patient was decompensating fast), as shown in Table 3-1. The questions also focused on individual and collaborative spaces at each phase. The individual space is where each peer self-regulates their thinking and feeling, whereas the collaborative space is where peers communicate, interact, and control their reasoning and emotions as a group. The investigator played back the video recording to assist with participants’ recollection during the simulation, minimizing recall bias.

Each interview lasted 15 to 45 minutes, with the entire interview session for the individual and dyad interviews lasting approximately one to 1.5 hours. The recorded interviews were transcribed using transcription software, and the investigator checked word-for-word to confirm the transcription’s accuracy and completeness. Each transcript was given an identification number without any personal identifying data. All transcripts and videos were saved in the investigator’s computer with protected password access and deleted upon study completion.

Data Analysis

Two different approaches were used to answer the study aims: (1) Charmaz’s (2014) multi-stage coding to develop a PCCDM theoretical framework for Aim 1 and (2) thematic analysis to explore nursing students’ group emotions during PCCDM for Aim 2. The investigator analyzed the transcribed data from the in-depth interview sessions with a
constant comparison technique to generate a broader understanding of the concept. The video recordings provided context for understanding how the collaboration process unfolded. Additionally, the investigator analyzed participants’ interactions, including their communications and clinical actions, at different simulation phases (Figure 3-3).

Charmaz’s Multi-Stage Coding Process

The process consists of (1) initial coding, (2) focused coding, (3) axial coding, and (4) theoretical coding (Charmaz, 2014). In initial coding, the investigator studied data fragments (e.g., words, lines, or events) and constructed codes by expressing them with actions in gerunds (Charmaz, 2014). Additionally, the investigator constructed the codes from the vantage of the participants (Draucker, 2021). The focused coding includes reexamining and comparing initial codes to analyze, synthesize, categorize, and organize data based on repeating or salient patterns (Charmaz, 2014; Draucker, 2021). The investigator used a constant comparative method to compare data within the same interview and in different interviews to find similarities and differences throughout the coding process (Charmaz, 2014). The investigator performed this process using qualitative coding software to sort and organize the codes.

The axial coding focuses on the emerging categories and delineates the dimensions of the categories (Charmaz, 2014). Thus, the investigator utilized the categories from focused coding and divided them into meaningful subcategories and dimensions in axial coding (Charmaz, 2014; Draucker, 2021). Finally, the investigator connected the categories and formulated the theoretical framework in the theoretical coding phase of identifying the categorical relationships, theorizing the concept or phenomenon, and allowing the framework to emerge (Charmaz, 2014; Draucker, 2021).
Since the coding procedure was not linear, the investigator revisited the raw data and returned to the initial coding stages, as such active involvement and recursive process in coding were essential (Charmaz, 2014). Furthermore, the investigator wrote memos to promote and record conceptual thinking and ideas, including emerging categories, and identify potential gaps throughout the study (Charmaz, 2014; Draucker, 2021). For example, the investigator kept memos describing the methodological and analytical processes throughout data collection and analysis.

Thematic Analysis

Thematic analysis was used to explore the group emotion for Aim 2 for its flexible approach to identifying, analyzing, organizing, describing, and reporting themes inductively or deductively (Braun & Clarke, 2006; Fereday & Muir-Cochrane, 2006), allowing the investigator to incorporate this method with grounded theory study during data analysis. Furthermore, this method allowed psychosocial data interpretation (Braun & Clarke, 2006), which was suitable for analyzing the concept of group emotion in PCCDM.

The investigator followed Braun and Clarke’s (2006) six phases of thematic analysis: (1) familiarizing with data, (2) generating initial coding, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the report. Although the thematic analysis was relatively flexible and straightforward compared to grounded theory, potentially leading to data inconsistency (Holloway & Todres, 2003), striving for trustworthiness in this method was critical (Nowell et al., 2017).
Trustworthiness of the Study

This study followed Lincoln and Guba’s (1985) and Charmaz’s (2014) criteria of trustworthiness: (1) credibility, (2) dependability, (3) confirmability, (4) originality, (5) resonance, and (6) usefulness or transferability (Table 3-3).

Credibility

Credibility refers to the ultimate validity of a study that demonstrates the “truth value,” an adequate representation of multiple constructed realities by researchers and participants (Lincoln & Guba, 1985, p. 296). Techniques to improve credibility include triangulation of data collection, persistent observation, prolonged engagement, member checking, and peer debriefing (Lincoln & Guba, 1985).

Triangulation of data collection (i.e., in-depth interviews with individuals and dyads and video recordings of peer interactions) and analysis (i.e., interview transcriptions, video-recorded peer interactions, memos, and constant data comparison) contributed to the study’s trustworthiness. The investigator immersed himself in the data and literature throughout the process. Once the preliminary findings and interpretations were developed, the investigator reached out to the participants to validate the results (i.e., member checking with the last dyads). The dissertation committee members reviewed and audited raw and analyzed data to ensure accuracy and potential biases and debriefed with the investigator to make recommendations for revision.

Dependability

Dependability is the data’s consistency and reliability over time (Polit & Beck, 2021). Researchers can fulfill this criterion by demonstrating an audit trail with reflexivity, allowing internal and external dialogue (Tobin & Begley, 2004). The audit
trail should include the raw data, field notes, transcripts, results and findings, and reflexive notes (Lincoln & Guba, 1985). Researchers can record their daily schedule and logistics, personal reflections, and methodological decisions with rationales (Lincoln & Guba, 1985).

In this study, the investigator kept all the data and notes, including a reflexive journal with memos, and allowed the dissertation committee to audit his work. The reflexive journal consisted of methodological and analytical memos, capturing the investigator’s decision-making of the sampling process and categories development. The journal also allowed the committee members better understand the investigator’s thought process of data collection and analysis, including developing the theoretical framework.

**Confirmability**

Confirmability is the study’s objectivity, demonstrating a clear, accurate, and congruent derivation of interpretations and findings from the data (Polit & Beck, 2021). The strategies to establish confirmability include triangulation of data collection, audit trail, and reflexive journal (Lincoln & Guba, 1985), as mentioned above.

**Originality**

Originality determines whether the categories are fresh in providing new insights and thus “challenge, extend, or refine current ideas, concepts, and practices” (Charmaz, 2014, p. 337). Therefore, the investigator remained open to any significance or nuance in the data analysis. Subsequently, the investigator avoided premature closure during theoretical sampling through peer debriefing (Draucker, 2021) and memoing (Holton, 2007). An ongoing literature review also allowed the investigator to critique and compare
existing studies and theories using the constant comparative method discussed earlier (Charmaz, 2014; Draucker, 2021).

**Resonance**

Resonance refers to the constructed categories representing the participants’ experience and offering insights to others (Charmaz, 2014; Charmaz & Thornberg, 2020). The investigator included participants in developing the categories to achieve the fullness of the studied experience (Draucker, 2021). For example, the investigator asked specific questions salient in previous interviews (e.g., collaborating with peers they knew well or not at all) to determine similarities or differences among the participants. Thus, the investigator connected the data between the participants and resonated their experience with the larger student populations. The constant comparison method allowed the investigator to gather richer and more nuanced data grounded on the participants’ experiences.

**Usefulness and Transferability**

Usefulness comprises offering findings that others may use in their everyday lives, building a framework for practice applications, and contributing to the current literature and research (Charmaz, 2014; Charmaz & Thornberg, 2020). The investigator could consult and involve experts in education and simulation to determine how the findings could be applied once the study was completed. Additionally, the investigator could work with other researchers interested in expanding the study’s findings to their population (e.g., graduate-level students, other healthcare disciplines) or settings (e.g., augmented or mixed reality simulation).
Although researchers are not responsible for dictating which and what information to be transferred, they are responsible for providing all the necessary descriptive data to the readers (Lincoln & Guba, 1985). The readers can then decide the relevance of the findings in other contexts. Thus, the investigator described the coding and analytic process with thick descriptions when reporting the study’s findings. Furthermore, the investigator hoped to use the constructed framework for instrument development to measure PCCDM in the future.
Sampling Process

Note. The data collection process started with convenience sampling (a), followed by subsequent purposeful and theoretical samplings (b) based on the first few rounds of data analyses. The data collection and analysis occurred concurrently throughout the process. An iterative, constant comparison process (c) continued until theoretical and data adequacy and saturation had been achieved.
Figure 3-2

Study Progression

Pre-Study Training
**Figure 3-3**

*Data Collection and Analysis Process*

![Diagram showing the data collection and analysis process:](image)

**Note.** G1 = Group 1, G2 = Group 2, G3 = Group 3, G16 = Group 16; P1 = Participant 1, P2 = Participant 2, P1+P2 = Participant 1 and 2.
<table>
<thead>
<tr>
<th>Clinical Situation</th>
<th>Interview Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low acuity and stakes</td>
<td>I am interested in understanding how you and [participant X] made decisions caring for the patient. Tell me how you and [participant X] collaborated in making decisions when you first met the patient at the beginning.</td>
</tr>
<tr>
<td></td>
<td>1. How did you and [participant X] interact when making the decision?</td>
</tr>
<tr>
<td></td>
<td>2. How did you and [participant X] come to a mutual decision?</td>
</tr>
<tr>
<td></td>
<td>3. What would you have done differently on your own?</td>
</tr>
<tr>
<td></td>
<td>4. How did you communicate with each other?</td>
</tr>
<tr>
<td></td>
<td>5. What were your thoughts at that time?</td>
</tr>
<tr>
<td></td>
<td>6. What were your feelings at that time?</td>
</tr>
<tr>
<td></td>
<td>7. How did you control your thoughts and feelings?</td>
</tr>
<tr>
<td></td>
<td>8. How did you aware of each other’s thoughts and feelings?</td>
</tr>
<tr>
<td>Moderate acuity and stakes</td>
<td>Tell me how you and [participant X] collaborated when you noticed that the patient’s condition started to change.</td>
</tr>
<tr>
<td></td>
<td>1. How did you and [participant X] interact when making the decision?</td>
</tr>
<tr>
<td></td>
<td>2. How did you and [participant X] come to a mutual decision?</td>
</tr>
<tr>
<td></td>
<td>3. What would you have done differently on your own?</td>
</tr>
<tr>
<td></td>
<td>4. How did you communicate with each other?</td>
</tr>
<tr>
<td></td>
<td>5. What were your thoughts at that time?</td>
</tr>
<tr>
<td></td>
<td>6. What were your feelings at that time?</td>
</tr>
<tr>
<td></td>
<td>7. How did you control your thoughts and feelings?</td>
</tr>
<tr>
<td></td>
<td>8. How did you aware of each other’s thoughts and feelings?</td>
</tr>
<tr>
<td>High acuity and stakes</td>
<td>Tell me how you and [participant X] collaborated when you noticed that the patient was rapidly deteriorating.</td>
</tr>
<tr>
<td></td>
<td>1. How did you and [participant X] interact when making the decision?</td>
</tr>
<tr>
<td></td>
<td>2. How did you and [participant X] come to a mutual decision?</td>
</tr>
<tr>
<td></td>
<td>3. What would you have done differently on your own?</td>
</tr>
<tr>
<td></td>
<td>4. How did you communicate with each other?</td>
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<td></td>
<td>5. What were your thoughts at that time?</td>
</tr>
<tr>
<td></td>
<td>6. What were your feelings at that time?</td>
</tr>
<tr>
<td></td>
<td>7. How did you control your thoughts and feelings?</td>
</tr>
<tr>
<td></td>
<td>8. How did you aware of each other’s thoughts and feelings?</td>
</tr>
</tbody>
</table>
Table 3-2

Revised Interview Guide

<table>
<thead>
<tr>
<th>Emerging Categories</th>
<th>Interview Questions</th>
</tr>
</thead>
</table>
| Cognition           | 1. How does your thinking affect your interaction with [participant X]?
|                     | 2. How does your thinking affect your emotion? |
| Behavior            | 1. How does your interaction with [participant X] affect your thinking?
|                     | 2. How does your interaction with [participant X] affect your emotion? |
| Emotion             | 1. How does your emotion affect your interaction with [participant X]?
|                     | 2. How does your emotion affect your thinking? |
| Collaborative Space | 1. Tell me about your thought process when working with [participant X].
|                     | 2. Tell me about the action that you took when working with [participant X].
|                     | 3. Tell me about your emotion when working with [participant X]. |
### Table 3-3

**Trustworthiness Criteria and Evidence**

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credibility</td>
<td>Triangulation of data collection and analysis, including journals, interviews, videos, and field notes.</td>
</tr>
<tr>
<td></td>
<td>Prolonged engagement of data, including constant data comparison between literature and fieldwork.</td>
</tr>
<tr>
<td></td>
<td>Data analysis and examination by the dissertation committee and debriefing sessions through meetings and correspondence.</td>
</tr>
<tr>
<td></td>
<td>Member checking with the last dyads during the interview.</td>
</tr>
<tr>
<td>Dependability</td>
<td>Documentation of the entire process using audit trail, including raw data, field notes, transcripts, results and findings, and reflexive notes.</td>
</tr>
<tr>
<td></td>
<td>Adherence to Charmaz’s grounded theory method and Braun and Clark’s thematic analysis method.</td>
</tr>
<tr>
<td></td>
<td>Peer debriefing with the dissertation committee through meetings and correspondence.</td>
</tr>
<tr>
<td>Confirmability</td>
<td>Triangulation of data collection and analysis.</td>
</tr>
<tr>
<td></td>
<td>Audit trail of the concept via transcribed interviews, journals, and memos.</td>
</tr>
<tr>
<td></td>
<td>Peer debriefing with the dissertation committee through meetings and correspondence.</td>
</tr>
<tr>
<td>Originality</td>
<td>Avoidance of premature closure during theoretical sampling through debriefing and memoing.</td>
</tr>
<tr>
<td></td>
<td>Constant data comparison with ongoing literature review and data analysis.</td>
</tr>
<tr>
<td>Resonance</td>
<td>Constant comparison method between participants during interviews.</td>
</tr>
<tr>
<td>Transferability</td>
<td>Description of the study’s implications in nursing education, including how the finding can be applied in nursing simulation and future studies.</td>
</tr>
<tr>
<td></td>
<td>Expansion of the study’s findings to other populations (e.g., graduate-level students, other healthcare disciplines) or settings (e.g., augmented or mixed reality simulation).</td>
</tr>
</tbody>
</table>
CHAPTER 4: RESULTS

The results from the participant demographic survey, the grounded theory study addressing Aim 1, and the thematic analysis addressing Aim 2 are reported in this chapter. The theoretical framework, categories, and themes are also presented.

Survey Results

A total of 16 dyads (N = 32 participants) participated in this study, as shown in Table 4-1. The sample consisted primarily of females (n = 23), White (n = 12), and participants in the age group between 25 to 34 (n = 18). Participants of color (n = 16) exceeded the number of Whites, including Latinx or Hispanics (n = 7), Asians (n = 5), and Blacks or African Americans (n = 3). Other racial and ethnic groups were mixed race (n = 2), Persian (n = 1), and Armenian (n = 1), demonstrating a diverse sample.

More than half of the participants (n = 21) reported having simulation experience (Table 4-2). Among those responses, computer screen-based was the most common simulation experience (45.45%), followed by manikin-based (31.82%), standardized or simulated patient (18.18%), and virtual reality (4.55%). Eighteen out of 21 participants reported participating in at least three simulations in the past, and 15 of them have had experience working with the other participant in the dyads.

Because two schools participated in this study, two dyads were from different nursing programs (Group 8 and Group 11), and five participants reported not knowing their study participants, while the remaining (n = 27) reported knowing their peers moderately to extremely well (Table 4-3). Out of the 27 participants, more than half of them (n = 17) had experience working together in clinical, but less than a quarter (n = 6) had experience working together in simulation.
Among the five simulation cases, one case (myocardial infarction) had some technical issue, which the investigator only used once (Group 2) for this study (Table 4-4). The investigator randomly selected the other four cases for each dyad. The simulation duration for each dyad also varied depending on their performance (Table 4-5). Each phase represented the patient acuity and clinical stakes: (1) the patient was relatively stable in low acuity and stakes, (2) the patient started to deteriorate in the moderate acuity and stakes, and (3) the patient deteriorated fast in high acuity and stakes.

The first two simulations had technical microphone issues, limiting data analysis from the video recording. The duration ranged from 410 to 997 seconds. Two cases did not allow direct simulation progression manipulation by the investigator, resulting in shorter (i.e., anaphylaxis) or longer (i.e., hyperkalemia and renal failure) total duration. The high acuity and stakes phase did not happen in Group 11 since peers achieved the simulation outcomes before reaching that phase.

**Grounded Theory: Theoretical Framework**

The first aim of this study was to develop a theoretical framework that describes the process of prelicensure nursing students’ PCCDM when caring for an acute and deteriorating virtual patient using grounded theory. Ngo’s PCCDM theoretical framework described the three interrelated domains that emerged from this study: group cognition, behavior, and emotion (Figure 4-1). These domains went through a peer regulatory process of awareness, communication, and regulation. Group dynamics encompassed the domains and peer regulatory process, alternating between individual and collaborative spaces. The outcomes were group performance and, hypothetically, competent and safe nursing care among nursing students.
Group Cognition, Behavior, Emotion

Based on the study’s findings and literature, group cognition, behavior, and emotion are the domains that emerged from the categories. The term group represents (1) individual contribution to each domain or (2) the sum of each domain. Table 4-6 depicts each domain’s categories and subcategories (peer regulatory process). Because the domains are interrelated, the relationships between them are also explained.

Group Cognition

Three categories emerged from group cognition: (1) having an awareness of thought processes, (2) communicating thought processes, and (3) regulating thought processes.

Group Cognition: Having an Awareness of Thought Processes

Awareness of thought processes during simulation were (1) having the same or different thought processes and (2) knowing or assuming they knew their peer’s thought processes. Participants shared having the same thought processes as their peers based on the clinical cues and their hypotheses, objectives, and actions. One dyad shared how they decided to take action based on clinical cues by “thinking the same thing,”

P2: Yeah, but I also felt like we were thinking the same thing, and I knew that we were thinking the same thing, just... I don’t know if that makes sense.
Interviewer: Thinking the same thing…
P2: Like thinking, “OK, we got it. Get some oxygen to her.” We just didn’t know how… if that makes sense.
P1: Yeah, we kept checking the monitor. “It’s not going up, it’s not going up,” because we kept trying everything. At some point, we were both thinking [of] rapid response (G14_Pair).

Another participant shared how they formulated the hypothesis and action plan based on clinical cues,
P1: I think we are kind of, like, I don’t know if he would say something or I would, kind of, try to analyze what he was saying, and look at the patient and, you know, try to figure out what the problem was together. So, yeah, and even, like, looking at the Pyxis, and seeing, like, the medications and then, you know, with their wheezing and stuff, umm, we’re like, you know, maybe we need to give her Epi. It could be [an] allergic reaction…

(G15_P1)

Having the same thought processes led to being “on the same page” (G2_Pair, G7_Pair, G8_Pair, G8_P2, G9_Pair, G10_P1, G11_P1, G11_Pair) or “in the same place” (G11_Pair) and having “the same wavelength” (G7_P2) and “an understanding” (G15_P1).

Participants said they knew or assumed they knew what their peer was thinking. They described knowing their peer’s thoughts or thought processes through communication or action. Participants verbalized clinical data, hypotheses, and actions (i.e., thinking aloud), allowing their peers to confirm their thought processes. Contrarily, some participants believed they knew their peer’s thoughts even though they were not communicating. One participant shared,

P1: I think I could tell [what she was thinking] because we don’t, we don’t get silent. We, you know, we usually communicate. When we get silent, we’re both trying to figure [it] out. Like, we’re kind of just, “What should we do?” (G1_P1).

Participants also relied on their peer’s actions or inactions to understand their thoughts, letting actions speak for themselves. These actions were initiating an assessment and taking an intervention. For example, assessing the patient to obtain a baseline or monitor their progress (G1_Pair, G4_P2, G6_P1, G11_P1, G15_Pair), administering medication to counter the allergic reaction (G8_P2), and positioning the patient flat to perform a chest compression (G3_Pair). One dyad shared,
P2: Like doing [an assessment], I feel like I was able to tell he was thinking cause, again, it was just the assessment portion, like, just hook up all the leads, get the blood pressure, O2 saturation, temperature, like, all the, just the vital signs, just to see where we’re at with the patient. And, like, to plan our next intervention.

P1: Yeah. I think during the beginning, yeah, I think I had an idea of what he was thinking and stuff, in the assessments and stuff. I think that’s kind of why we jumped into it, too. [It] is like we know we have to do an assessment. So, we kind of know that things we have to do, and then I think later on that’s where, you know, [we are] not too sure once we’re, like, doing our actual interventions. That’s when it’s, yeah, don’t really know, like, [what] we’re thinking (G15_Pair).

Besides taking action, one participant assumed knowing their peer’s thought processes from their inaction,

P1: I was lost and was pushing for her (P2) to give [the medication]. I definitely recognize, like, her thought process behind [not giving the medication]. And you know, she’s right. We shouldn’t be giving something that we don’t know the effects [of the medication] (G10_Pair).

One of the main reasons for the assumption was knowing each other well and being trained in the same nursing program. Participants expressed that they had the “same wavelength” (G7_P2) and “chemistry” (G13_P2) and became “so synched” with each other (G16_Pair). When asked whether they could sense or read each other’s thought processes, one of the dyads responded, (G16_Pair)

P1: Yeah, it’s just really hard when, like, obviously, you can’t read what’s going on in my head, and we have to verbalize [it]. I think we’ve just become so synched during nursing school that we… I wouldn’t want to say I can read her mind, but we kind of know, like generally…

P2: What [is] the next step, or what [do] we need to do (G16_Pair).

And the other dyad described,

P1: …we worked together before. We’ve had competency together. I’ve had every clinical day with him on the floor…. We’ve worked together a lot throughout clinicals, throughout competency. So, like we’ve been in real patient scenarios together at clinical…. I’ve seen, like, what he does and how he talks to patients. So, I feel, like, I could kind of think of his next move. So, that’s why because, like, we were close [in] clinical, and
this is, like, a similar situation. So, I feel like we were on the same page with what was going on with the patient...
P2: In a sense, I do, I do feel like she’s able to read what I want… we’ve also had clinicals together as well…so we’ve had a lot of teamwork together in that sense. So, we kind of [got], like, a chemistry built…So, I think we all have [had] a feel for each other and kind of just know what to expect from each other (G13_P2).

**Group Cognition: Communicating Thought Processes**

Participants communicated their thought processes by sharing and exchanging thoughts, verbalizing clinical data and findings, and asking or questioning an idea or thought. They described “bouncing ideas off each other” (G1_Pair, G6_P1, G7_P2, G12_P2, G16_Pair) and exchanging ideas “back and forth” (G1_P1, G10_Pair, G14_P2, G15_Pair) to analyze data, formulate hypotheses, and generate solutions (G3_Pair, G4_P1, G4_P2, G5_Pair, G7_P1, G7_P2, G8_Pair) while “feeding ideas off each other” (G1_P2, G2_P1, G15_Pair) and correcting peers if they were wrong (G3_Pair).

Participants also questioned each other’s thought processes during the simulation to ensure taking the appropriate actions, including administering the correct medication (G4_P2, G15_Pair), using the proper oxygen device (G14_P2), and calling the appropriate rescue team (G3_Pair).

On the other hand, participants did not communicate their thought processes for several reasons: (1) not having the knowledge, (2) thinking on their own, and (3) being on the same page. Not knowing the patient’s condition or the solutions to the problem was the most common reason for not communicating with peers. One dyad explained,

P2: And we both have just a way of communication, and so when that disappeared, it was obvious we were both in a different mind space because that’s not where we usually are. We usually…
P1: We at least speak…we at least say something. You know, we were just really, like, lost.
P2: Lost. Yeah. (G1_Pair)
Peers also communicated less when they were processing information on their own (G4_P2, G6_Pair, G11_P1, G13_P2), trying to “put the pieces together in [their] head” (G8_P2). Also, some peers found it difficult to translate their thoughts into words while having “internal troubleshooting” and “[their] wheels turning” (G1_Pair). Although some dyads spoke their thoughts out loud, they were not communicating with each other:

P2: I think we were both thinking out loud but not talking…
P1: …to each other.
P2: Like we were, we were both, like, going through the process externally, and we were talking about things, but we weren’t necessarily talking to one another like we were just working through the process on our own individually [as] opposed to working in collaboration, like, “Hey, this is what’s going on with the monitor. What do you think we need to do?” “I think we need to do this and then do an intervention.” It was kind of, like, I was working one side, [and] she was working [at] another angle, and it was weird. We were both on the same page, kind of, but working in tandem as separate units (G9_Pair).

Some dyads believed that they did not necessarily have to communicate as they were “on the same page” (G13_Pair, G16_Pair), knowing what needed to get done (G15_Pair). Also, some participants believed communicating by “highlighting” only pertinent information (G4_P1, G7_P1, G13_Pair) could avoid unnecessary “noise” and redundant information and save time (G7_Pair).

**Group Cognition: Regulating Thought Processes**

Participants regulated their thoughts using multiple processes. Individual thinking contributed to group cognition when ideas and thoughts were communicated with peers. As discussed earlier, thinking as a group involved sharing and exchanging ideas and verbalizing their thought processes. Participants reported the following processes when regulating their thoughts individually or collectively: (1) activating prior knowledge, (2) reasoning, and (3) focusing.
Activating prior knowledge was required to apply what they had learned in the simulation. Their prior knowledge comprised theoretical knowledge, clinical practice, and work experience (G1_Pair, G2_P1, G5_P1, G7_P1, G7_P2). However, their knowledge might not apply in the scenario (G11_Pair), or they did not have the knowledge to do so (G14_Pair).

Two types of reasoning were evident in this study: (1) analytical and (2) intuitive. Analytical reasoning included (1) recognizing and analyzing data, (2) formulating and prioritizing hypotheses, (3) generating solutions, and (4) reflecting and evaluating outcomes. Participants recognized relevant data by assessing the patient and reading the electronic health record. Most participants started assessing the patient as trained in school (G6_P1, G8_P1) using the nursing process (G2_P1, G6_P1, G16_P1). Participants explained that collecting and analyzing data was to get a “baseline” (G13_P2), “have all the information” (G13_Pair), and “cover all the bases” (G11_Pair) before developing clinical hypotheses and solutions.

Participants also took several actions intuitively, including reading the chart while receiving the handoff report (G8_P1, G16_Pair), performing an assessment on the patient at the beginning (G1_P1, G3_Pair, G11_Pair), and responding to clinical cues (G1_P2, G7_Pair, G11_Pair), which they were trained in the clinical settings (G11_Pair, G13_P1, G16_Pair). They described their intuition as having the “instinct” (G8_P1, G13_P1) and the “first” or “initial thought” (G7_Pair, G11_Pair) to take action, and it felt “natural” (G11_P1, G13_P1). When asked why they had the “instinct” and felt “natural” to start gathering data, one participant shared,

P1: It’s just because, like, that’s what we do in real life and clinical after report, like, my nurse always sits me down, and it’s like, “Let's look at
labs, see what’s wrong,” and then, like, “Let's go check on the patient’s vitals.” That’s why. (G13_P1)

Participants also focused on individual thoughts or actions, peers, clinical data, and situations. They explained how external “noise” (e.g., patient’s family complaints) affected their concentration (G5_P2, G12_P2), which required them to “tune everything out” and divert their focus to what was important (i.e., the patient) (G9_P2, G13_P2), including “blocking” their peers out (G5_Pair). One participant described,

P2: I can tune everything out just to make sure I understand what I need to get done, and then come back into it as a, like, teamwork. I think that I can create my own individual space with distractions (G13_P2).

One participant stated that they did not want to “throw random ideas out” to avoid “distracting [their peer’s] train of thoughts” (G8_P2). However, some participants took notes of their peers’ actions, ensuring they were appropriate (G12_P2) and validating their own decisions (G8_P1).

On the other hand, some participants acknowledged they were so focused on their thoughts and actions during the simulation that it shifted their attention away from their peers (G4_Pair, G7_P2, G11_P1, G15_P2), which resulted in minimal interactions and communication (G4_P2, G12_Pair). One participant shared,

P2: We could have communicated more, but um…I don’t know that I would have really been listening because I was really, I mean, to be honest, I was reading [the EHR], and that’s why I had to ask her about the heart sounds more than once because I really wasn’t able…I wasn’t paying attention. So yeah, that’s why I said I don’t know that I would have done… anything differently unless I would have put down the tablet so I could really listen to what she (P1) was saying. (G4_Pair)

Furthermore, overfocusing on one piece of information could result in tunnel vision and not looking at the big picture. Participants described how they were fixated on one
clinical cue and missed other relevant data (G2_Pair, G8_P1, G14_P1). One participant explained,

P2: Well, I was stuck on the last page…I would try to focus on the nitroglycerin and like…[the] information [on nitroglycerin] more than other medications. Yeah, I should look more…I didn’t see…compared to see [what other medications] might help (G2_Pair).

**Group Behavior**

Categories that emerged from group behavior were (1) having an awareness of actions, behaviors, or roles; (2) communicating actions, behaviors, or roles; and (3) regulating actions, behaviors, or roles.

**Group Behavior: Having an Awareness of Actions, Behaviors, or Roles**

Having an awareness of group actions, behaviors, and roles consisted of (1) perceiving their peer’s actions, behaviors, and roles; (2) observing their peer’s actions or behaviors; and (3) perceiving group dynamics. Participants perceived peers’ actions or inactions based on how they responded in simulation (G1_Pair, G9_Pair, G12_P2, G13_P1) with or without communication. However, participants acknowledged that they could communicate better by verbalizing their actions instead assuming peers knew what they were doing (G1_P1, G9_Pair,). One participant described,

P1: Sometimes I just do things without, like, saying it because I just assume but... Maybe just vocalize everything that we’re doing [and] working in a pair just so that the other person is aware as well, which I feel, like, I could definitely work on cause I’m just, sometimes, I get into my own head, and I just do things [because] I’m so used to it (G1_P1).

Participants also recognized that observing their peer’s actions helped with their thought processes and confidence to take the following action (G1_P2, G1_Pair, G3_Pair, G7_P2, G8_P1, G9_P1). One participant shared,
P2: And P1, I think, had a better idea of raising the bed more because [the patient] couldn’t breathe properly. So, to raise him up a little bit more, if I remember correctly, he was lying down at first [when] we walked in. So, that was actually a smarter move. So, that was good. I feel like that’s good teamwork right there. So, it allowed for that because my thought immediately was [going] for the stethoscope to listen…auscultate the lung sounds (G1_P2).

Participants also described their group dynamics, from perceiving the lack of “direct collaboration” (G5_Pair) to sensing and feeding off each other’s “energy” (G4_Pair, G6_P1), being in a “flow” (G7_Pair, G10_P1, G10_Pair), and having “chemistry” established with one another (G13_P2, G13_Pair). In recognizing and understanding their roles, most participants reported having the “same” or “equal” roles as nurses (G1_Pair, G4_P2, G5_Pair, G9_P2, G11_P2, G15_P1), being at the “same level” (G15_P2) without any “hierarchy” (G7_P2). However, a few participants had a role conflict by seeing their peers as being “the charge” (G15_Pair) and comparing them to their “nurse” or “clinical instructor” (G6_P2).

**Group Behavior: Communicating Actions, Behaviors, or Roles**

Participants communicated their actions and behaviors by (1) talking out loud, (2) discussing, (3) instructing or telling, (4) suggesting, and (5) asking. Talking or thinking aloud allowed peers to get input (G5_P2, G11_Pair, G16_P1) and validate their actions (G5_Pair). It also prevented a “rash decision” (G5_P2) and “running into each other” (G16_P2), especially during high acuity and stakes situations (G3_P1). Some participants learned the thinking-aloud method from their training:

P1: And so, we’ve always been taught to, like, at school to verbalize what we’re doing, what we’re thinking. So, I think during the simulation, we did the same thing. So, whenever we perform what action, we say, “OK, I’m putting on the pulse ox.” “OK, pulse ox is 92.” “OK, that’s a little low. I’m gonna put on the mask.” “Do you agree?” “Yes, no,” kind of thing (G16_P1).
Participants sometimes verbalized their actions instead of their thought processes. When asked whether they communicated their thought processes or actions, one participant described,

P2: I think action, but our processes are similar, like [the patient is] saying that she has chest pain, we’re both checking for pain medication. So, I think when we’re both gathering the data, we both have the same idea of what to do next... So, I think we’re both like having the same thought processes that lead to the same action. (G16_Pair)

Participants discussed their actions to delegate tasks (G1_P1, G7_P1) and troubleshoot a clinical issue (G14_P1, G15_P1), ensuring their actions’ “benefits outweighed the risks” (G15_Pair). However, simply agreeing to their peer’s actions differed from discussing and reviewing them critically. When asked whether there was a thorough discussion about administering pain medication, one dyad expressed,

P2: I don’t really, I wouldn’t say [a] discussion. I think it was just like, “Hey, should I do this?”
P1: Yeah. I feel like it was kind, that’s kind [of], like, [a] discussion. Kind of like, “Oh, pain med.” “Oh, yeah,” kind of thing. No? I feel like… yeah. Maybe we didn’t, like, stop to think about it. (G14_Pair)

Participants also communicated by instructing or telling peers to correct their actions (G1_P2) or take specific actions (G3_P2, G5_P1, G6_P1), possibly a wrong one (G2_P2). Instructing or telling peers to take action was straightforward with a more direct tone, which was different than suggesting or asking. For example, participants described their peers saying with “firmness” but not in “a bossy way” (G1_P2) or a “just-give-it” tone (G2_P2, G10_Pair). Several participants preferred to be direct when interacting with peers. One participant explained,

P2: A lot of the stuff I asked was kind of more of a statement than a question, like, instead of, you know, “Can you listen to, can you listen [to the] lungs sounds?” It was just, you know, I would hand the stethoscope,
“Here,” you know, “Take a listen to the lungs [really] quick, and see what’s going on.”

Interviewer: So, you will be more direct.
P2: Yeah, yeah, I’m more of a direct person than kind of asking. It’s especially if I see something that needs to get done. Then I’ll kind of… [be] less open about asking, and [be] more of a, you know, directive-driven kind of thing. So… (G9_P2)

Another participant justified being “more direct” and “aggressive” because they knew each other well (G10_P2). One participant perceived their peer as “passive-aggressive” by suggesting an action with a questioning tone (G5_Pair):

P2: Because he didn’t say, “OK, I’m gonna check the order before we see what we [could] administer.” Or like, “You should check the order before…” It was like, “Maybe we should blank…?” (in a questioning tone). And I’m like, “OK. Maybe we should!” (in a sarcastic tone) (G5_Pair).

In contrast, some participants preferred using a less direct tone when communicating their actions. For example, participants communicated in a suggestive tone (e.g., “OK, let’s take the temperature” (G15_P1) and “Let’s call the doctor” (G9_Pair)), in a questioning tone (e.g., “Should we do this?” (G16_Pair)), or in both tones (e.g., “And why don’t we try this?” (G1_P1)). Participants also acknowledged that they should communicate with peers by asking questions to get their input instead of instructing or telling them what to do. One participant explained,

P1: Yeah, like, I’ll just start asking questions more, too. It’s not just, like, saying things but asking questions. “Hey, what do you think of this? Can I get your input on this?” You know what I mean? Like getting somebody else’s mindset (G6_Pair).

And another participant also expressed,

P1: If you say, “I’m gonna call rapid response,” and it kinda minimizes the other person’s opinion because you’re already saying you’re gonna do it. But when you ask, “Should we call…” then it opens the door up and allows them to give their input. And obviously, if they don’t agree, they can say, “Oh no, no, I don’t think we should” (G16_Pair).
The way they asked questions was also vital:

P2: Instead of saying, “Hey, don’t give it to him,” I could have said something like, “Hey, do you really think that PO med is going to work fast enough, or should we keep looking?” You know, kind of curious question instead of like a demanding question (G4_P2).

However, participants could perceive their peers as being uncertain about an action by their tone of voice (G8_P2) and from asking questions (G8_P2, G11_P2):

Interviewer: And you mentioned that she doubts, second-guesses herself. Can you give me an example?
P2: Well. Um, like, she would answer things with, like, a question sometimes. Like, she would say, like, “Should we give…?” like, I don’t know, I can’t remember exactly what she said, but, like, she would say something like, “Should we call rapid response?” Like a question, kind of, instead of, like, a direct decision, like, “I’m gonna call rapid response” (G11_P2).

**Group Behavior: Regulating Actions, Behaviors, or Roles**

Participants regulated their actions and behaviors using several regulatory processes involving actions, inactions, and peer interactions. Actions and inactions could be individual (e.g., taking action individually) or collaborative effort (e.g., not taking action as a group). Interactions occurred when peers communicated and exchanged thoughts and emotions.

The processes could also have positive or negative outcomes to support PCCDM. Actions with positive outcomes comprised (1) taking appropriate actions, (2) prioritizing what needed to be done, and (3) responding to the situation using thought processes; actions with negative outcomes were (1) taking the wrong actions or missing the right actions, (2) not consulting peers resulting in a wrong action, and (3) reacting to the situation without thoroughly checking their actions. In a few cases, participants took “impulsive” actions (G4_P1) without checking or consulting with their peers, including
not knowing the dose (G4_Pair, G11_Pair), route (G12_P2), and indication (G13_P1) for a medication. One participant shared,

P1: I heard the order, and I knew the medication. It was the furosemide IV and the sodium [polystyrene sulfonate]. So, I just clicked on it [on the Pyxis]. And I grabbed it and gave it, but I didn’t check the [dose] cause I remember after I gave it…. “Wait, didn’t she say something about 40 milligrams?” And I looked at the Pyxis, and it says 10, and I only gave 10. And then it wasn’t IV push. I’m like, “Wait, was I supposed to hang a bag or something?” I’m not sure because it says IV, not IV push. I just, I moved too fast. The order, we’re waiting on the order, waiting on the order. And then it came. I’m like, “OK, Pyxis,” boom, boom, boom, “Let’s go, let me help [the patient].” But I didn’t do my checks. So, then I started freaking out again (G4_Pair).

On the flip side, some participants hesitated to take action (i.e., inaction) to avoid giving the wrong medication (G5_P1) or giving the medication that could result in negative outcomes (G10_Pair). One participant described their inaction in giving the medication Lasix,

P2: I was, I was honestly kind of hesitant with [giving the medication] too… And then I looked at the blood pressure. I was like, “Wait, really don’t do it,” like his blood pressure [was] really low, “Don’t give it.” And I was pretty sure about that. But…yeah, but I was really sure about that in the moment. I really know the actual blood pressure range for Lasix (G10_Pair).

Another participant shared,

P1: I think it was healthy. Like, I think it was good for him (P2) to be hesitant cause you shouldn’t just be giving meds. I think I was more panicked than [he was, and] I would have just given [the medication]. Um… I think he (P2) had the right idea. (G5_P1)

Inaction could also result in adverse outcomes, as participants described they “froze” for not knowing the next step to take (G1_P1, G14_Pair). As one participant shared,

P2: When I froze, it was, like, towards the end when [P1] was still playing with the [ambubag]. I ran out of ideas, and I was, like, waiting for [the rapid response team] to come, and then I was, like, “OK, when is this gonna end?” Like, “When are they gonna come?” Or “When is something
gonna happen?” Like, I mean, obviously, for a real patient, you’re not going to just stand there and, like, [ask] “When is something gonna happen?” (G14_Pair).

Interactions between peers consisted of (1) agreeing or disagreeing with peers, (2) leading and supporting peers, and (3) including or not including peers in decision-making. Having an agreement or disagreement was one of the most common peer interactions. Participants could agree or disagree about an idea or action to reach positive or negative outcomes. Agreeing with their peers about an idea or action included formulating the patient’s diagnosis (G5_P1, G8_P2), applying or using the appropriate oxygen device (G5_Pair, G14_P2), stopping the antibiotics infusion that caused anaphylaxis (G5_P2), administering the correct and relevant (G5_P2, G8_P2, G11_P2, G12_P2, G15_P1) or irrelevant medications (G13_P2, G14_Pair), delegating tasks (G10_Pair), and calling the provider or rescue team (G1_P1, G3_Pair, G4_P2, G5_P1, G6_P2, G10_P2, G12_Pair).

Two main contradicting ideas or actions were calling code blue when the patient was still alive (G3_Pair, G6_Pair, G10_P1, G13_P1) and administering a medication that they were unsure (G2_P2, G7_Pair, G10_P2). Also, participants disagreed about irrelevant actions their peers took, such as checking the blood glucose when the patient did not have diabetes or did not experience hypoglycemia (G13_P1). Such action was “a filler move” (G10_Pair), which participants felt was “better to act than do nothing” (G11_Pair, G14_P2) to fill the void between thoughts and action.

Participants led and supported each other during the simulation. Leading the situation could be perceived as taking the “leading role” (G5_P2, G9_P2), “taking charge” (G3_P2, G6_P2, G12_Pair), “taking over” (G6_P2), and to the extremes,
competing (G3_P2, G7_P1) and “controlling” (G2_P2, G3_P2, G7_P1, G14_P1). One participant acknowledged being competitive with their peer,

P2: I think it’s a combination of I do tend to take control, and I know that, and I often think it’s the right thing to do, which is why I’m doing it. But sometimes, I worry that I’m doing it too much. I don’t want to overstep. I don’t want to tell people what to do too much. I don’t want to have a dynamic. But then I also have…I want to win (G3_P2).

Participants also co-led at certain times during the simulation (G6_P1, G7_P2, G8_Pair, G11_P1, G13_Pair, G15_P1), by going “back and forth” (G13_P1) and “balancing each other out” (G12_P1) with “fifty-fifty” leading roles (G8_P1).

When one peer was leading, the other supported them by “evaluating” (G13_P2) or checking (G3_Pair, G5_P2, G7_P1, G14_P1), as having “two ears and two eyes are always better than one” (G4_P1). Although they assisted their peers, these supporters were also “versatile” (G11_Pair) when it came to leading by “gauging” and “adapting to [other] people’s styles” (G3_Pair) and “readjusting” their roles as needed (G5_P1).

Some participants believed that no one was leading as they “worked together” (G4_P2) and “came to agreements” (G10_P2). One participant stated that no one was leading; instead, they were “playing lead in the blind” as both were “lost” (G14_P2). Some participants stated that only one person should be leading to avoid “too many cooks (or chefs) in the kitchen” (G5_Pair, G11_P2), and both cannot be “passive” (G3_Pair) as it was “hard to get things done” (G5_Pair). One participant shared,

P2: I always think like, you know, you can’t, you shouldn’t have, like, too many chefs in the kitchen, you know, like two people both trying to lead or both trying to support. You know, it’s, like, really, you know, it’s really hard to get things done. (G5_Pair)

Most participants included their peers in making decisions to get their input (G5_Pair), validate their findings (G12_Pair), come to a consensus (G11_Pair), “keep
each other in the loop” (G9_P2, G10_P1), and “be on the same page” (G8_Pair, G9_P2, G10_P1). However, including peers was not always the case in some dyads as they felt concerned about not having enough time in the simulation (G6_P1) and more about “getting the job done” and less about making their peers “felt included” (G5_P1). When asked whether they included their peer in making decisions, one participant acknowledged,

P1: Probably not. I need help with that area. Yeah, I should probably include [her] more so, like, you know, or stop to say, like, “What do you think about this?” Like, [getting] her input and then maybe we would have....um... probably done a little bit better. I feel, like, that would have actually improved it. But at the time, I was, like, well, I don’t know how long we have on this [simulation], and our patient is declining. So, I don’t, I don’t, I didn’t feel like I had time to do that if that makes sense (G6_P1).

**Group Emotion**

Three categories emerged from group emotion: (1) having an awareness of emotions, (2) communicating emotions, and (3) regulating emotions.

**Group Emotion: Having an Awareness of Emotions**

Participants had an awareness of their peer’s emotions by sensing those feelings. Participants could sense their peer’s positive, negative, and mixed emotions during the simulation from their (1) voices, (2) words, (3) actions, and (4) inactions. Participants perceived their peer’s emotions as positive, including feeling “calmed” (G7_P2, G12_Pair, G14_Pair, G15_P1) and “confident” (G15_P1), and negative, such as feeling “worried” (G5_P1, G5_P2, G16_P2), “frantic” (G16_P2), “confused” (G4_Pair, G15_P2), “frustrated” (G3_Pair, G14_P1), “awkwardness” (G11_Pair), “stressed” (G8_Pair), and “nervous” (G4_Pair, G5_Pair). They also perceived mixed positive and
negative emotions in peers, as in feeling “confident” and “unsure” at the same time (G11_P2).

Although participants could not see their peer’s facial expressions in the virtual reality, they could sense and tell their emotions through the tone of their voices (G4_Pair, G5_P2, G6_P1, G7_P2, G10_P1, G15_P2), their words (G5_P1, G10_P1, G11_P1), or both (G3_P1, G4_P1, G5_P1, G12_P1). Also, knowing each other helped them sense their emotions (G4_P1). As one dyad shared,

Interviewer: And it’s interesting you mentioned that you could feel each other’s frustration in the sense…
P1: Even though I couldn’t see her face, you know.
P2: Picked up on the voice.
P1: We just know each other.
P2: Yeah. And that too. It was like the vocal, and just what we did here [in simulation]. But yeah, we knew each other, and it was like, I think it was, like, this energy coming off each other, just like we could feel it. (G1_Pair)

Some participants perceived their peer’s emotions from their behaviors and actions, including “talking faster” and “moving around” (G16_P2), “jumping into [action]” (G11_P2), being “quick” (G13_P1), and “slowing down” (G15_Pair); or inactions, such as “freezing up” (G6_P1, G16_P1) and “taking a long time [executing an action]” (G10_Pair).

**Group Emotion: Communicating Emotions**

Participants communicated their emotions verbally or non-verbally. Participants verbalized their emotions using words and statements and expressed them using voices and other expressions (e.g., sighs). Verbalizing or expressing their emotions during the simulation was rare because (1) participants wanted to focus on the patient instead of their emotions (G2_P2, G5_Pair, G13_P1), (2) participants believed it was not
appropriate to share their feelings in front of the patient or family (G4_P1, G5_Pair, G14_P1, G14_Pair, G16_P1), (3) participants assumed their peers could sense and feel their emotions (G4_Pair, G10_Pair), and (4) participants did not know how or want to share their emotions with others (G1_P2, G4_P2, G5_Pair). On the flip side, participants also expressed their emotions non-verbally through the tone of their voice and other non-lexical expressions, including sighs and nervous laughs.

**Group Emotion: Regulating Emotions**

Participants regulated group emotions by (1) controlling individual and group emotions and (2) supporting each other’s emotions. Participants controlled their emotions by “turning [their emotions] off” (G13_Pair), “compartmentalizing [their] feelings” (G11_P2), “transferring” their emotions by “leaving [them] at the door and focusing on the patient” (G16_P1) and diverting their attention to thoughts “without having emotions clouded [their] thought process” (G15_P2). One participant explained how they turned off their emotions,

P2: Umm, so, if you let anxiety takes over, I’ve learned over time, you start to forget things. So, you kind of have to, like, I was saying, like, put yourself in your own little bubble but still be aware of everything that’s going on. Like, the patient could be freaking out, but you have to maintain your calm in that moment. That’s kind of one thing that I learned, but of course, like, if there is an emergency, you need to be able to react but don’t let your…. don’t let your mind takes over. You have to just trust yourself in that moment and trust that you know what you’re doing and going through everything, checking all the boxes, essentially (G13_Pair).

Participants also supported each other’s emotions by “talking” to peers (G15_Pair) or having a group self-talk (G4_P1), being the “rock” in the situation by maintaining composure (G13_Pair), and “boosting [their peer’s] confidence” (G6_P1).
Relationships Between Domains

Group cognition, behavior, and emotion are interrelated as one domain might influence the other domains. Although these domains could happen concurrently (e.g., thinking while taking actions), the purpose was to explore the relationships between these domains to understand PCCDM better, as shown in Table 4-7.

Group Cognition Influenced Behavior

Categories that emerged when group cognition influenced behavior were (1) thinking prompted actions, (2) thinking resulted in inaction, (3) not knowing prompted actions, and (4) not knowing resulted in inaction. Participants took actions based on several types of thinking: (1) analytical reasoning, (2) intuitive reasoning, and (3) prior knowledge and experience, as discussed earlier. Taking actions using clinical reasoning was the most common thought-action relationship, as participants used clinical cues to formulate hypotheses and responded by thinking individually or as a group. Participants also used their intuition to take clinical actions. As previously mentioned, they described such thinking as having the instinct or first thought without going through analytical reasoning. However, participants acknowledged not discussing the action with their peers when thinking intuitively (G3_Pair, G5_P1, G5_P1, G8_P1). As one participant explained,

P1: I think, you know, I’m not sure [why there was no discussion]. I think maybe if we did, you know, say, “Hey, let’s do this, and you do this,” maybe it would be more organized. But it feels, I guess, it felt natural to just do what was in front of me (G11_P1).

Participants also applied what they had learned in nursing school, including lecture and clinical experience, in the simulation. When asked how they knew to take a specific action, one participant shared,
P1: Yeah, we are actually in the same cohort for the same nursing school. So, they’re essentially teaching us the same things, and we’re learning the same thing. And, always for nursing, we use the standard format of ADPIE, which is the assessment, diagnosis, planning, and then implementing, and then evaluating. So, we’re trying to put that into the actual virtual sim. (G6_P1)

Although thinking could activate an action, some participants experienced the opposite: (1) pausing and (2) hesitating to take action. Participants paused when they were “out of options” (G14_Pair) or, more importantly, questioned themselves or peers before taking a critical action, such as administering medication (G10_Pair, G15_P1). One participant shared,

P1: I was like, “Just give [the medication].”

P2: Just give it... And I was seconds away from doing it. Like, I literally was gonna go... and give it to [the patient’s] hand. And I was, like, “Wait,” like, “What if they ask,” like, “What is that?” or something like [that]. That’s so bad, and what if it’s something that, like, it’s also harmful to [the patient] that I have to question in the order... and, like, I was, like, “No, just put it back.” So, I think it was us just going back and forth with the confusion. (G10_Pair)

Another participant related the pause as “thinking” before the following action, where “batching” and “processing” information happened (G7_P1). Participants also hesitated to take action because they disagreed with their peers about the action (G2_P2, G6_Pair) and tied the action with an emotion, such as not talking to their peers as feeling lost (G4_P2) and “not [feeling] comfortable [giving a medication]” as not having a “direct [provider’s] order” (G5_P2) and being “afraid of practicing out of [their] scope” (G8_Pair).

Participants also shared that not knowing could result in taking action or inaction. The most common action that resulted from not knowing was calling for help, including notifying the provider (G4_P1, G9_P2, G10_P1, G12_Pair, G13_P1), paging for the
rapid response team (G1_P2, G7_Pair, G14_Pair), or, to the more extreme, calling code blue (G3_Pair). Participants also stated that they collaborated more (G15_Pair) and followed their peer’s lead (G11_Pair, G14_Pair) when they did not know what to do or felt unsure about something. Alternatively, participants “froze” and “shut down” (G1_P1, G14_Pair), including not speaking up (G4_P2) or responding to peers (G1_P1), for not knowing how to proceed.

**Group Behavior Influenced Cognition**

Two categories emerged when group behavior influenced cognition: (1) questioning and (2) reflecting on their action or inaction. Participants questioned whether they should be administering a medication (G4_Pair, G7_Pair), whether they gave the wrong medication dosage (G2_P1, G4_P1), whether their action was effective (G5_Pair), and how to communicate with the provider (G3_Pair). They also reflected on their action or inaction. One participant reflected on giving medication by mistake, resulting in more thoughts and emotions:

P1: Yeah. Because I had already given the medication, you know, I was stressed prior to getting the order, and then whenever we did, and I just rushed to do it. And then I realized my mistake or that I had made a mistake. I didn’t even know what the mistake was. I don’t know if I gave him too much, too little, wrong route, [or] what it was. So, then my heart, like, my mind starts going of all the complications that could have arisen because of that. So, that’s when I got stressed (G4_Pair).

**Group Cognition Influenced Emotion**

Knowing or not knowing triggered emotions was the category that emerged from the cognition-emotion relationship. Not knowing triggered negative emotions was the most common and expected. The most described emotions by the participants due to not knowing were feeling “confused” (G1_Pair, G2_Pair, G3_Pair, G5_Pair, G6_P1,
“nervous” or “nerve-racking” (G1_P1, G2_Pair, G4_Pair, G5_Pair, G10_P2, G14_P2), “stressed” or “stressful” (G8_Pair, G13_P1, G14_P1), “lost” (G1_Pair, G4_P2, G10_Pair), “panicked” (G1_P2, G7_P1, G10_P1), “concerned” (G1_P1, G15_P2), “worried” (G1_P1, G8_P2), and “anxious” (G11_P1, G15_P2). Other emotions included feeling “uncertain” (G8_P2), “pressured” (G1_P1), “flustered” (G4_P1), “freaked out” (G1_Pair), “frustrated” (G1_P2), “startled” (G1_P1), “chaotic” (G10_Pair), “embarrassment” (G11_P2), and “debilitating” (G5_P1). On the flip side, knowing what to do activated positive emotions in participants. One participant from the group who solved the case before entering the high acuity and stakes shared,

P2: Um, a sense of like “Aha!” cause, like, we were like figuring it out. Yeah, because I had done one simulation prior, and it’s like, I was, like, not getting any of the stuff right. And this one felt, like, a little bit more, like, concise, and, like, I understood [it]. It felt that I could, like, follow, like, a path of, like, symptoms to, like, what was actually happening. Um. Yeah, it’s, like, a sense of, like, satisfaction because it was, like, “OK, I see low blood pressure. I see increased [in] respirations. She’s not feeling well. She has the rash. I can safely say that this is an allergic reaction.” So, yeah, a sense of, like, accomplishment (G11_P2).

Group Emotion Influenced Cognition

Categories that emerged from the group emotion-cognition connections were (1) negative emotions impeded thinking, (2) negative emotions stimulated thinking, (3) positive emotions influenced thinking, and (4) not letting emotions affect thinking.

Participants described how their emotions “slowed down” and “disrupted [their] thought process” (G16_Pair), which made it difficult to “concentrate,” “think straight,” and “think clearly” (G1_Pair, G5_P2, G5_Pair), resulting in forgetting information (G6_Pair, G13_Pair) and second-guessing themselves (G16_Pair). One participant described,

P1: And I think, as a group, we were really, like, afraid [of] what was going on. And so, I think that was just making our thought process kind of
everywhere, honestly, you know. “Check the orders?” “What do we do?” “What’s gonna push next?” “Do we call the code?” “Do we not call the code?” Even when we tried to call the doctor back and everything, there was just a lot of… It was, it was pretty chaotic, our thought process as a whole. (G10_P1)

Negative emotions could also activate and stimulate their thought processes. Participants stated their negative emotions heightened their alertness (G16_Pair) and focus (G8_Pair, G9_P1, G10_P2) to think more “critically” (G7_P1, G8_P2, G15_P1) and “deeply” (G15_Pair), weigh all the possible solutions (G5_P2, G8_Pair, G11_Pair, G14_P1), and motivate them to problem solve quickly (G7_P1, G8_P2, G11_P1, G15_P1). One participant described, “When I’m panicked, I guess I’m problem-solving” (G11_Pair). Another participant explained how their emotions influenced their cognition and, subsequently, action:

P1: Yeah, I think…that [emotion] leads me to, kind of, over, not overthink, or just, like, really analyze things, like, “OK, is this the right thing? Am I doing this right?” Yeah, I guess it just, you know, makes me kind of think more before, you know, taking action (G15_Pair).

Likewise, participants expressed that positive emotions also influenced their thinking. For example, participants felt “concerned” (G10_P1, G12_P1) and “motivated” to focus (G10_P2) and think logically (G7_P1). They also acknowledged that their peers appeared calm when figuring things out (G7_P2, G10_P1). Furthermore, participants felt supported by having peers there to stimulate their thinking (G1_P1).

Although emotions influenced participants’ thought processes, some participants tried stepping back to acknowledge their emotions (G15_Pair, G16_P1) and diverting negative emotions (e.g., stress) to positive ones (e.g., motivation) (G12_P1). One participant shared how they regulated their stress,
P1: For a moment, there’s that, like, wave of stress. But then you step back, and you say, “OK, I’m here to do a job, I’m a nurse. The patient is already stressed, [and] their family’s stressed. I can’t be stressed, too.” And then you, you go back to normal (G16_P1).

**Group Behavior Influenced Emotion**

Categories that emerged when group behavior influenced emotions were (1) taking actions activated positive emotions, (2) taking actions or not taking actions activated negative emotions, and (3) not receiving help resulted in negative emotions. Participants described that taking action made them feel calm and understand the situation better (G16_P2). Also, doing what they knew boosted their confidence (G7_Pair). They also felt safe interacting with peers as their actions and thoughts were validated (G4_P1, G11_P2). Taking actions or otherwise could also result in negative emotions, especially when the action was wrong (e.g., giving the wrong medications) (G4_Pair) or potentially caused patient harm (e.g., giving antihypertensive medications with low blood pressure) (G10_P1). Participants also felt guilty not consulting their peers before taking action (G5_P1) or stressed when dividing and ensuring tasks get done (G3_P2) as they wanted to be in control of the situation (G3_P2). Not receiving help from others with more experience, such as the provider or the rescue team, also stressed them out (G6_P2, G8_P1).

**Group Emotion Influenced Behavior**

Four categories emerged when group emotion influenced behavior: (1) having positive emotions drove an action, (2) having negative emotions drove an action, (3) having emotions resulted in inaction, and (4) not letting emotions affect their interactions. Participants described how positive emotions drove positive actions. For example, experiencing their or peer’s “sense of urgency” and “adrenaline rush” pushed them
forward to move faster (G2_P1, G7_P1, G9_Pair, G12_P2). Some peers described the feelings as a “positive kind of anxiety” (G2_Pair), “drives,” and “momentum” (G6_Pair). Also, participants felt confident and supported by their peers to take action (G3_P1, G7_Pair).

Although positive emotions drive positive actions, they could also result in negative actions. One dyad stated that their excitement and adrenaline made them communicate less (G9_P1, G9_P2). Another participant mentioned that giving the wrong medication was influenced by their peer’s overconfidence (G2_Pair). Also, participant trusted their peers to take the correct action (G9_Pair, G10_Pair, G12_Pair) without checking their work (G9_P2, G10_Pair). Consequently, one participant administered the wrong medication because their peer had “too much trust” in them without verifying it (G4_Pair). Participants also followed their peer’s lead and relied on them, trusting their clinical abilities (G6_Pair, G9_P2). However, trusting peers could also lead to wrong actions for not checking each other’s work. As one participant put it bluntly, “[They] could follow me off a cliff!” (G6_Pair).

Having negative emotions could also drive negative or positive actions or interactions. Participants took undesirable actions from having negative emotions, such as responding slower (G11_Pair, G16_P2), doubting themselves (G10_Pair, G11_P1), taking actions without a game plan (G14_Pair), skipping a few steps and missing clinical cues (G15_P1), and more commonly, communicating less (G1_P1, G5_Pair, G7_P1, G14_P1, G14_P2, G14_Pair). For example, participants described “blocking [their peer] out” (G5_Pair) and “shutting everything off” (G5_Pair), resulting in less communication. More alarming was when participants took the wrong action (e.g., giving the wrong
medication) when feeling unsure, stressed, and panicked (G2_P2, G4_Pair, G10_Pair).

One participant explained that their action of giving medication differed from their peer when experiencing negative emotions:

P1: I think I agree with her (P2). The panic and us being frazzled definitely affected [how we administer the medication]. [It] affected me differently because I was more so, “Just do it, just do it!” And I was in, like I said, I wasn’t thinking of a bad outcome. I was thinking, “Oh,” like this is, “All I’m doing is good.” Like, “Just push it, just give it.” And I think that’s where, you know, we differ. She was thinking, “Do it. Don’t do it. Why can’t we give it?” And I was thinking, “Just go, go, go!” (G10_Pair).

Conversely, having negative emotions could also result in positive action, such as motivating them to take action (G8_P1, G12_P1), getting into a “problem-solving mode” (G11_P2), delegating individual tasks (G10_Pair, G15_P1), being more cautious (G5_P2), wanting to do better (G4_P1), and communicating more (G15_Pair). One participant shared,

P1: I think [my emotion] kind of just made me want to communicate more. I would say, like, you know, like, the second half of this scenario is, like, I think, you know, once the emotion started coming in, I think it was just, like, we needed to communicate more, you know? And yeah, I think just using two brains is better than one. So, it’s like [communicating with each other] (G15_Pair).

Experiencing emotions could also result in not taking action, particularly negative emotions. For example, participants were more reluctant to speak up when uncertain (G1_Pair, G8_P2, G8_Pair, G14_P2), and they froze in action being panic and feeling uncertainty (G1_P1, G8_P2). Participants also acknowledged that emotions did not affect their interactions with peers (G7_P2, G8_P2, G14_P2, G15_P1, G16_P1) because they were “in the same boat” (G15_P2) and came to an agreement (G14_P1).
Collaborating in Different PCCDM Spaces and Simulation Phases

Collaboration among peers is dynamic as it occurs in different PCCDM spaces and simulation phases. Based on the concept analysis, PCCDM spaces include individual and collaborative spaces, and simulation phases consist of low, moderate, and high acuity and stakes.

Thinking in Individual and Collaborative Spaces

Thinking in individual spaces was when participants were in their own “headspace” to “reason” and “gather information” (G7_Pair, G15_P1) while remaining aware that their peers were also “figuring [things] out” (G7_Pair) and “double checking what [their peers were] doing in [their] head” (G13_P1). Although participants had “[their] own thought process,” they also tried to “feed off of what [their peers were] doing” (G15_Pair). The downside of thinking in their individual space was that the participants stopped listening to others by “tuning everything out” to “think on [their] own” (G13_P1) and “understand what needed to get done” (G14_P1, G13_P2) instead of just following peers (G13_P1). As one participant described, “I feel like I’m in my own little bubble when I’m thinking about what’s going on next” (G11_P1), and another participant stated, “I feel like I went [into] my zone at some point, so I didn’t know what was going on around me” (G14_P1). However, participants “came back into” the collaborative space after thinking in their individual spaces (G13_P2).

Taking Action in Individual and Collaborative Spaces

Participants remained in their individual space when performing independent tasks (G10_P2, G11_P2, G12_P1, G15_P1) to “get more done,” “cover as much ground,” avoid “doing the same thing” (G15_P2), and “save time” (G13_P1), especially when the
patient was deteriorating fast (G11_P1). Another reason for performing separate tasks was allowing their peers “focus on what [they were] doing at that moment” (G7_Pair).

Although they were “doing [their] own thing,” they ended up “coming together” to “problem solve” (G15_P1) and “work towards the same goal” (G16_Pair). For example, participants described “working towards [the same ideas] differently” (G14_P2, G14_Pair) while being “independent of each other” (G11_P1). One participant shared,

P2: I was gonna say, yeah, [we were in our individual space] because I think, like, we have to be, like, one piece of…a bigger part. So, like, we have to be [in] our own space in order to do the job. Like, you have to be in your own space to, like, call the doctor and focus on what you need to do, and then I need to be in my own space to do what I'm doing. (G8_Pair)

While participants took on individual actions, they remained aware of the patient’s condition, listened to what their peer was saying (G10_P1), and checked on each other’s work (G11_P2). As one participant explained,

P1: I’m a little bit different where I’m not in my personal space. I still feel, like, I’m in everyone’s, like…in the present with everyone in there, not just my own, because I felt, like, whatever decision I make, they have to know, or I will have to let them know. So, even though I’m doing my thing, or, like, not doing my thing, but doing a thing, it’s still for the benefits of the group. So, I wouldn’t say I was in my personal space if that makes sense (G8_Pair).

Participants shifted to the collaborative space when they needed to include their peers (G5_Pair, G9_P2, G10_P1, G11_Pair) and communicate with each other (G15_P1, G15_Pair) to be “on the same page” (G8_Pair, G10_P1, G12_Pair, G13_P1) while supporting each other (G4_P1, G7_P1, G11_P1, G13_P1). Thus, participants alternated between individual and collaborative spaces (G7_Pair, G11_Pair, G12_P1), “going back and forth constantly” (G13_Pair). One participant explained they “[could not] always
have a shared mind throughout the process” and had “moments where [they had] to step aside [and] think individually” (G7_Pair). Another participant shared,

P1: It’s like, at first, we were together on it, and then we separated, we did our own things, and now, we’re now, this is the point where we came back together, we’re like, “OK, now we’re doing this together, now we’re collaborating.” Like, “What should we do next now that we’ve done these things on our own?” (G11_Pair).

**Experiencing Emotions in Individual and Collaborative Spaces**

Because participants rarely shared their emotions openly and explicitly, they experienced those emotions in individual spaces. One participant shared how they expressed their emotions internally,

P2: So… I feel, yes, we have moments where we’re in separate space. And the moment [the patient] got even worse off, he started coughing and all that stuff, I’m like, “Oh my God, Oh my goodness!” Like, first I’m like, I’m like, “OK, what is going on?” (G7_Pair)

However, as discussed earlier, participants “learned to set aside those emotions” (G16_P1) or “step out of that shock” (G7_Pair), prioritizing their thoughts and actions over emotions because “the patient [was] a priority” (G16_P1). Several participants shared “not letting [their] emotions drive [their] actions” (G13_P1) or “control how [they] think” (G8_P1). One participant explained shifting emotions to thoughts and actions:

P1: I think my thoughts were more present than feelings at this point because, at first, it was like panic, and then it was like, “OK, well, I’m checking off boxes now.” I’m going down a checklist of, “OK, we’ve done this, this, and this. What would be next?” Like, if I was reading this in a book somewhere, what would be the other options that I have? And I think the next thing I do is, I just, I think, I pick up the chart after this, and I start looking at, “OK, well, what else is she taking? What else is in her history? What are the orders? What else can I do?” (G11_Pair)
Thus, participants’ emotions were either shifted and suppressed in their individual space or not readily expressed with their peers in the collaborative space.

**Collaborating During Low Acuity and Stakes**

The low acuity and stakes phase started at the beginning of the simulation when the patient was relatively stable. Participants were more “cooperative” (G2_Pair, G8_P1), thinking together while “piggybacking off one another” (G10_P1), mainly because they remained calm (G1_Pair) and were not experiencing too many intensified emotions (G1_Pair, G2_Pair, G7_Pair, G8_P1, G15_Pair). Thus, they were “able to think of the steps to take” (G12_P2), understand each other (G8_P1), and communicate with each other when needed (G10_P1). Communication was more “unsaid” (G10_P1) because they knew the routine of performing different tasks (G3_Pair, G9_P2).

Also, participants did not feel the need to divide tasks (G9_P1) or take charge and lead because “it wasn’t an emergency…and [they] had some time to collaborate” (G4_P2). Consequently, some participants did not have a clear role from the beginning (G9_P1) as they were taking on different tasks (G10_P1). As one participant shared,

P2: Initially, with [reading] the [electronic health record] and receiving the report. Obviously, we’re all, we’re both together for that one. And then… not really afterward. There wasn’t really, like, a specific point where we were doing it. It was kind of…we were doing, like, a whole assessment, but pieces, like piece by piece, like she would [take] a piece, and then I would take a piece, she would take a piece, and I would take a piece (G9_P2).

**Collaborating During Moderate to High Acuity and Stakes**

As the scenario’s acuity and stakes increased, participants started to direct their attention to the patient (G12_Pair), including initiating actions and taking on different independent tasks and roles (G9_P1, G12_P1). Participants believed in “doing different
things” and “utilizing two people” to accomplish more (G14_Pair). However, some participants communicated less, or not at all, during higher acuity and stakes (G1_Pair, G5_P1) because it was time-consuming (G13_Pair). As one participant shared,

P1: Yeah, I felt, like, it was an emergency situation. So, it’s, like, just do what you can, not like, “So, what are we going to do right now?” kind of thing, you know, like, we couldn’t stop and plan. (G14_Pair)

On the flip side, some dyads started “talking more and communicating better” (G13_Pair) by speaking their minds and brainstorming (G10_P1, G15_Pair), realizing that they should include peers in the decision-making process (G10_P1) and not making decisions on their own (G1_Pair).

Some participants led or took charge of the situation (G12_P1) by delegating roles and tasks (G9_P2), while others did not (G4_P2, G6_P2). One participant explained the importance of taking charge in an emergency,

P2: I think that when you have an emergency situation, you do generally need one person who is in charge to delegate to some extent, so that there [are] clear priorities, and not one person is doing something [and] the other person is doing something [else], and no one knows what the other person is doing. I think having one person who has a picture in their mind of what needs to be done in the steps and watch those [that] need to be done is good. Kind of like they take timeouts, you know, [during] an emergency situation in the hospital before they intubate or something like that. The doctor will take a timeout, or someone will take a timeout, and they’ll say, “OK, this needs to be done, this was done,” and they checked in. (G3_P2)

However, participants could blindly follow their peer’s instructions, such as giving the wrong medications, because they were uncertain (G2_Pair). As their emotions intensified (G1_Pair, G6_Pair, G7_Pair, G10_P1, G14_P2, G15_Pair, G16_Pair), and they no longer knew what to do next, most participants relied on the provider or rapid response team to move on (G1_P1, G1_P2, G7_Pair, G10_P1, G10_P2, G11_P1, 3).
Thematic Analysis: Group Emotion

This study’s second aim was to explore nursing students’ group emotions during PCCDM in simulation using thematic analysis. The themes that emerged were (1) not expressing group emotion explicitly, (2) prioritizing group thinking and action over emotion, (3) experiencing various emotions throughout the simulation, and (4) experiencing similar or different emotions than peers.

Not Expressing Group Emotion Explicitly

One of the main reasons that participants did not verbalize or communicate their emotions was that they believed it was inappropriate, especially in front of the patient and family members. One participant explained it was “challenging as how to communicate [their emotions] without getting the patient upset or scared” (G4_P1). Similarly, another participant stated that expressing their feelings to their peers in front of the patient and family members would make them “even more worried” (G5_Pair). One participant shared,

P1: I don’t think it’s good for the patient to see the nurse, like, under stress because then that’s when they’re like, “Oh, I should be under stress too if the nurse is stressing out,” you know, it’s good to keep the patient calmed. [It] could have helped with the breathing, too, if you calm them down (G14_P1).

Because their focus was the patient, participants believed sharing their emotions was not the priority (G2_P2) as there was “no time [for them] to focus on how [they feel as] the patient was declining” (G5_Pair). When asked why they did not express their feelings, one participant shared,

P1: I didn’t wanna be the patient in this situation, like, I wanted to, I wanted us to focus on our patient. I don’t wanna bring my emotions into it, in any real life, like, I probably wouldn’t ever tell another nurse that I am because, like, I’m not the focus in the situation. So, that’s why (G13_P1).
Another reason why participants did not share their feelings explicitly was that they assumed their peers knew how they felt. One participant explained,

   P1: I was comfortable [with] the fact that she knew exactly what I was going through. Like she knew that I was stressed. She knew that I [had] made a mistake. She knew that I was trying to figure it out, and I think that she felt the same sense of urgency, and I didn’t have to say, “Hey, I’m really stressed out,” right? You know, she already knew that (G4_Pair).

Some participants acknowledged that they were “not expressive” (G5_P2) and “not good at expressing [their] emotions or sharing [their] thoughts about the emotions” (G4_P2). Regardless, participants believed that if they were to express their feelings, it should be done after stepping away from the patient (G5_Pair, G16_P1), allowing them to seek emotional support from their peers if needed (G4_P1).

Although participants did not share their emotions explicitly during the simulation, they expressed them through interjections during the simulation. The most common interjections were “Oh my God,” “Oh my gosh,” or “Oh my goodness” (G3_X5; G3_Z5; G4_AC5; G4_AI5; G5_K5; G7_J5; G8_S5; G8_U8; G9_Z5; G10_R5; G16_Z5); “Oh, no!” (G8_X5; G8_AB5; G11_M5; G14_F5; G15_Y5; G15_AC5); and “Shoot!” (G12_AL5; G14_AC5; G15_Y5). Other less common expressions were “Shit!” (G8_AB5), “We need help!” (G3_AG5), “Bummer!” (G4_AB5); “Yay!” (G4_AN5), “Jeez” or “Jeez Lewis” (G4_AQ5), “Aaahh…” (G5_H5), “Oh, dang!” (G8_L5), and “Ugh!” (G8_R5). These interjections denoted mostly negative (e.g., “Shoot!”) rather than positive emotions (e.g., “Yay!”). They also showed their emotions from their voice tones and loudness, including nervous tone (G4_AM5; G10_V5) or raising their voice (e.g., “Call the code!”) (G3_T5; G7_X5; G9_U5; G9_W5; G9_Z5), and their non-lexical
expressions, such as sighs (G3_AF5; G4_M5; G5_O5; G7_P5) and nervous laughs (G3_AF5; G8_L5; G9_X5; G10_AB5; G10_AF5).

**Prioritizing Group Thinking and Action over Emotion**

Participants prioritized their thought processes and actions by channeling their focus on the patient (G9_P2, G15_Pair, G16_P1), allowing “[their] mind to take over [their emotions]” (G16_P1) and “think logically” (G8_P1, G15_P2), especially in critical situations (G7_Pair). When asked whether their thoughts, actions, or emotions dictate their decision-making, one participant explained that “[their] thinking [was] more amplified than [their] emotions” and “let logic works its way” (G8_P1). Another participant described,

P1: I think taking action and thinking probably take priority over feelings. You know, the feeling is kind of like, right, I’d say [at] the moment or when the families, you’re like, “OK, address that.” But now it’s OK, we need to, we need to take action, and we need to, you know, kind of just critically think and figure out what’s going on. So, I think, you know, the taking action and thinking definitely, you know, take priority (G15_P1).

Another participant also shared the same opinion,

P2: I would say thinking and taking action would dominate more. I’d say thinking dominates more, just thinking about the whole scenario and what could I do here? And then taking action, you would take action based on those thoughts. Um, feelings? Try not to let them get in the way. They’re good to some [extent] a little. Like I said before, like, it’s good to have a little bit of fear, a little bit of anxiety to, like, make you react, but you don’t want to be crippled by the fear and anxiety. Um, but I think thinking and taking action dominate [emotions]. Yeah (G15_P2).

Some participants did not allow emotions to control their thoughts and actions. They stated that their personality or how they were trained in school determined how they prioritized their thoughts, actions, or emotions (G13_P1, G16_P1). One participant described,
P1: I try not to let my emotions drive my actions. We, especially in, like, patient care, that’s very important. But, like, I just don’t think I’m that kind of person to let emotions drive my actions. Like, I always want to think first and make the best decision. I feel like that just depends on the person, kind of. But I mean, I kind of feel like we’re taught to not, not let our emotions drive our actions, being in like the nursing profession. So yeah, that’s what I tried to not do. But if I ever feel like my emotions are like overcoming the situation, I would, like, call the charge nurse or another nurse to help, yeah (G13_P1).

**Experiencing Various Group Emotions Throughout the Simulation**

It was expected that participants experienced multiple emotional states in different simulation phases. Participants experienced positive, negative, and mixed emotions during the simulation.

**Experiencing Positive Group Emotion**

Positive emotions were (1) feeling supported or comforted, (2) feeling of trust, (3) feeling confident, (4) feeling comfortable, (5) feeling accomplished, (6) feeling calmed, (7) feeling motivated, and (8) feeling eager or excited. Participants felt supported and comforted having peers thinking with them, including having “another mind” (G13_Pair) or “two brains” (G15_P2) to “bounce ideas off” of each other (G11_P1). One participant shared,

P1: Yeah, the patient was, like, distressed and anxious. So, I felt, like, a little anxious because of that. But like I said, like, I felt, like, I felt comfort knowing, like, he (P2) was there too, like, just another mind in that situation. (G13_Pair)

They also felt supported as peers “had more experience” (G13_P1), “picked up on [cues] quickly” (G7_Pair), and “knew what [they were] doing” (G3_Pair). Furthermore, participants were comforted knowing their peers were “on the ball” (G7_Pair, G9_P1), and they could “do multiple things at once” (G11_Pair) by delegating tasks to each other.
Lastly, participants felt supported knowing that they were not alone (G3_Pair, G6_P1) as “[they] were in this together” (G11_Pair).

Participants also mentioned having trust in peers, including trusting peer’s decisions (G4_Pair, G7_Pair) and what they were saying or doing (G3_Pair, G4_Pair, G6_Pair, G7_Pair, G9_Pair, G15_Pair). Participants trusted their peers as they knew each other well (G3_P1, G13_P2). Besides trust, participants felt confident in their peers for their experience and knowledge (G14_P1), actions (G9_P2, G11_P2, G11_Pair), and the way they spoke, such as speaking “with authority” (G3_Pair). Participants also felt confident in themselves during the simulation, knowing they “did everything to the best of [their] knowledge and abilities” (G7_Pair) and were “heading in the right direction” (G7_Pair).

**Experiencing Negative Group Emotion**

Negative emotions experienced by participants were (1) feeling unsure, uncertain, and lost; (2) feeling inadequacy or insecurity; (3) feeling anxious, nervous, or scared; (4) feeling pressured, stressed, or overwhelmed; (5) feeling frustrated; (6) feeling worried; (7) feeling helpless; (8) feeling panicked; (9) feeling disappointed; (10) feeling abandoned; and (11) feeling shy. Participants felt unsure and uncertain about their thoughts or actions, including questioning their own actions (G2_P2, G5_Pair, G15_Pair), resulting in panic (G11_Pair) and anxiety (G15_Pair). They also experienced uncertainty in themselves, including having “self-doubt” (G15_P2), “second-guessing [themselves]” (G11_Pair), not having “[self]-confidence” (G7_Pair), and felt like “the blind leading the blind” (G15_P2).
Participants also felt anxious or nervous about their thoughts and actions and the clinical situation. They experienced those emotions primarily because of the deteriorating patient, but also the external noises and distractions made the family members (G5_P1, G14_P2, G16_P2, G16_Pair) and the simulation’s realism (G2_P1, G15_P2). For example, one participant felt nervous about calling “a fake doctor” (G3_Pair). Similarly, participants also felt stressed, pressured, and overwhelmed by the deteriorating patient and family members (G5_P2, G6_Pair, G11_Pair, G14_P1, G15_P1) because they had to “focus on two patients” instead of one (G16_Pair).

Participants reflected on their inadequacy and insecurity, including “doubting [themselves]” (G15_P2) and questioning whether they were “doing the right thing” (G7_P2), they were “not good at [simulation]” (G7_P1), or they “should [have] known [the information]” (G11_Pair). One participant described their experience of inadequacy and insecurity,

P2: I reached a point where, yeah, I was still thinking about the patient, but then I started thinking about me, and I was like, “This is not good, I don’t know what to do.” And all of a sudden, I feel like, for me, the focus did shift to me, at one point, as a student in my lack of knowledge, my lack of competency in this situation. And it was just more of a frustration, like, [I] mentioned to you (the interviewer) earlier, I got frustrated with myself. I didn’t know what to do, and I thought, I think, “I should know this, right?” (G1_Pair).

**Experiencing Mixed Group Emotion**

Emotions that could be perceived as positive or negative were (1) anticipating and (2) feeling a sense of urgency. Participants experienced positive anticipation by “thinking ahead” (G10_P1) and responding accordingly to the situation (G1_Pair, G3_P1, G3_Pair, G11_Pair). On the other hand, negative anticipation was “waiting for something to
happen” but “[not] knowing what to do” (G1_Pair). One dyad shared their experience about their anticipation,

P1: I was like, “Something’s gonna happen.” I was just waiting for something to happen. And then when it was kind of, like, getting worse, and then it was just not really getting better, I don’t know. I thought [the oxygen saturation] would shoot up to, like, 95, like…
P2: Yeah, I was waiting.
P1: Right. And like, I think that’s when I was like, “OK, I really don’t know what to do anymore.” And like, yeah, I’m like, “Should I be…Should I know this? Should I not?” Like, I don’t know how much I was supposed… I think I was like, “Oh, maybe I should already know this” (G1_Pair).

Participants also felt a sense of urgency, “adrenaline spike” (G9_Pair), or “fight or flight” (G7_P1). A positive sense of urgency prepared participants to get into the “interventional” mode (G9_Pair), feeling the urge to help the patient (G2_Pair, G12_P1), and pushed them to take action and move forward (G9_Pair). However, a negative sense of urgency triggered negative emotions (G9_Pair) and resulted in a wrong action (G12_Pair). One participant shared,

P2: “Oh shoot!” That was the emotion. It’s like, “Oh shoot,” like, “This is not gonna go well very quickly,” or the expectation at that point for me was that it was going to turn south really quick because [the] respiratory [condition] is such a big issue, and if you have a respiratory issue, that can create a whole host of other issues. So, that was the “Oh shoot!” (G9_Pair).

Experiencing Similar or Different Emotions as Peers

Some participants experienced the same emotions as their peers (G1_P2, G4_P2, G14_P2, G15_P2, G16_P1), but others did not (G7_Pair, G12_P2, G14_P1).

Experiencing the same emotions as peers comforted them, knowing they were not the only ones who felt that way. As one participant shared,

P2: I feel, I personally feel she was in the same boat as me–she was feeling the nerves. I could hear it in her voice, the kind of that jitteriness that I felt I
had. So, it was somewhat comforting because I felt so lost that it was nice to know, “OK, I’m not the only one,” Like she’s lost too. So, it helped me to know that I’m not as incompetent as I think at that time. I think it’s nerves and just inexperience (G1_P2).

Some participants compared themselves to their peer’s emotions, perceiving their peers to be “more calmed” (G14_Pair), “stayed collected” (G12_P2), and “less frustrated [and] flustered” (G4_P1). However, some participants acknowledged they were not as confident as their peers perceived (G7_Pair).
Figure 4-1
Ngo’s PCCDM Theoretical Framework
### Table 4-1

**Participant Demographics**

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Table 4-2

*Simulation Experience*

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Table 4-3

**Knowing and Experience Working with Each Other**

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Table 4-4

Simulation Cases

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### Table 4-6

*Domains, Categories, and Subcategories*

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<td>Talking out loud</td>
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<td>Asking or questioning</td>
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<td>Group Emotion</td>
<td>Having an awareness of emotions</td>
<td>Sensing their peer’s emotions</td>
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<td>Sharing the same emotions</td>
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<td>Communicating emotions</td>
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<td>Communicating emotions non-verbally</td>
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<td>Regulating emotions</td>
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<td>Controlling individual and group emotions</td>
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<td>Supporting each other’s emotions</td>
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<td>Experiencing different types of emotions</td>
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<td>Experiencing mixed emotions</td>
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<th>Regulating actions, behaviors, or roles</th>
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<td>Taking appropriate actions</td>
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<td>Prioritizing what needed to be done</td>
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<td>Responding to the situation using thought processes</td>
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<td>Taking the wrong actions or missing the right actions</td>
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<td>Not consulting peers results in a wrong action</td>
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<td>Reacting to the situation without thoroughly checking their actions</td>
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<td>Not taking action</td>
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<td>Agreeing or disagreeing with peers</td>
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<td>Including or not including peers in decision-making</td>
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<td>Interacting with peers</td>
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Table 4-7

*Relationships Between Domains*

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<tr>
<th>Domains</th>
<th>Categories and subcategories</th>
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<tr>
<td><strong>Group cognition influences behavior</strong></td>
<td>Thinking prompted actions</td>
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<td>Taking action based on analytical reasoning</td>
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<td>Taking action based on intuitive reasoning</td>
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<td>Taking action based on prior knowledge and experience</td>
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<td>Thinking resulted in inaction</td>
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<td>Pausing</td>
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<td>Hesitating to take an action</td>
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<td>Not knowing prompted actions</td>
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<td>Calling for help</td>
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<td>Collaborating more</td>
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<td>Following their peer’s lead</td>
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<td>Not knowing resulted in inaction</td>
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<td>Freezing</td>
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<td><strong>Group behavior influences cognition</strong></td>
<td>Questioning an action</td>
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<td>Reflecting on their action or inaction</td>
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<td><strong>Group cognition influences emotion</strong></td>
<td>Not knowing triggered emotions</td>
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<td>Not knowing triggered negative emotions</td>
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<td>Knowing triggered emotions</td>
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<td>Knowing triggered positive emotions</td>
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<tr>
<td><strong>Group emotion influences cognition</strong></td>
<td>Having negative emotions impeded thinking</td>
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<td>Having negative emotions stimulated thinking</td>
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<td>Having positive emotions influenced thinking</td>
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<td>Not letting emotions affect thinking</td>
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<td><strong>Group behavior influences emotion</strong></td>
<td>Taking actions activated positive emotions</td>
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<td>Taking actions or not taking actions activated negative emotions</td>
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<td>Not receiving help resulted in negative emotions</td>
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<td>Group emotion influences behavior</td>
<td>Having positive emotions drove an action</td>
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<td>Having negative emotions drove an action</td>
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<td>Having emotions resulted in inaction</td>
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<td>Not letting emotions affect interactions</td>
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CHAPTER 5: DISCUSSION

Peer collaborative clinical decision-making (PCCDM) is inherently complex that involves intricate connections between group cognition, behavior, and emotion in different PCCDM spaces and simulation phases. Exploring each domain and the relationships between domains based on the emerging categories of awareness, communication, and regulation (peer regulatory process) provides the framework of PCCDM. This chapter will present (1) the PCCDM framework by explaining the group dynamics of each domain and peer regulatory process (PRP), (2) themes from group emotion in PCCDM and their significance, and (3) the implications and future research of the PCCDM framework and group emotion in education and simulation.

PCCDM Domains

The PCCDM domains are group cognition, behavior, and emotion. As mentioned in the last chapter, the term group denotes the individual and the sum of contributions to the group process. Individual contributions include personal cognition, behavior, and emotion from peers demonstrated and shared by an individual, while the sum of contributions is the shared cognition, behavior, and emotions among peers. The individual or group contributions can add value to the group process (e.g., identifying relevant clinical cues), but they can also steer it towards a negative outcome (e.g., giving the wrong medication). However, positive group cognition, behavior, and emotion that go through an effective PRP will hopefully lead to a positive group performance.

Group Cognition, Behavior, Emotion

The definition of PCCDM encompasses the cognitive and socioemotional interactions among peers about a clinical situation. The terms cognition, behavior, and
emotion are broad in different disciplines; thus, it is vital to justify these terms in relation to PCCDM. In general definitions, cognition is conscious and unconscious knowing to awareness and perception of an event (American Psychological Association, n.d.-b; Britannica, 2023). In this study, group cognition is the inter-subjective knowledge constructed and shared by peers to make clinical decisions through their narratives and clinical actions, requiring activities mediated by artifacts and signs (Vygotsky, 1978). Thus, it excludes the unconscious knowing to the peers’ awareness and perception. Group cognition in nursing simulation includes co-constructing and sharing knowledge among peers (Berndt et al., 2015; Bucknall et al., 2016; Carey et al., 2018; Fieler et al., 2021; Himes & Ravert, 2012; S. J. Lee et al., 2015; Rogers, 2011).

The American Psychological Association (n.d.-a) defines behavior as observable and non-observable activities responding to external or internal stimuli. Group behavior includes observable clinical actions, inactions, and interactions taken by peers and their perceptions of those processes. Therefore, group behavior does not merely focus on clinical actions taken or not taken by peers but their interactions with each other. These peer interactions in simulation include promoting group cohesiveness (Badowski, 2019), understanding roles and responsibilities (Carey et al., 2018; Hayes et al., 2019; Hustad et al., 2019; Najjar et al., 2015), empowering and supporting peers (Carey et al., 2018; McWilliams et al., 2021; Söderström et al., 2012), and sharing common goals (Kessler & Kost, 2021; S. J. Lee et al., 2015).

Emotion is a complex experiential and biobehavioral reaction to a significant event or state (American Psychological Association, n.d.-c). Group emotion in this study is perceived and shared feelings as well as their tone of voice and non-lexical expressions
displayed by peers. As peers do not readily share their feelings, those implicit emotions observed during simulation are essential to understand group emotion for this study.

Although the literature on group emotion in nursing simulation is limited, a few studies support its importance. For example, Najjar et al. (2015) found that emotional processing does not start until students’ anxiety is dispelled, usually at the end of the simulation. Hustad et al. (2019) reported that simulation is essential in promoting self-confidence among nursing students through positive feedback, self-awareness, and positive attitude change.

**Peer Regulatory Process**

The peer regulatory process (PRP) consists of (1) having an awareness, (2) communicating, and (3) regulating the three PCCDM domains of group cognition, behavior, and emotion. The PRP is part of the group dynamics, which directs the outcomes of PCCDM. The process involves one or all the PRP components. For example, students may not be completely aware of their peers’ thought processes before communicating and regulating their thoughts and ideas. Lacking one or more PRP components may lead to less ideal PCCDM. Thus, peers should have some degree of awareness, communication, and regulation of individual and shared cognition, behavior, and emotion in PCCDM.

**Having an Awareness of Group Cognition, Behavior, and Emotion**

Awareness of individual and group cognition, behavior, and emotion is critical in PCCDM. Self-awareness in nursing is the awareness of individual traits, emotions, actions, and beliefs with others and environments within their contexts (Rasheed et al., 2019). Thus, having self-awareness in PCCDM contributes to group awareness, allowing
peers to understand their cognition, emotion, and behavior. Conversely, group awareness also informs individuals’ cognitive and social attributes, including the outcomes created by the group (Buder et al., 2021). Therefore, group awareness serves as a mediator to bridge the gap between individual and group contributions in the problem-solving process (Schnaubert & Bodemer, 2022).

Students perceive group cognition by comparing theirs with peers’ thought processes and knowing, or assuming they know, what their peers are thinking. They tend to have the same thoughts based on their cognitive processes to formulate hypotheses, plan clinical actions, and subsequently have an agreement regardless of whether they know each other. When peers have different thoughts or thought processes, they communicate those thoughts with their peers or demonstrate them through their behavior (e.g., hesitating about an action). Students also make assumptions about their peers’ thinking, actions, or inactions. Although verbalizing their thoughts allows peers to know what they are thinking, non-verbal communication (e.g., being quiet or silent) also gives clues to their peers’ thoughts (e.g., not knowing the next step). Similarly, observing peers’ actions or inactions allows them to know their peers’ thought processes. Knowing each other well and being trained in the same nursing program are the main reasons they could tell what their peers think.

Students are also aware of group behavior by observing peers’ actions or behaviors, perceiving group dynamics, and perceiving their peers’ roles. Observing their peers’ actions or behaviors activates their thought processes (e.g., knowing the clinical situation) and emotions (e.g., feeling supported by peers). Students also perceive positive or negative group dynamics and their roles in the collaboration based on their
interactions. Sensing peers’ emotions through their voices, statements, and actions or inactions during the simulation is common in PCCDM. These emotions can be positive, negative, or a mix of both. Students also share the same or different emotions experienced by their peers.

Nickerson (1999) argues that humans construct models of what others know or feel through (1) direct observation of one’s actions, (2) shared context and affiliation, (3) shared previous experiences, and (4) levels of knowledge. For example, students may assume their peers know what to do based on their actions (direct observation) or their experience working together in simulation. However, over-imputing their knowledge about peers can misestimate what their peers know without clear communication (Nickerson, 1999). Thus, making assumptions about group cognition, behavior, and emotion should be minimized to avoid ambiguity. Instead, peers should communicate their thoughts, actions, and feelings for effective PCCDM.

Communicating Group Cognition, Behavior, and Emotion

Successful group collaboration requires effective communication, efficient work processes, and peer commitment (Kwon, 2020). Students communicate group cognition by sharing, verbalizing, and questioning their and peers’ thoughts, ideas, and clinical data. They also communicate group behavior by speaking out loud or discussing clinical actions, ensuring they are on the same page. In contrast, students do not communicate with peers because they (1) lack the knowledge to share, (2) think on their own, or (3) believe they are on the same page with their peers. They also communicate in different manners, from more (e.g., instructing or telling) to less directness (e.g., suggesting or asking). Communicating with inter-animation, including debating, negotiating, and
having diverging views, is considered a true dialogic knowledge construction (Trausan-Matu et al., 2021). Thus, simply verbalizing their thoughts or actions and agreeing or disagreeing without in-depth discussion does not promote peer dialogues in PCCDM. However, time remains the critical factor determining peer communication in different simulation phases, especially during high-acuity and stakes situations.

Communicating group emotions can be verbal or nonverbal. Students rarely verbalize their emotions for (1) wanting to focus on the patient, (2) believing it is inappropriate to share their emotions in front of the patient or family, (3) assuming their peers know how they feel during the simulation, and (4) they do not know or want to share their emotions with peers. Communication of group emotion using expressive words (e.g., “Oh my God!”), tones of voice, and non-lexical expressions (e.g., sighs) are more common expressions in simulation. Although immersive VR simulation limits face-to-face interactions and nonverbal communication (e.g., body language), several studies have shown that it still enhances communication during student collaboration (Qiao et al., 2021).

**Regulating Group Cognition, Behavior, and Emotion**

Students regulate group cognition by (1) activating prior knowledge, (2) incorporating reasoning, and (3) focusing on their thought processes. Their prior knowledge includes theoretical knowledge, clinical practice, and work experience. Students also use reasoning skills, including analytical and intuitive thinking, to recognize and analyze relevant data, formulate hypotheses, generate solutions, and evaluate outcomes. The NCSBN’s Clinical Judgment Measurement Model emphasizes (1) prior experience and knowledge as one of the contextual factors influencing clinical
judgment and (2) clinical reasoning as the cognitive operations to achieve clinical judgment (Dickison et al., 2019). Although students focus on group cognition and behavior, overfocusing or fixating on one clinical cue or action leads to tunnel vision and missing other relevant cues. Having tunnel vision is one of the reasons why students lose their situational awareness during simulation (Hunter et al., 2021). Also, students who fixate on irrelevant cues in a discrimination learning task increase their prediction errors (Torrents-Rodas et al., 2021). Therefore, discerning relevant information is a critical aspect of group cognition regulation.

Students also regulate group behavior through actions, inactions, and peer interactions, which can result in positive or negative outcomes. They regulate their interactions by agreeing or disagreeing, leading and supporting, and including or not including peers in the decision-making process. Instead of passively agreeing with peers, conflicting ideas can lead to a greater group awareness of individual similarities and differences and, subsequently, higher learning gains in problem-solving (Buder et al., 2021). Regardless of whether peers agree or disagree with each other, the outcomes matter most ultimately. Leading and supporting each other during simulation is also essential for regulating group behavior. A recent meta-analysis found that peer learning is more effective among nursing students if the peer tutor is supportive and willing to share and discuss (Choi et al., 2021). Also, peer socialization and collaboration promote communication skills, critical thinking, and self-confidence (Stone et al., 2013). Therefore, leading and supporting peers while including them in collaboration is crucial in PCCDM.
Students control individual emotions and rarely as a group. They also support each other’s emotions during the simulation. Strategies regulating emotions include (1) selecting and modifying the situation, (2) changing the perception of the input, (3) reappraising emotional response, and (4) targeting emotional expressions (Suri & Gross, 2016). Although students may not alter the situation much, they can change their perception and reevaluate their emotions during simulation. They also try not to express their emotions explicitly to their peers. However, interpersonal emotion co-regulation through individual expressions also regulates peers’ emotions; thus, peers who communicate and share their emotions strengthen their relationships (Fischer & Manstead, 2016). Because students do not readily share their feelings, emotions are less likely to be co-regulated. Consequently, group emotion is the least articulated domain during simulation, even though it is significantly associated with the other domains.

**Relationships Between Domains**

Since group cognition, behavior, and emotion are interrelated, exploring their relationships provides an understanding of how peers interact and respond to each other making clinical decisions during simulation.

**Group Cognition Influences Behavior and Emotion**

The relationships on how group cognition influences behavior and emotion include how thinking and knowing drive an action or inaction and trigger emotions. Thinking by activating prior knowledge and experience and incorporating reasoning is common and based on the information-processing and dual-processing theories discussed in chapter one. These thought processes can drive an appropriate, inappropriate, or irrelevant action or inaction, and they can result in positive, negative, or mixed emotions.
Though taking clinical actions tends to occur more frequently in simulation, inactions also play an important role in PCCDM. Inactions (e.g., pausing and hesitating about an action) give students the time to think to avoid significant mistakes. Pausing, similar to hospital timeout, is essential in clinical decision-making to stop possible negative momentum (e.g., taking actions quickly but inappropriately) and drifting during action (e.g., distracted by mundane tasks) (J. Y. Lee et al., 2021). Although hesitation about an action can be perceived as unfavorable (e.g., lacking confidence), Hoffman & Elwin (2004) found that new nurse graduates who are hesitant in making decisions demonstrated higher critical thinking than those who do not hesitate.

Knowing the correct steps during simulation promotes positive emotions, but not knowing them can activate actions, inactions, or negative emotions. When there is a mismatch between clinical cues and outcome expectations, students rely on and seek help from those with more experience than their peers, such as calling the rescue team or the provider (Tower et al., 2019). The benefits of using this approach can be mixed—being cautious and thinking forward to prevent further patient deterioration or heavily depending on others by “passing the buck” without activating their thinking and learning. Inactions from not knowing (e.g., “freezing”) can be observed during simulation, which can be associated with cognitive factors and happen more frequently in those who avoid losses than those who seek rewards (Alban & Pocknell, 2017). An example is administering a medication but potentially giving the wrong medication. Students concerned with possible patient harm (loss-avoiders) may not give the medication compared to students who want the patient to get better (reward-seekers).
The behaviors of taking action or inaction and how they associate with emotions can be explained by the behavioral inhibition and activation systems proposed by Gray (1970, 1987). Gray’s Reinforcement Sensitivity Theory posits that the behavioral inhibition system (BIS) reduces responses to avoid negative outcomes, and the behavioral activation system (BAS) responds to positive stimuli. However, activation of BIS may result in negative emotions (e.g., anxiety), and stimulation of BAS may trigger positive emotions (e.g., excitement). Gray’s revised theory hypothesizes that BIS inhibits, detects, and resolves conflicts, which can be achieved through approach or avoidance (J. A. Gray & McNaughton, 2007). For example, the conflict between giving or not giving a medication (activation of BIS) results in negative emotions (anxiety) among peers as they decide whether to give or hold the medication. Also, individuals have different BIS-BAS traits based on their psychophysiology (Harmon-Jones et al., 2013), which is out of the scope of this study.

**Group Behavior Influences Cognition and Emotion**

Group behavior influences cognition and emotion by questioning or reflecting on an action or inaction and activating positive or negative emotions from an action or inaction. Students question their peers when unsure whether the actions are appropriate or relevant. Questioning peers allows further discussion about a particular action, preventing potential nursing errors (e.g., giving the wrong medication). However, students may not stop to question peers for emotional reasons, such as overly trusting peers and feeling embarrassed for not knowing. Although it is unclear whether questioning affects clinical reasoning directly, many studies show that the type of questions asked (i.e., low versus high cognitive levels) influences nursing students’ critical thinking (Merisier et al., 2018).
Students also reflect on their actions or inactions during simulation, which may subsequently activate emotions. Reflection-in-action (reflecting while collaborating and caring for the patient in simulation) requires students to pause and share their thoughts aloud to be effective (Mulli et al., 2021). However, speaking their thoughts can work both ways—allowing peers to understand their thought process or adding unnecessary “noise” if the information is irrelevant. Thus, communicating pertinent information without the “fluff” is essential in PCCDM. Also, taking action can generate positive, negative, or mixed emotions depending on the type of action. In particular, giving the wrong medication activates negative emotions. Consequently, negative emotions, such as fear and anxiety, influence students’ thought processes during simulation, including reflection-in-action (Mulli et al., 2022).

**Group Emotion Influences Cognition and Behavior**

Cognition and behavior influenced by group emotion include experiencing positive or negative emotions that can impede or stimulate thinking and drive an action or inaction. Also, students tend not to let their emotions affect their thinking and peer interactions. Negative emotions (e.g., insecurity or anxiety) can disrupt cognitive processes affecting their attention, memory, and problem-solving. These negative emotions can also drive undesirable clinical actions (e.g., communicating less with their peers) or result in not taking any action (e.g., not speaking up). Conversely, negative emotions can activate thinking, such as brainstorming and thinking of all the possibilities with peers, and drive positive actions, such as getting into problem-solving mode by communicating more and delegating tasks. Experiencing positive emotions (e.g., feeling supported by peers) also influences their thinking (e.g., becoming more attentive) and
drives positive (e.g., moving faster) or negative actions (e.g., giving the wrong medication).

Students also do not let their emotions influence their thought processes or peer interactions using several strategies, including prioritizing thinking and actions over emotions and diverting negative emotions to positive ones. As discussed earlier, different individuals respond to BIS-BAS systems differently. The effects of BIS-BAS include (1) selective attention (i.e., selecting and focusing on specific stimuli), (2) attentional scope (i.e., processing a variety of items simultaneously), (3) aggressive cognitions (i.e., intention to achieve a desired goal), and (4) cognitive dissonance reduction (i.e., decreasing two or more opposing ideas) (Harmon-Jones et al., 2013). For example, students shift their feelings to their thought processes and interactions with peers to achieve a desired patient outcome.

Additionally, the types of emotion also influence judgment and decision-making based on their dimensions: (1) time of decision (pre-decisional versus post-decisional affect), (2) time of affect (immediate versus expected affect), and (3) affect-decision relationship (integral versus incidental affect) (Västfjäll & Slovic, 2013). Students may experience different emotions before or after a decision has been made. For example, students might feel motivated to administer medication (pre-decisional affect) but experience anxiety after discovering they administered the wrong medication (post-decisional affect). They may also experience emotions in the present moment when making a decision (immediate affect) or anticipate emotional reactions to future outcomes (expected affect). Finally, students may experience emotions directly related or
unrelated to the decisions. For instance, students feel stressed deciding what medications to give (integral affect) while the family complains (incidental affect).

**Group Domains in PCCDM Spaces and Simulation Phases**

Stahl (2006) explores the construction of intersubjective knowledge through group discourse in computer-supported collaborative learning—a cyclical and iterative process involving group knowing situated to context and temporality. The temporality is essential in simulation as peer performance depends on the space and time, corresponding to PCCDM *spaces* (individual and collaborative instead of physical or virtual) and simulation *phases*, respectively. Exploring group domains in different spaces and phases provides a more inclusive perspective of the PCCDM framework.

**Group Cognition, Behavior, and Emotion in PCCDM Spaces**

Some students think independently, while others prefer to think as a group. Thinking alone in the individual space stops their interactions with peers momentarily before coming together in the collaborative space. Similarly, students take their own actions in individual spaces and work on the same tasks together in the collaborative space. Group cognition happens when students collaborate using language to express their thought processes to co-construct knowledge (Stahl, 2006). Although communication happens more frequently in the collaborative space to ensure they are on the same page, students also verbalize their thoughts and actions when thinking and taking action individually. Thus, communicating thoughts and actions help regulate group cognition and behavior.

However, students do not readily share their feelings in the collaborative space. Instead, they express their emotions in individual spaces verbally using interjections (e.g.,
“Oh my God!”) or non-verbally from their tone of voice or non-lexical expressions (e.g., sighs). Co-regulating group emotion influences individual and group socioemotional interactions and experiences and strengthens social bonds (Fischer & Manstead, 2016; Mänty et al., 2020; Näykki et al., 2014). Although students have a valid reason for not sharing their emotions openly during simulation (e.g., perceiving it as inappropriate), they cannot easily co-regulate group emotion in the collaborative space. Consequently, students mainly control their individual emotions through diversion or suppression.

Co-regulated learning in collaboration involves a temporary shift of cognitive and socioemotional components, distributed and shared among peers in a group (Hadwin et al., 2018). For example, a collective thinking process requires alternating between individual and group regulation of sense-making activities involving reflection and discussion (Borge et al., 2018). Similarly, group emotion can be regulated and shared during collaborative learning (Järvenoja et al., 2020). Therefore, students constantly shift between individual and collaborative spaces in their thought processes, actions, and emotions when collaborating with their peers.

**Group Cognition, Behavior, and Emotion in Simulation Phases**

Group cognition, behavior, and emotion vary in different simulation phases. Some students are more readily to team up and brainstorm, while others prefer to take on individual actions and tasks during low acuity and stakes. Although some students communicate from the start, others do not, as they assume knowing what their peers are thinking or doing. Also, emotions tend to be less heightened, allowing students to think and take steps logically and systematically. However, students may experience “nervous
anticipation” before the simulation and “shock and awe” at the beginning until they get into the flow (Behrens et al., 2021, p. 1).

Similarly, students collaborate and make decisions differently in moderate to high acuity and stakes situations. Some students believe in delegating tasks, while others jump into action performing individual actions without any discussion. Taking charge of or leading the situation becomes more noticeable in high-stakes situations; however, some peers do not include such behavior. Communication can also vary; some groups communicate more, and others tend to be lesser. Although emotions are not shared, they become more expressive with or without realization by peers. Other observable behaviors as the scenario progress include taking hasty actions, choosing filler moves, and calling for help.

**Group Emotion in PCCDM**

Emotions can impede or stimulate cognitive processes and learning in simulation (LeBlanc & Posner, 2022). Simulation research primarily focuses on nursing students’ emotions regarding self-efficacy (Lugo et al., 2021), cognitive load (Schlairet et al., 2015), emotional competence (Alghamdi et al., 2021), and task performance (Yang et al., 2021); the impact of simulation design and facilitation on psychological safety (Daniels et al., 2021; Madsgaard, Røykenes, et al., 2022); and the debriefing techniques on psychological outcomes (Harder et al., 2020; Lugo et al., 2021). However, limited studies emphasize group emotion in simulation. Group emotion can be viewed as a combination of the group’s “top-down” and “bottom-up” components, where the “top-down” approach refers to the individual’s emotion influenced by the group, and the “bottom-up” approach refers to the aggregation of individual group emotions (Barsade &
Gibson, 1998, 2012). Thus, the same perspective applies in this study, allowing a more holistic view of group emotion in PCCDM.

One of the key themes is that students do not express group emotions explicitly during simulation. It is a common practice for healthcare professionals intentionally exclude their emotions from decision-making when caring for patients (Kozlowski et al., 2017). Similarly, students have learned and trained in school to separate their emotions by prioritizing thinking and taking appropriate action. However, students express their emotions through interjections, voice tones, and non-lexical expressions. Because emotions can be transferred between individuals implicitly and explicitly (Kelly & Barsade, 2001), students may transfer these implicit emotions to their peers. Such emotional convergence phenomenon can be related to the tendency to take on peers’ emotions during interaction (i.e., group contagion) or the conformity to the group’s emotional norms (E. R. Smith & Mackie, 2016). Therefore, peers with the same emotions may be subjected to such implicit emotional transfer.

Students also experience many group emotions at various simulation stages, including positive, negative, or mixed emotions. A recent integrative review reported that healthcare professional students experienced a variety of emotional “rollercoasters” throughout the simulation, shifting between positive and negative emotions (Madsgaard, Smith-Strøm et al., 2022, p. 1). Positive emotions emerge from being supported and trusting their peers in PCCDM. Positive emotional states may have a positive learning outcome, including enhanced task performance with increased speed and fewer errors (Yang et al., 2021). Thus, creating a safe, positive, and non-judgmental simulation
learning environment, including being attentive and mindful of students’ emotions, is necessary (Madsgaard, Røykenes, et al., 2022).

Negative emotions arise from feeling uncertain or having self-doubt, experiencing inadequacy or insecurity, and feeling nervous, anxious, and scared. These emotions occur when students experience a stall in their progressions during the simulation and may persist during and after debriefing, impacting their self-confidence in future learning (Behrens et al., 2021). However, negative emotions can also propel students to think deeper, act faster, and collaborate better. According to the control-value theory of achievement, anxiety can positively or negatively correlate with motivation in different individuals (Pekrun, 2006). Therefore, negative emotions may benefit specific individuals if they know how to use them to their advantage.

**Implications and Future Research**

This study explores peer collaboration and decision-making in simulation, leading to the development of the PCCDM framework and understanding of group emotion. The framework comprises the PCCDM domains (group cognition, behavior, and emotion) and the iterative peer regulatory process (awareness, communication, and regulation). The framework aims to advance the science in healthcare simulation, nursing education, and inter and intraprofessional collaboration in clinical practice.

**Healthcare Simulation**

**Intraprofessional Collaboration Framework**

Research on collaboration and decision-making among peers in simulation is limited as most healthcare simulation research focuses on interprofessional collaboration. More importantly, most simulation frameworks do not explore the collaboration and
decision-making process among peers. For example, NLN/Jeffries Simulation Framework focuses mainly on educational practices, simulation design characteristics, and outcomes (Durham et al., 2014). Although the TeamSTEPSS framework has been used in simulation research, including studying nursing students’ communication, mutual support, situation monitoring, and leadership, the knowledge of how the framework can apply in intraprofessional versus interprofessional collaborations is limited (Foster et al., 2019). Therefore, developing this framework will hopefully fill the gap.

**Simulation Best Practice**

Theoretical frameworks can be used to guide best practices in simulation; however, current literature using frameworks in developing, implementing, and assessing is inconsistent (Bell & Fredland, 2020). The International Nursing Association of Clinical and Simulation Learning (INACSL) develops standards in simulation design, facilitation, and operation based on research. INACSL advocates utilizing a theoretical or conceptual framework to build the simulation experience that aligns with the objectives and targets specific learners, such as adults and interprofessional teams (INACSL Standards Committee, Watts, Penni I., et al., 2021). However, frameworks specific to intraprofessional collaboration among nursing students do not exist, as most simulation practice uses interprofessional frameworks, such as TeamSTEPPS. Also, most frameworks do not address group emotions, an essential component to promote psychological safety among learners as one of the best practices (INACSL Standards Committee, McDermott, Donna S., et al., 2021). The PCCDM framework that addresses peers’ emotions and their associations with cognition and behavior can be used to develop best practices and guidelines in intraprofessional simulation.
**Instrument Development**

It is challenging to measure peer collaboration and decision-making without an instrument. There are many simulation instruments; however, instruments that measure PCCDM are limited. Most instruments measure parts, and not all, of PCCDM. For example, Kiesewetter and Fischer (2015) developed an intraprofessional instrument measuring teamwork behavior exclusively, such as team coordination, cooperation, and adjustment behaviors. Also, their instrument was designed for medical students. Smith et al. (2015) developed an instrument measuring nursing students’ teamwork skills, but the instrument was yet to be published. Moreover, Smith et al. used an interprofessional framework (i.e., TeamSTEPPS) to develop their instrument. Because instruments measuring PCCDM and theoretical frameworks on intraprofessional collaboration are sparse, the PCCDM framework will hopefully serve as a framework for instrument development. Also, the framework covers cognitive, psychomotor, and affective learning; thus, it allows a more holistic understanding and evaluation of PCCDM by simulation educators based on Kirkpatrick’s Model (1994).

**Nursing Education**

**Clinical and Simulation Practice**

American Association of Colleges of Nursing’s (AACN, 2021) Essentials underscores professional partnerships, including interprofessional, intraprofessional, and paraprofessional partnerships, with the emphasis on (1) communication that facilitates partnership; (2) team dynamics; and (3) mutual learning, respect, and shared values. In clinical practice, effective nurse-nurse collaborations require effective communication, clear role expectations, and supportive and empowering relationships (Chua et al., 2022;
Ylitörmänen et al., in press), which aligns with the AACN’s Essentials. However, Chua et al. (2022) found that although nurses have a mutual understanding of patients’ conditions and role expectations with their peers, they lack shared decision-making. Therefore, helping nurses understand group cognition, in addition to teamwork and collaboration, can help nurses better understand each other’s thought processes.

As discussed in chapter two’s concept analysis, the AACN’s Essentials can be achieved using simulation as a learning modality. Thus, the ultimate goal of a simulation is to transfer the competencies learned and apply them in the clinical setting, including nurse-to-nurse collaborations. Therefore, nurse educators can use the PCCDM framework to guide their clinical teaching to fulfill the AACN’s Essentials and close the competencies gap between classroom learning and clinical practice.

**Classroom Learning**

Not only can students’ clinical judgment be acquired in the clinical or simulation practice, but it can also be learned in the classroom. A recent national survey found that although nursing programs use multiple strategies to teach clinical judgment, the most common strategies are simulation and case studies to stimulate student thinking and prepare them for clinical practice (Nielsen et al., 2023). As for teamwork, a systematic review and meta-synthesis found that students learn team building, communication, and leadership skills through various learning modalities, including role-playing and journal writing (Butcher et al., 2017). Additionally, intraprofessional student collaboration enhances communication and teamwork, increasing student trust and respect (Butcher et al., 2017), aligning with AACN Essentials. Nurse educators can promote these core competencies using the PCCDM framework in the classroom.
Besides learning activities, preparing students for the Next Generation NCLEX may promote PCCDM. Clinical actions taken by peers in PCCDM can be appropriate, inappropriate, or irrelevant and unnecessary. These options are similar to the Next Generation NCLEX’s extended multiple-response questions, requiring students to choose them based on clinical findings or actions in a scenario (Poorman & Mastorovich, 2020). Therefore, the framework can focus nurse educators and students on questions related to group cognition (e.g., identifying relevant clinical cues) and action (e.g., prioritizing appropriate clinical actions).

**Beyond Nursing Education**

Although this framework concentrates specifically on nursing students’ PCCDM, it may apply to other healthcare professions that require intraprofessional collaboration and decision-making. Besides nursing, other healthcare professions advocate for intraprofessional collaboration to benefit the patient and their disciplines, as schools often emphasize interprofessional over intraprofessional collaboration (DiMaria-Ghalili et al., 2014; Gobis et al., 2018; Janssen et al., 2017). For example, an integrative review found that competencies to promote intraprofessional collaboration does not differ significantly from nursing, including patient-centered care, roles and responsibilities, mutual understanding and knowledge, attitude and respect, communication, and leadership (Janssen et al., 2020). Therefore, the PCCDM framework can hypothetically use in other healthcare professional education.

Because interprofessional and intraprofessional collaborations are equally important, another application of the PCCDM framework is merging interprofessional and intraprofessional education. The PCCDM framework can be used with other
interprofessional frameworks for a more comprehensive collaborative education and inclusive simulation design, facilitation, and assessment. Incorporating collaborative learning in nursing education can promote inter- and intraprofessional collaborations; however, research in this area remains scant and require further investigation (Zhang & Cui, 2018). Thus, the PCCDM framework can be added to inter- and intraprofessional collaborative education for a more comprehensive student learning experience.

**Limitations**

There are several limitations to this dissertation based on the following factors:

**Participants**

Only dyads were used for all the studies, excluding the opportunity to explore PCCDM in larger groups. Although participant demographics showed a diverse student population in the grounded theory study, only two nursing schools participated in this study, limiting the study’s generalizability. Future studies should include different numbers of participant groups (e.g., triads and tetrads) and multiple research sites to compare and validate the findings.

**Simulation Software and Training**

Virtual reality (VR) simulation was used in this study as it did not require a dedicated space and an easy replication of the clinical scenarios. Because VR simulation did not allow face-to-face interactions among participants, it prevented the investigator from studying specific non-verbal communication, such as eye contact and facial expressions, which could be explored using other types of simulation (e.g., manikin-based or standardized patients). Thus, repeated studies using other types of simulation are recommended to explore these non-verbal communication cues.
The myocardial infarction simulation case had technical issues, preventing the investigator from using it on other groups besides Group 2. Also, although participants received one-hour VR training, the simulation novelty may affect their PCCDM. If time and cost permit, participants should be provided more training with spaced repetition in future studies.

Data Collection and Analysis

The investigator also had a microphone malfunction when recording the first two simulations. Thus, the videos of those dyads could not be analyzed, limiting data analysis on peer collaboration during simulation. Also, the investigator’s computer froze during one group’s interview (G14), and it did not allow participants to watch the simulation video recording, increasing recollection bias. However, the remaining data was enough to reach theoretical and data saturation.

This study primarily explored social cognition and emotion among peers and did not include biological factors (e.g., hormones and neurotransmitters) and other cognitive processes (e.g., attention, memory, and motivation); thus, more biobehavioral research is needed to add, expand, and validate these findings. Furthermore, some aspects of the PCCDM domains were not exclusively studied. For example, although some participants mentioned being “motivated” during the study, it was not exclusively studied.

Conclusion

Nursing students collaborate and make decisions are essential to promote safe and competent patient care. Peer collaboration and clinical decision-making are two complex concepts that have not been well-studied together in nursing education. Because peer collaborative clinical decision-making (PCCDM) is not well defined, a conceptual
definition was developed using the hybrid concept analysis method by combining the literature and participant narratives to formulate a more comprehensive, student-centered definition. Subsequently, the investigator developed the PCCDM theoretical framework using the grounded theory method and explored group emotion using thematic analysis. The results were the PCCDM framework and group emotions experienced by peers during PCCDM.

The PCCDM framework comprises group cognition, behavior, and emotion (domains) that undergo the peer regulatory process of awareness, communication, and regulation. The relationships between each PCCDM domain provide a more in-depth understanding of PCCDM. Also, the group domains are significantly distinct in different PCCDM spaces and simulation phases. The framework can be applied in simulation, education, and clinical practice in nursing and other healthcare professions. It also paves the way for future studies, including developing an instrument to measure PCCDM objectively.
## APPENDIX A

*Literature Review: Defining Attributes, Antecedents, and Consequences of Peer Collaborative Clinical Decision-Making*

<table>
<thead>
<tr>
<th>Author(s), Year, Country</th>
<th>Terminology related to PCCDM</th>
<th>Simulation type</th>
<th>Participant roles and number of participants per group</th>
<th>Theoretical Framework or Conceptual Model</th>
<th>Defining Attributes</th>
<th>Antecedents</th>
<th>Consequences</th>
</tr>
</thead>
</table>
| Badowski, 2019, USA      | Peer coaching                 | Simulation type not stated | Participants’ roles were (1) primary nurse, (2) secondary nurse, (3) patient, (4) family, and (5) observers; the total number per group was not specified | QSEN teamwork and collaboration and TeamSTEPPS | • Providing mutual support  
• Communicating respectfully  
• Embracing team cohesiveness  
• Convincing others  
• Speaking up and voicing concerns  
• Recognizing own limitations | • Prior knowledge and experience  
• Communication training and tools | • Safe and quality patient care  
• Healthy work relationships |
| Berndt et al., 2015, USA  | Collaborative classroom       | Low-fidelity manikin | Participant roles were two primary nurses with 12 observers: a total of 14 per group | Did not specify | • Discussing interventions together  
• Anticipating patient needs  
• Co-constructing solutions to a problem  
• Thinking forward | | • Patient well-being  
• Sound clinical judgment |
| Bucknall et al., 2016, Australia | Collaboration decisions | Standardized patient | Participant roles were a team leader (first responder) and other active | Did not specify | • Seeking ideas from other members after exhausting own knowledge | • Individual characteristics (knowledge, skills, | • Patient safety |
| Carey et al., 2018, USA | Collaborative cognition | Manikin-based simulation | Did not specify | • Actively deciding among members on the next step  
• Verbally communicating among team members to solve a problem  
• Escalating a problem when interventions are out of the scope of practice or patient safety is at risk | personality traits), certainty with decisions, anxiety  
• Patient characteristics  
• Clinical context and support |

| | | | | • Decreased anxiety and increased confidence  
• Identification of individual performance gaps  
• Avoidance of role confusion  
• Empower each other  
• Opportunities to practice teamwork, collaboration, and professionalism  
• Recognition of own strengths and limitations |
<table>
<thead>
<tr>
<th>Study Authors and Year</th>
<th>Type of Learning</th>
<th>Simulation Type</th>
<th>Participant Roles</th>
<th>Did not Specify</th>
<th>Benefits and Developments</th>
</tr>
</thead>
</table>
| Crews et al., 2021, USA | Teamwork and collaboration | Student-directed livestream virtual simulation using a manikin | Participants were directing one of the faculty functioning as a nurse caring for a patient; 10 students per group | Did not specify | • Discussing different perspectives  
• Embracing different views  
• Recognizing areas needing improvement  
• Collaborating with peers to provide step-by-step directions  
• Prioritizing care  
• Thinking ahead  
• Individualizing care based on the patient’s condition  
• Group size  
• Development of clinical judgment, prioritization, communication skills |
| Fiero et al., 2021, USA | Peer-to-peer learning | Simulation type not stated | Participants were based on student level in the program (level 1—perform nursing skills, level 2—perform assessment, level 3—administer medications, and level 4—charge nurse); five to six students per group | Did not specify | • Guiding each other to solve a problem  
• Sharing knowledge  
• Reinforced prior knowledge  
• Enhanced leadership and communication skills  
• Increased confidence and knowledge  
• Feeling less anxious and intimidated |
| Hayes et al., 2019, Australia | Liaise and collaborate | Role-play simulation | Participants were (1) nurse administering medications, (2) nurse interrupting medication | Benner’s novice to expert, Kolb’s experiential learning, Tanner’s | • Looking beyond themselves  
• Expanding beyond individual roles  
• Recognizing own roles versus others  
• Positive patient outcomes  
• Development of situation awareness |
<table>
<thead>
<tr>
<th>Study</th>
<th>Methodology</th>
<th>Nature of Simulation</th>
<th>Participant Roles</th>
<th>Learning Objectives</th>
<th>Additional Notes</th>
</tr>
</thead>
</table>
| Himes & Ravert, 2012, USA | Situated peer coaching | Scripted unfolding case study simulation | (1) nurse and (2) patient; total number per group not specified | - Gaining a deeper understanding of individual roles and delegation  
- Understanding the importance of a holistic approach  
- Understanding the importance of collaboration and functioning as a team  
- Recognizing when to approach and help the team |  
| Paige and Daley’s situated cognition learning framework | Participants received instant feedback from peers  
- Learning from each other  
- Safe learning environment  
- Preparation for the simulation  
- Developing critical thinking and communication skills |  
| Hustad et al., 2019, Norway | Team collaboration | High-fidelity manikin | Participants were nurses and observers; the total number per group was not specified | - Recognizing the importance of communication and interactions with others  
- Recognizing own and others’ roles and responsibilities  
- Recognizing the importance of leadership  
- Recognizing the importance of patient’s individual knowledge and skills (e.g., communication) |  
- Increased self-confidence, skills, and clinical judgment  
- Lasting learning experience |
<table>
<thead>
<tr>
<th>Josephsen &amp; Butt, 2014, USA</th>
<th>Collaborative practice</th>
<th>Virtual multi-patient simulation</th>
<th>Participant roles were observers</th>
<th>Cognitive and social learning theory; QSEN competencies</th>
<th>Prioritizing care based on the clinical situation</th>
<th>Using SBAR when communicating</th>
<th>Increased knowledge of RN role in clinical reasoning, delegation, prioritization, and collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kessler &amp; Kost, 2021, USA</td>
<td>Cross-cultural collaboration</td>
<td>High-fidelity manikin and task trainer</td>
<td>Participant roles were leaders and followers for one simulation, and nursing and interprofessional for another simulation</td>
<td>Did not specify</td>
<td>Utilizing non-verbal cues when collaborating</td>
<td>Becoming aware and sensitive toward each other’s similarities and differences</td>
<td>Individual cultural background</td>
</tr>
<tr>
<td>Lee et al., 2015, Korea</td>
<td>Teamwork; cooperative work</td>
<td>High-fidelity manikin simulation</td>
<td>Participant roles were active participants or observers; two to three students per group.</td>
<td>Did not specify</td>
<td>Having a set of shared beliefs, values, and norms in team collaboration</td>
<td>Observing and sharing others’ experiences help to reinforce learning</td>
<td>Time during simulation</td>
</tr>
<tr>
<td>Study</td>
<td>Learning Approach</td>
<td>Simulator/Activity Description</td>
<td>Collaborative Learning Theory</td>
<td>Other Considerations</td>
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<tr>
<td>McWilliams et al., 2021, USA</td>
<td>Cooperative learning</td>
<td>Haptic IV simulator Participant roles were not specified, but learners were sequenced in order of who attempted the IV simulation first, second, or third; two or three students per group.</td>
<td>Cooperative learning theory • Recognizing that the team success depends on the success of all team members (positive interdependence) • Working together until all team members were successful • Interacting with another to promote group success • Observing and assisting one another to learn and build knowledge and skills</td>
<td>• Prior experience in skills • Learner simulation order • Team size • Successful skills attempt</td>
<td></td>
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<tr>
<td>Najjar et al., 2015, USA</td>
<td>High-fidelity manikin simulation</td>
<td>Participant roles and the number of students per group were not specified.</td>
<td>NLN/Jeffries simulation framework • Becoming aware of each other’s strengths and weakness • Recognizing the importance of group cohesiveness • Complementing each other roles during collaboration</td>
<td>• Simulation and clinical experience • Group size • Familiarity with group members</td>
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</tbody>
</table>
| Owen et al., 2014, USA | Near-peer teaching and learning | Standardized patient using upper-level students | Participant roles were nurses and observers; the total number per group was not specified | Bandura’s social cognitive theory | • Wanting peers to recognize and acknowledge their feelings  
• Looking for validation in their feelings  
• Feeling the need to “perform” in front of peers |  
• Developing self-responsibility  
• Contributing to the learning process |  
• Cognitive and skills development  
• Enhanced communication and decision-making skills  
• Learning from peers |
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<tbody>
<tr>
<td>Pront &amp; McNeill, 2019, Australia</td>
<td>Multi-station simulations; simulation types not stated</td>
<td>Participant roles were (1) primary (coordinator of activities), (2) documentation (documentation of activities), (3) treatment (performs nursing tasks), and (4) observer (provides feedback to the group).</td>
<td>Did not specify</td>
<td></td>
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</tbody>
</table>
• Being supported by peers  
• Assessing each other  
• Providing alternative perspectives  
• Being aware of overpowering others |  
• A supportive and facilitative learning environment |  
• Application of knowledge and skills  
• Identification of gaps in knowledge and skills  
• Increased confidence  
• Opportunity for professional growth |
| Rogers, 2011, Australia | Social constructive learning | Computer-based simulation | Participant roles were not specified; the total number per group was not specified | Constructivist learning theory and Kolb’s experiential learning | • Co-constructing a mental model through peer collaboration  
• Formulating a prediction and performing a solution as a team to solve a problem  
• Observing and determining the actions were valid from the collaboration |

| Söderström et al., 2012, Sweden | Collaborative training | Screen-based, task-trainer virtual simulation | No specific participant roles as students interpreted radiographic images and operated the simulator in dyads | Did not specify | • Being encouraged to cooperate and communicate  
• Being supported by peers  
• Relying on peers to problem solve  
• Number of students per group  
• Relationships between group members  
• Simulation training and context |

| Söderström et al., 2014, Sweden | Collaborative simulation training | Screen-based, task-trainer, virtual simulation | No specific participant roles as students interpreted radiographic images and operated the simulator in dyads | Schon’s knowing-in-action, reflection-on-action, and reflection-in-action; Dewey’s perspective on reflection | • Sharing responses in a group dialogue  
• Encouraging active exploration  
• Having a sense of control  
• Utilizing multiple ways of reflection (e.g., reflection-in-action and reflection-on-action)  
• Prior knowledge and simulation training  
• Visual cues and feedback from simulation  
• Facilitates experiential learning |
## APPENDIX B

**Fieldwork: Major Themes, Subthemes, and Defining Attributes of PCCDM**

<table>
<thead>
<tr>
<th>Major Themes</th>
<th>Subthemes</th>
<th>Defining Attributes</th>
</tr>
</thead>
</table>
| Group communication | Explicit versus implicit communication | **Explicit:** Verbalizing what they are observing, verbalizing their thought process, discussing tasks explicitly, speaking out loud their ideas  
**Implicit:** Assuming that peer agrees without discussion, not having a discussion about what needs to be done, having less discussion knowing and trusting peer’s decision |
| One-way versus two-way communication | **One-way:** telling peer what to do instead of having a discussion, instructing peer to call the provider because of the urgent situation  
**Two-way:** Sharing clinical findings with peers, exchanging ideas through discussion and dialogue |
| Verbal versus non-verbal communication | **Verbal:** Getting a verbal agreement that their decision is appropriate, talking to each other about what to do first  
**Non-verbal:** Observing and validating peer’s action |
| Speaking up versus keeping quiet | **Speaking up:** Asking for clarification when there is a disagreement, correcting a peer’s action with a question, speaking up if there is a potential patient harm  
**Keeping quiet:** Not speaking up when undecided about what to do next, not speaking up because of family presence, not speaking up because of the chaotic situation |
| Listening or providing feedback | **Listening to feedback:** Receiving feedback from peers on the next action, hearing each other thought process  
**Providing feedback:** Giving positive feedback to support peers, providing feedback if the peer disagrees |
<p>| Group awareness | Group cognition-related | Acknowledging that the peer knows what is going on, recognizing the peer’s action is appropriate |
| | Group socio-emotions-related | Developing awareness of interacting and communicating with peers, recognizing the group’s strengths and limitations |
| Group regulation | Establishing and defining roles | Knowing each other’s roles in taking the next action, establishing roles between peers, having clear roles for better team organization |</p>
<table>
<thead>
<tr>
<th>Group reasoning</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dividing and delegating tasks</td>
<td>Dividing tasks between each other to be more efficient and avoid redundancy, delegating when there are too many tasks</td>
</tr>
<tr>
<td>Developing trust</td>
<td>Trusting that peers will make the right decisions, trusting that peers will speak up if they disagree, trusting peer’s decision by validating the results</td>
</tr>
<tr>
<td>Having shared goals</td>
<td>Working independently and as a group to meet shared goals, understanding shared goals to meet patient outcome</td>
</tr>
<tr>
<td>Supporting and engaging in teamwork</td>
<td>Looking out for each other during interventions, standing by to help out when needed, supporting each other when facing challenges</td>
</tr>
<tr>
<td>Taking turns to lead and follow</td>
<td>Taking turns to initiate and support each other, switching back and forth in making decisions</td>
</tr>
<tr>
<td>Exchanging and expanding information</td>
<td>Bouncing ideas off each other, throwing out ideas to initiate the thought process</td>
</tr>
<tr>
<td>Discussing and negotiating ideas</td>
<td>Explaining the reasons for not taking the next action, rationalizing their actions for not giving medications</td>
</tr>
<tr>
<td>Validating and consensualizing ideas</td>
<td>Validating peer’s actions by checking their work, coming to an agreement to take the next action</td>
</tr>
<tr>
<td>Co-constructing and processing information</td>
<td>Understanding the clinical picture based on peer assessment, combining ideas and thoughts as a group</td>
</tr>
<tr>
<td>Aligning with peers’ thought processes</td>
<td>Thinking on the same page or same wavelength, having the same thought process,</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group emotion</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive, cognitive-related</td>
<td>Having anxiety pushes them to act faster, acknowledging that peers will think through the stressful situation</td>
</tr>
<tr>
<td>Positive, social-related</td>
<td>Feeling comfortable and supported working with peers, focusing on staying calm in an urgent situation</td>
</tr>
<tr>
<td>Negative, cognitive-related</td>
<td>Acknowledging that emotions negatively influence how they think and communicate, feeling frustrated not knowing what to do next, feeling unprepared for the situation</td>
</tr>
<tr>
<td>Negative, social-related</td>
<td>Experiencing panic causes less interaction among each other, feeling each other’s emotions without sharing them explicitly</td>
</tr>
</tbody>
</table>
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LICENSURE AND CERTIFICATIONS:
California Board of Registered Nursing, Registered Nurse 2009–present
California Board of Registered Nursing, Public Health Nurse 2012–present
California Board of Registered Nursing, Nurse Practitioner 2014–present
National League for Nursing, Certified Nurse Educator 2020–present
Society for Simulation in Healthcare, Certified Healthcare Simulation Educator 2020–present

PROFESSIONAL ASSOCIATIONS:

Sigma Theta Tau International Honor Society of Nursing 2021–present
Gamma Tau at-Large Chapter 2022–present
Governance Committee
International Society of the Learning Sciences 2021–present
International Nursing Association for Clinical Simulation and Learning 2020–present
National League for Nursing 2020–present
Organization for Associate Degree in Nursing 2019–present
Society for Simulation in Healthcare 2016–present
American Association of Nurse Practitioners 2014–2019
California Association for Nurse Practitioners 2014–2019
American Association of Heart Failure Nurses 2013–2016

PUBLICATIONS:


PRESENTATIONS:


Ngo, T. P., & Antisdel, J. (2022, April 21). The association between sleep quality and remote learning among nursing students during the COVID-19 pandemic [Virtual presentation]. Faculty Innovating for Nursing Education, Indiana University-Purdue University, Indianapolis, United States.

Ngo, T. P. (2021, October 27). NCSBN Clinical Judgment Measurement Model. [Virtual presentation]. Faculty Innovating for Nursing Education, Indiana University-Purdue University, Indianapolis, United States.


HONORS, AWARDS AND FELLOWSHIP RESEARCH & TRAINING:

Faculty Innovating for Nursing Education Scholar Award 2020–2023
National League for Nursing, Education Scholarship Award 2021
Society for Simulation in Healthcare, Virtual Scholars Program 2021
Charles R. Drew University, Student Government Association, Clinical Instructor Award 2017