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SOCIAL NETWORK CENTRALITY, SOCIAL CONSTRUCTION OF KNOWLEDGE,

AND NURSE PRACTITIONER COMPETENCY IN ASYNCHRONOUS ONLINE

DISCUSSIONS AMONG ADULT GERONTOLOGY ACUTE CARE NURSE

PRACTITIONER STUDENTS

By

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B.S. Nursing, University of Wyoming, 1994
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DISSERTATION

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ABSTRACT

The relationships between social network centrality, social construction of knowledge, and nurse practitioner competency among adult gerontology acute care nurse practitioner students participating in asynchronous online discussions were explored. Social network centralities (betweenness, in-degree, out-degree, closeness, and eigenvector) were determined through social network analysis. Social construction of knowledge was assessed by the Interaction Analysis Model (IAM). Nurse practitioner competency was evaluated using the Novice to Expert model. A retrospective exploration of an online discussion board from the College of Nursing at the University of New Mexico was conducted. The centralities of betweenness, closeness, and eigenvector demonstrated a significant relationship with the dependent variable of nurse practitioner competency. Social construction of knowledge did not demonstrate a significant relationship with

nurse practitioner competency. The centralities of betweenness, in-degree, out-degree, closeness, and eigenvector demonstrated a significant relationship with social construction of knowledge.

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CHAPTER 1 INTRODUCTION

Demonstration of competency is required by nurse practitioners (NP) in order to provide care for the more than one billion patients seeking care in the United States (American Association of Nurse Practitioners [AANP], 2020; Distler, 2015; Fukada, 2018; Gravina, 2027; Kesten et al., 2015; Tractenberg et al., 2019). Nurse practitioner competencies are heterogenous, domain specific, and involve the application of complex knowledge, skills, values, and attitudes to real-life situations (Frank et al., 2010; Frank et al., 2010; Fukada, 2018; Gravina, 2017; National Council for State Boards of Nursing [NCSBN], 2005; Nieminen et al., 2011).

Over 290,000 nurse practitioners deliver health care in a variety of settings which include clinics, hospitals, emergency departments, private practice, and home health (AANP, 2020). Health care services provided by nurse practitioners encompass diagnosing and managing acute, chronic, and complex health issues, health promotion, disease prevention, health education and counseling in a variety of health care settings (AANP, 2020; Yang et al., 2019). Approximately 89.7% of NPs are certified in primary care and 8.9% are certified in acute care (AANP, 2020; Kleinpell et al., 2018). The acute care nurse practitioner (ACNP) manages patients with acute, complex/chronic, and critical illnesses (Hoffman & Guttendorf, 2017; Kleinpell et al., 2018).

For more than 40 years, NP education has been competency-based and continues to remain the standard (AANP, 2020; Gravina, 2017; Tractenberg et al., 2019). Educational programs must meet national accreditation requirements and competency-based standards (AANP, 2020). Nurse practitioner faculty must ensure the congruency of their curricula with competencies in order for students to achieve minimum competency

for practice (NONPF, 2017; Richard-Eaglin, 2017). Students must demonstrate achievement of knowledge and skills to provide safe patient care in order to progress or graduate (AANP, 2020, Fukada, 2018; Distler, 2015; Kesten et al., 2015; National Council for State Boards of Nursing [NCSBN], 2005; Nieminen et al., 2011).

The nursing profession has expanded the number of nurse practitioner programs due to the increased need for health care providers as millions of Americans were able to secure health insurance via the Affordable Care Act (Richard-Eaglin, 2017; Yang et al., 2019). Over 85% of Master's of Science in Nursing (MSN) degrees offered are either in the online or hybrid format (American Association of Colleges of Nursing [AACN], 2013; Distler, 2015). These online and hybrid programs are also required be nationally accredited and follow the competency-based standards (Schumacher & Risco, 2017). Students enrolled in online programs are required to demonstrate achievement of competency (Distler, 2015; Schumacher & Risco, 2017; Trachtenberg et al., 2019). The University of New Mexico has a national accredited, competency-based adult-gerontology acute care nurse practitioner program that utilizes a hybrid format.

Within online and hybrid nurse practitioner programs, asynchronous online discussions are commonly utilized and widely accepted (Massey et al., 2019; Jo et al., 2016; Raymond et al., 2016). The asynchronous online discussion (AOD) provides a forum for students to interact, engage, make social connections, share knowledge, and reflect on information (Afify, 2019; Brierton et al., 2016; Harmon et al., 2014; Osborne et al., 2018; Ringler et al., 2015; Woods & Bliss, 2016; Yen et al., 2019). The social constructivist view suggests that knowledge is constructed and co-created through this social discourse and interaction (Vygotsky, 1978; Doolittle, 2014). It has been proposed

that social construction of knowledge occurs as a result of the social networks in asynchronous online discussions (Gunawardena et al., 1997; Henri, 1992; Newman et al., 2004; Romero et al., 2013). Analysis of social interactions through social network analysis (SNA) reveals how knowledge is shared and passed between students (Andersen, 2004; Borgatti & Ofem, 2011; Covelli, 2017, Garrison et al., 2000; Markel, 2001; Ringler et al., 2016; Romero et al., 2013). Social network analysis also reveals the position of individuals in the group as active/passive participants, influencers, producers, and consumers of information (Chen & Huang, 2019; Desai et al., 2020; Durairaj & Umar, 2015; Yen et al., 2019). The relationship between social networks and social construction of knowledge is complex and continues to be investigated. However, determining the relationship between social network centralities, social construction of knowledge, and nurse practitioner competency remains unexplored.

Significance of the Problem

Nurse practitioner faculty, teaching in the online environment, have the responsibility to deliver quality education to nurse practitioner students. In order to provide an education that meets national requirements for competency, specific strategies must be integrated into teaching practice. The expansion of online and hybrid programs challenge nurse practitioner faculty to adapt to this teaching medium. Nurse practitioner faculty must be familiar with contemporary strategies and theory to understand how students create social networks, what their positions are within the network, and construct knowledge in order to support student achievement of competency. How social network centrality, social construction of knowledge, and nurse practitioner competency are related is unknown.

Study Purpose & Research Questions

Purpose

The purpose of this study is to explore the relationships between social network centrality, level of social construction of knowledge, and nurse practitioner competency among adult gerontology acute care nurse practitioner (AGACNP) students participating in an asynchronous online discussion. Doolittle (2014) states that the complex interactions between the faculty, students, and resources are non-linear, adaptive, and constructive resulting in a gained knowledge that is greater than the sum of its parts. Understanding the complex social interactions and how students construct knowledge in this forum gives nurse practitioner faculty the ability to support students to successfully achieve the required competencies for their practice. This study will add to the literature regarding social network analysis, social construction of knowledge, and nurse practitioner competency.

Research Questions

This study addressed the following research questions based on participation in asynchronous online discussion by AGACNP students:

1. What centralities are demonstrated by each of the individuals in the network?

2. What levels of social construction of knowledge are demonstrated by AGACNP students participating in asynchronous online discussion?

3. What level of competency is demonstrated by AGACNP students who participated in the discussion?

4. How does social network centrality, level of social construction of knowledge, and nurse practitioner competency relate to each other?

Theoretical & Conceptual Frameworks

There are three major constructs that are being investigated in this study. As such, three theories were selected to guide this study social constructivism, social network theory, and the Synergy Model for Patient Care.

Social Constructivism

Constructivism is an approach to learning asserting that learners construct their own knowledge through their perceived experiences. Principles of constructivism are that knowledge is actively constructed and not passively created, it is personal, and learning exists in the learner's mind. Social constructivism states that knowledge is constructed as a result of interactions between the learner and the environment, which includes other learners. According to Vygotsky (1978) the role of culture and language are essential in the construction of knowledge. Humans experience, communicate, and understand reality through the framework of language and culture. Vygotsky (1978) suggests that knowledge is not just constructed but is co-constructed as part of a collaborative process. The theory emphasizes the importance of feedback to individuals in constructing knowledge (Durairaj & Umar, 2014). The epistemological belief of social constructivism is one of interpretivism. Knowledge is how we interpret it based on previous experiences, personal views, and cultural background. New experiences and ideas are incorporated into existing knowledge in such a way that it makes sense in the learners' view.

Social Network Theory

Social network theory an overarching term for social science theories that study how people, groups, or organizations interact and connect through interpersonal

relationships within their network (Borgatti & Ofem, 2011; Nimmon et al., 2019). It draws on research and theory from psychology and sociology (Burt et al., 2013). Theorists examine the attributes of the individual and their relationships with others in the network (Borgatti & Ofem, 2011). The theory has its foundations from two key concepts: 1) people form groups as a result of interaction opportunities, such as physical locations, and 2) the communication within the group is more frequent and influential resulting in group level similar views (Burt et al., 2013). Individuals in a network can strengthen connections within a cluster or build connections across clusters (Burt et al., 2013). Granovetter (1973) suggested that individuals have strong ties to those who are similar to themselves and are unlikely to be sources of new information and it is the weak ties between individuals that are the greatest source of new information. Burt (1992) states that social networks have gaps, or lack of ties, between individuals or clusters, calling them structural holes. He suggests that it is the structural holes and weak ties are advantageous by acting as bridges in which knowledge can be shared and, in turn, promote innovation (Burchard & Cornwell, 2018).

Social networks have five types of relationships within a network: similarities, social relations, mental relations, interactions & transactions, and flows (Borgatti & Ofem, 2011). Similarities provide the relational conditions to facilitate or inhibit connections (Borgatti & Ofem, 2011). Social relations are the ongoing connections such as friendship and kinship with a sense of intersubjective reality (Borgatti & Ofem, 2011). Mental relations represent the perceptions and attitudes of others (Borgatti & Ofem, 2011). Interactions are discrete events that occur over time and in the context of social or

mental relations (Borgatti & Ofem, 2011). Flows are the intangible and tangible items that transferred via interactions (Borgatti & Ofem, 2011).

Borgatti & Ofem (2011) state the most important aspect of the network is to not view the connections between individuals in isolation but rather to view how the connections form paths and create structure. It is through the paths that information and resources can flow (Borgatti & Ofem, 2011). The structure of the network is what determines the network's behavior and outcomes (Borgatti & Ofem, 2011). There are three levels of analysis where theorizing occurs: the dyad, the node (or individual), and the network as a whole (Borgatti & Ofem, 2011). The dyad level considers the pair of individuals and looks at the strength of the tie, the geodesic distance, and the structural equivalence (Borgatti & Ofem, 2011). The node level characterizes how the individuals are connected in the network such as size, structural holes, and centrality of in the network. The 'network as a whole' looks at density and centralization (Borgatti & Ofem, 2011).

Synergy Model for Patient Care

The Synergy Model for Patient Care (Figure 1) was developed through a workgroup of American Association of Critical Care Nurses Certification Corporation. The original design was directed towards critical care nurses and has been adapted to incorporate acute care nurse practitioners. It is a middle-range grounded theory in which the central concept is that when patient characteristics drive nurse competencies, optimal outcomes for patients and their families will occur (Becker et al., 2006). The model was important in shifting nurses' thoughts that care was more than tasks to be performed and should be grounded in meeting the needs of patients and optimizing outcomes (Becker et

al., 2006). Nurses need to recognize that each patient brings a set of unique characteristics to the situation and these underlie the needs of the patients (Becker et al., 2006). The model also states that nurses have their own set of characteristics which drive their competencies (Becker et al., 2006). When the two sets of characteristics match, patient outcomes are optimized (Becker et al., 2006). Certain nursing competencies are required to provide acute/critical care and are dependent on patient needs.

The model guides the promotion of synergistic care through the integration of the three major concepts: 1) patient characteristics, 2) nurse competencies, and 3) outcomes. Synergy occurs when the patients with the greatest level of need are matched with nurses with the highest degree of competency. Becker et al. (2006) identified nine assumption of the model:

- Each patient is a biological, social, and spiritual entity who is at a particular developmental stage. The whole patient (body, mind, & spirit) must be considered.

- The patient, family, and community all contribute to providing a context for the nurse-patient relationship;

- Each patient can be described by a number of characteristics. All characteristics are connected and contribute to each other. Characteristics cannot be looked at in isolation.

- Nurses can be described in a number of dimensions. The interrelated dimensions paint a profile of the nurses.

- A goal of nursing is to restore each patient an optimal level of wellness as defined by the patient.

- Nurses create the environment for the care of the patients. The context or environment of care also affects what a nurse can do.

- Impact areas are inter-related, and the nature of the interrelatedness may change as a function of experience, situation, or setting changes.

- Nurses may work to optimize outcomes for patients, patients' families, healthcare providers, and the healthcare system/organization.

- Nurses bring their background to each situation, including various levels of education/knowledge and skills/experience.

This model is important in guiding patient outcomes through nursing competency. Nurses realize that patients cannot be treated the same. Nurses have a moral obligation to provide competent care to patients with diverse health problems to optimize outcomes.

Figure 1

The American Association of Critical Care Nurse Synergy Model for Patient Care

(Becker et al., 2006, p. 134)
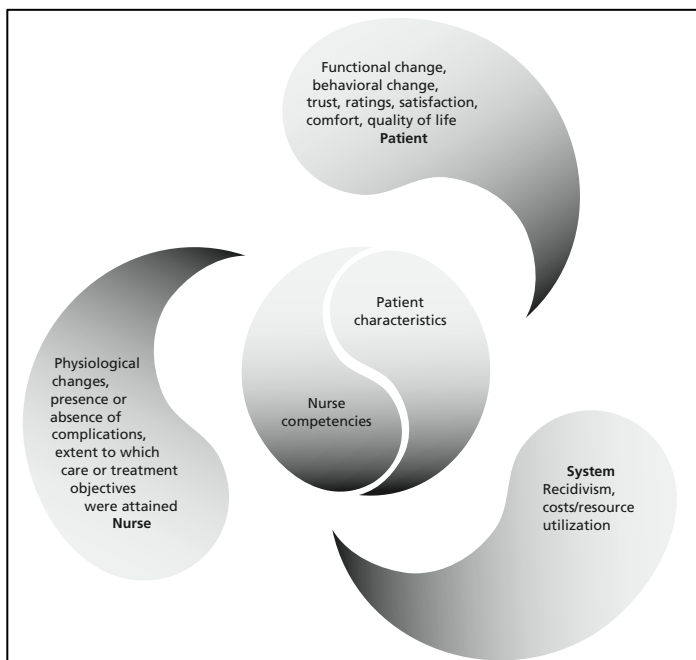
Definition of Terms

Conceptual Definitions

The following conceptual definitions were used in this study:

1. Adult-gerontology acute care nurse practitioner: a registered nurse educated at the graduate level to provide continuous and comprehensive advanced nursing care to acute ill adult-gerontology patients (young adults, older adults, and frail elderly) experiencing episodic illness, exacerbation of chronic illness, or terminal illness" (American Association of Critical Care Nurses, 2019);

2. Competency-based education: "the outcomes-based approach to the design, implementation, assessment, and evaluation of an education program, using an organizing framework of competencies" (Schumacher & Risco, 2017);

3. Social construction of knowledge: the newly self-organized understanding and comprehension of knowledge and adaptation of internal mental models through shared interactions and experiences (Doolittle, 2014); and

4. Social Network centrality: locations of positions in networks of individuals (Freeman, 1978);

5. Competency: the ability of an individual to apply complex knowledge, skills, values, and attitudes in real-life situations (Frank et al., 2010); and

6. Social network: "the finite set of students and the interactions among them in a discussion forum" (Gunawardena et al., 2016, p. 40).

Operational Definitions

The research questions investigate specific items related to nurse practitioner competencies, network centrality, and social construction of knowledge. The following operational definitions were used in this study:

1. Betweenness centrality: Betweenness centrality: the shortest path of information flow between individuals (Freeman 1978);

2. In-degree centrality: the number comments received by an individual (Freeman, 1978);

3. Out-degree centrality: the number of comments given by an individual (Freeman, 1978);

4. Closeness centrality: the measure of an individual's position within a network (Freeman, 1978);

5. Eigenvector centrality: the measure of an individual's interactions with others who are more connected (Freeman, 1978);

6. Discussion post: the comments or responses by each participant of a discussion board;

7. Discussion board: the collective of discussion posts;

8. IAM phase: the coded level for knowledge construction (Gunawardena, 1997).

CHAPTER 2 REVIEW OF LITERATURE

Online Learning Enrollment

Over the past several decades, enrollment in online programs has significantly increased and continued growth is projected in the next several years (Allen & Seaman, 2017; Collins et al, 2019; Jaggars & Xu, 2016; Knestrick, et al., 2016; Richard-Eaglin, 2017). Estimates for enrollment in online courses were upwards of six million in 2015 (Allen & Seaman, 2017). Post-baccalaureate online education is also on the rise with an estimated three million students enrolled and projected to increase over the next 10 years (National Center for Education Statistics, 2019). The flexibility of online courses makes them a popular choice among students (Calderone & Sood, 2020; Courtney & Wilhoite-Mathews, 2015; Jaggars & Xu, 2016).

Asynchronous Online Discussions

Asynchronous online discussions are the most popular communication technology utilized on online education (Brierton et al., 2016; Calderon & Sood, 2020; Chen & Huang, 2019; Covelli et al., 2017; Durairaj & Umar, 2015; Lucas et al., 2014; Durrington et al., 2018; Jo et al., 2016; Osborne et al., 2018; Yen et al., 2019). Its value as an effective resource supporting learner communication has been recognized (Chen et al., 2019; DiPasquale & Hunter, 2018; Harmon et al., 2014; Yen et al., 2019). This forum supports student engagement and interaction in such a way that students are able to express facts, opinions, share ideas, resolve confusion, and scaffold group knowledge (Brierton et al., 2016; Chen & Huang, 2019; Durrington et al., 2006; Osborne et al., 2018; Ringler, et al., 2015; Woods & Bliss, 2016). The asynchronous nature of the forum provides time for students to critically consider material to share and reflect on material

posted by others resulting in higher order thinking skills (Brierton et al., 2016; Durrington et al., 2006; DiPasquale & Hunter, 2018; Gunawardena, et al., 2016; Harmon et al., 2014; Jo et al., 2016; Osborne et al., 2018; Ringler, et al., 2015; Woods & Bliss, 2016). However, the benefits of learning in the asynchronous online discussion are due to the regular participation in social discourse and building and maintaining social bonds (Chen & Huang, 2019; Jo et al., 2016; Yen et al., 2019). Research on students who are not active in discourse and remain passive, show they are at risk for academic failure (Calderon & Sood, 2020; Chen & Huang, 2019; Desai et al., 2020; Durairaj & Umar, 2015; He et al., 2014; Yen et al., 2019).

Foo and Quek (2019) investigated teaching presence on critical thinking in asynchronous online discussions through a literature review. Using scenario-based discussions as an approach promoted critical thinking across various academic disciplines. Scaffolding was also found to be effective in developing critical thinking which supported the findings of DiPasquale and Hunter (2018). Socratic questioning was also found to be effective in guiding students toward critical thinking, but the types of questions that are most effective have not been determined. Other research recommended using non-conventional methods of questioning to foster critical thinking (DiPasquale & Hunter, 2018; Donlan, 2019; Novotny et al., 2016) Direct instruction facilitated critical thinking; however, no type of direct instruction was identified as being most effective. Donlan (2019) suggested that teaching presence should reduce over time to allow students to assume responsibility for their learning. DiPasquale and Hunter (2018) suggested that instructors should model effective discourse to promote critical thinking.

Afify (2019) recognized that asynchronous online discussions are a frequently used tool in learning, yet there are many variables that can influence its success . In his research, he stated that group size affects students' learning performance. He explored different group sizes in asynchronous online discussions with critical thinking, and outcome performance. Three groups sizes were evaluated: a small-sized group with five participants, a medium-sized group with 12 participants, and a large-sized group with 32 participants. The small- and medium-sized groups provided a greater opportunity for students to absorb and reflect on content through deeper dialogue which positively influenced their critical thinking skills and improved performance as compared to the larger-sized group.

Social Network Centrality

The application of social network analysis provides a method to examine the social interactions and positionality in asynchronous online discussions (Durairaj & Umar, 2015; Gunawardena et al., 2016; Liu et al., 2017; Yen et al., 2019). Social network analysis provides insights into student behaviors by identifying producers and consumers of information, influencers in the group, how information is shared between students, and those students at-risk for academic failure (Chen & Huang, 2019; Desai et al., 2020; Durairaj & Umar, 2015; Yen et al., 2019). Research on social network centrality measures have demonstrated its ability to predict academic success (Calderon, 2020; Jo et al., 2016; Yen et al., 2019). Based on the results of SNA, faculty can provide intervene with support and personalized guidance to at-risk students (Desai et al., 2020; Shelton et al., 2017; Yen et al., 2019). The centrality measures most commonly utilized are betweenness, in-degree, out-degree, closeness, and eigenvector.

Network centrality has its foundations in graph theory as social networks can be represented in graph form (Brandes et al., 2016; Freeman, 1978; Schoch & Brandes, 2016; Riquelme et al., 2018). Graph theory describes the connections between points on a graph, also known as point centrality (Freeman, 1978). Centrality has been one of the most commonly studied concepts in social network analysis (Brandes et al., 2016; Riquelme et al., 2018; Schoch & Brandes, 2016). In 1978, Freeman produced the most influential work on the concept of centrality in social networks (Brandes et al., 2016; Colladon & Naldi, 2020; Iacobucci et al., 2017; Schoch & Brandes, 2016). As a result of his work, the prototypical measures of capturing centrality are betweenness, degree, and closeness (Brandes et al., 2016; Colladon & Naldi, 2020; Iacobucci et al., 2017; Schoch & Brandes, 2016; Zhang & Luo, 2017). Each measurement calculates how individuals are connected within the network (Freeman, 1978; Iacobucci et al., 2017; Schoch & Brandes, 2016; Zhang & Luo, 2017;

Key features of social networks are control, influence and transmission of information within the network (Jamali & Abolhassani, 2006; Colladon & Naldi, 2020; Freeman, 1978; Schoch & Brandes, 2016; Zhang & Luo, 2017). How information is controlled, influenced, and transmitted, and by who, can be measured by the network centralities of betweenness, degree, and closeness (Borgatti & Ofem, 2011; Jamali & Abolhassani, 2006; Colladon & Naldi, 2020; Zhang & Luo, 2017). Power within the network has been associated with network centrality (Jamali & Abolhassani, 2006; Zhang & Luo, 2017).

Betweenness Centrality

Betweenness centrality is the point in a network that falls between pairs of other individuals based on the frequency (Freeman, 1978). In other words, betweenness identifies how often an individual operates as a connection between other individuals in the network, acting as ties (Durairaj & Umar, 2014; Iacobucci et al., 2017; Liu et al., 2017; Zhang & Luo, 2017). With social networks, the individual with high betweenness can influence the network by retaining, sharing or distorting information from other individuals (Freeman, 1978; Iacobucci et al., 2017; Zhang & Luo, 2017). The example in Figure 2 illustrates the betweenness centrality between individuals Bob, Amy, and Clare.

Figure 2

Example of betweenness centrality
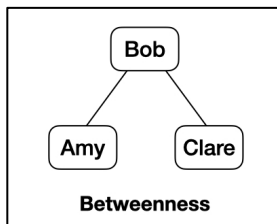
Note. Bob is the connection between Amy and Clare.

Degree Centrality

Degree centrality is the simplest measure of centrality (Freeman, 1978); it is the count of the number of individual connections (Durairaj & Umar, 2014; Freeman, 1978; Iacobucci et al., 2017). Freeman (1978) states this reflects the extent to which an individual "is in the thick of things" (p. 219). In the context of a social network, this means an individual with high degree can be viewed by others as a major channel of information and the center of communication (Freeman, 1978; Iacobucci et al., 2017;

Jamali & Abolhassani, 2006; Liu et al., 2017). In contrast, an individual with low degree can be viewed by others as isolated from the network and is located on the periphery (Freeman, 1978; Iacobucci et al., 2017). Figure 3 illustrates an example of degree centrality of three individuals, Bob, Amy, and Clare.

Figure 3

Example of Degree Centrality
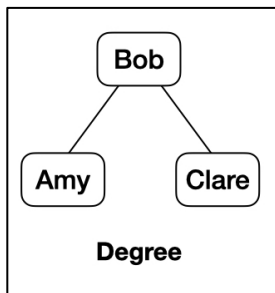
Note. Amy's degree = 1, Bob's degree = 2, Clare's degree = 1.

In-degree and out-degree are used to measure the sharing and receiving of information in a network (Durairaj & Umar, 2015; Liu et al., 2017). In-degree centrality represents information received by other individuals in the network or messages received (Durairaj & Umar, 2015; Liu et al., 2017). Out-degree centrality is the information shared with others, or messages sent (Durairaj & Umar, 2015; Liu et al., 2017). An individual who has high out-degree centrality is considered more active in spreading information and is considered influential and popular (Durairaj & Umar, 2015; Liu et al., 2017). Figure 4 illustrates and example of in-degree and out-degree of three individuals Bob, Amy, and Clare.

Figure 4

Example of In-Degree and Out-Degree Centrality
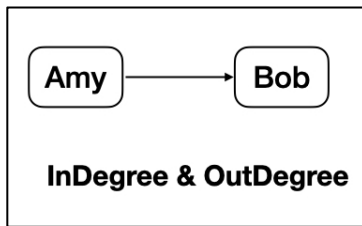
Note. Bob receives information from Amy; Out-Degree: Amy sends information to Bob.

Closeness Centrality

Closeness centrality is the proximity an individual has to others in the network (Freeman, 1978). The closeness centrality can reflect the efficiency of flow throughout the network (Iacobucci et al., 2014; Liu et al., 2017; Zhang & Luo, 2017). Freeman (1978) states this can also be a measure of independence from the network because an individual is not dependent on others to relay information. An individual with high closeness can have a more direct exchange of information with other individuals (Iacobucci et al., 2014; Jamali & Abolhassani, 2016; Liu et al, 2017; Zhang & Luo, 2017). An individual having low closeness has an increased dependence on others to exchange information (Freeman, 1978; Liu et al., 2017). Figure 5 illustrates closeness.

Figure 5

Example of Closeness Centrality
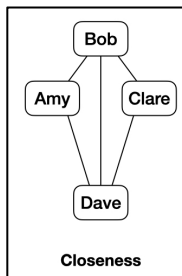
Note. Bob is closer to Amy & Clare than Dave; Amy & Clare are close to Bob and closer to Dave than Bob.

Eigenvector Centrality

Eigenvector centrality measures an individual's interactions with others in the network based on the others position in the network (Durairaj & Umar, 2015; Iacobucci et al., 2014; Liu et al., 2017). In other words, an individual with high eigenvector centrality interacts with others who are active in the network (Durairaj & Umar, 2015; Liu et al., 2017). An individual with low eigenvector centrality interacts with others who are passive in the network (Durairaj & Umar, 2015; Liu et al., 2017). Figure 6 illustrates eigenvector centrality.

Figure 6

Example of Eigenvector Centrality
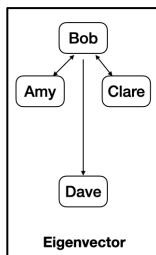
Note. Bob has more reciprocal interactions with Amy & Clare than he does with Dave

Social Network Centrality and Asynchronous Online Discussions

Research with social network analysis and asynchronous online discussions has focused on behaviors of students in the forum and how they negotiate meaning (Andersen, 2004; Borgatti & Ofem, 2011; Covelli, 2017, Garrison et al., 2000; Gomez, 2018; Gunawardena et al., 2016; Markel, 2001; Martono & Salam, 2017; Ringler et al., 2016; Romero et al., 2013). Martono and Salam (2017) examined student's learning in asynchronous online discussions through a meta-analysis. They reviewed a total of 51 articles on cognitive engagement online discussions. The articles were in three areas: 1) student's attitudes on information and communication with technology (ICT), 2) methodologies used in the field, and 3) the knowledge construction collaboration processes with 17, 16, and 18 papers respectively. The majority of the research on student's attitudes on using ICT utilized surveys. Findings indicated that students were eager to use technology, yet students were dissatisfied with the technology itself. Collaboration among students in the online environment was determined to be dependent on the students having adequate skills and attitudes (Martono & Salam, 2017). When undergraduates were compared to postgraduate students, it was believed that postgraduate students were more mature and motivated for self-study (Martono & Salam, 2017). Exploration of the methods used to evaluate knowledge construction revealed that content analysis is the main research methodology with the Interaction Analysis Model (IAM) by Gunawardena et al. (1997) being the most commonly used in studies. Additional information gleaned from the meta-analysis was the majority of articles reported students' knowledge construction remained at lower levels of cognitive engagement with only surface level engagement (Martono & Salam, 2017). Social

network analysis was the second most commonly used method and utilized in conjunction with other methods (Martono & Salam, 2017).

Recent literature has evaluated the value of social network centralities in asynchronous online discussions in identifying at-risk students and academic success. Research by Chen and Huang (2019) explored the student participation gap in asynchronous online discussions. Twenty students enrolled in an undergraduate online course participated for a total of 274 posts, 514 comments, 36 mentions, and 74 reactions that were analyzed. Using in-degree centrality as their measure of prestige, they explored students' level of prestige, reflection of prestige in the discussion, and factors contributing to prestige. Two groups formed, one with higher prestige and one with lower prestige. Results indicate that higher prestige students were more connected, had more reciprocal and persistent connections, and connected with other high prestige students. The students with lower prestige attempted to connect with the higher prestige students, but the connections were not reciprocated (Chen & Huang, 2019). The timing of postings in the discussion from high prestige students were earlier in the forum than for the low prestige students. Recommendations were for faculty to not only pay attention to those students on the periphery, but those with low prestige and plan strategies to support their success (Chen & Huang, 2019).

In 2016, Joksimovic et al. examined the network position of students in an asynchronous online discussion with academic performance. The researchers evaluated two instances of a single course delivered through a Massive Open Online Course (MOOC) using SNA to analyze the network. The first group had 776 threads analyzed and the second group 1018 threads analyzed. Their findings indicated that degree

centrality was significant in predicting the course outcome, while closeness and betweenness were not. The researchers suggested that centrality in the network with "super-strong" ties is not necessarily beneficial (Joksimovic et al., 2016). Students within the network having reciprocal ties and not "super-strong" ties was associated with academic achievement (Joksimovic et al., 2016).

In contrast, Yen et al. (2019) used self-regulated learning (SRL) skills as a predictor of network centrality of an asynchronous online discussion forum. Thirty-three graduate students responded to a survey based on a revised Online Self-Regulated Learning Questionnaire (OLSQ). The instrument was a 40 item, 7-point Likert scale and had a Cronbach alpha of 0.92. The centralities measured were in-degree, out-degree, betweenness, closeness, eigenvector, reciprocated vertex pair ration, and page rank. Three of the centralities were predicted by SRL: betweenness, closeness, and eigenvector. The researcher suggested that learners with higher SRL skills connect with others based on flow and distance of connections and are more likely to apply metacognitive strategies (Yen et al., 2019). These learners also have a more influential and collaborative role in the network as well as a more facilitating role with communication dynamics (Yen et al., 2019). The influential role of learners with a high level of betweenness acted as bridges among clusters in the network (Yen et al., 2019). They raised the question "is it necessary for all learners to pursue influential, prominent, and prestigious roles in social interaction in order to ensure effective learning?" (p.19) and suggested that a "healthy and effective learning community may be composed by different social network roles" (p. 19).

Social Construction of Knowledge

Socio-constructivism posits that knowledge can be constructed and co-created through social discourse and interactions (Vygotsky, 1978). Socio-cultural theory posits that individuals with more knowledge become facilitators and assist the learner in growing knowledge (LaPointe & Gunawardena, 2004). Through the combination of these two theories it is proposed that knowledge is created through the interaction between individuals as student piece together new knowledge with prior knowledge (Borgatti & Ofem, 2011; Doolittle, 2014; Gunawardena et al., 1997). Gunawardena et al. (1997) used the analogy of a patchwork quilt. Just as the process of forming blocks are the arranged and rearranged individual pieces to form the final block, bits and pieces of shared knowledge are pieced together to create knowledge. The individual blocks continue to be arranged and rearranged to form the final quilt design, similar to the continual construction of knowledge (Gunawardena, 1997).

Early work on social construction of knowledge and computer mediated messaging was done by Henri (1992). She provided a framework and model as a way to better understand the learning process in computer mediated messages. She suggested it is important to consider the dynamics of group communication, the learning process, and how knowledge is constructed. Henri (1992) indicated that interactions, social networks, and the group cohesion influence the process of knowledge construction. Computer mediated conferencing (CMC) supports the social sharing of ideas, reflection, and problem-solving that results in a higher quality of knowledge (Henri, 1992). The learning process itself is altered by the collaborative nature of CMC (Henri, 1992). It is imperative that educators understand the social and cognitive processes of the learners as

well as the content in order to identify student strength and weaknesses, providing support when needed (Henri, 1992).

As a form of computer mediated conferencing, asynchronous online discussions have been the subject of research in regard to social construction of knowledge. The majority of research has found that knowledge construction remains at lower levels with only superficial knowledge and little or no advancement to metacognitive knowledge (Brierton, et al., 2016; Cabrero et al., 2008; Heo et al., 2010; Lucas, et al., 2014; Saritas, 2008). The research indicates this is most likely related to the discussion design or facilitation strategies utilized by faculty (DiPasquale & Hunter, 2018; Durrington et al., 2006; Lucas, et al., 2014; Saritas, 2008; Brierton et al., 2016; Woods & Bliss, 2016).

Aviv et al. (2003) examined the differences between a structured and non-structured asynchronous learning network (ALN) design on the knowledge construction process. Content analysis on the ALNs utilized the Interaction Analysis Model (IAM) (Gunawardena et al., 1997) and social network analysis evaluated the network structures. A total of 248 messages were included in the structured ALN and 70 messages in the non-structured ALN. The content analysis results revealed the non-structured ALN achieved only phase I of the IAM, where the structured ALN achieved phases I, II, III, IV, and V with a majority in phase IV. This is in contrast to later research. The cohesion index of the two groups demonstrated a significant statistical difference between the groups. The structured ALN had a higher number of interconnections between subgroups which suggests a bridging phenomenon, the flowing of information to all members. Differences were also noted between centralities between the groups. The structured ALN demonstrated multiple responders in the ALN, while the non-structured ALN only

had one responder. The researchers concluded that a structured ALN design is associated with higher phases of knowledge construction, a high degree of cohesion, and strong interconnections between members.

Saritas (2008) evaluated how knowledge is constructed through computer-mediated conferencing (CMC) and discovered that prior to 1992, there was a limited amount of research focused on learning quality and this medium. The study aims investigated were social participation and interactive patterns, the encouragement of knowledge construction via CMC, and factors that influenced knowledge construction. The Interaction Analysis Model (IAM) by Gunawardena et al. (1997) was used for content analysis. The findings indicated the majority of content was at the lower phases of knowledge construction as determined by the IAM and further examination of the data revealed the structure of the discussion influenced the quality and quantity of the discussion.

Social Construction of Knowledge and Social Network Centrality

Gunawardena et al. (2016) explored the process of learning in online asynchronous discussions through use of the IAM (Gunawardena et al., 1997) and learning analytics. Their evaluation of knowledge construction used a single discussion forum with 42 postings by 15 students. The results found that content was at IAM phases I, II, and III, with no content at the higher levels of IV or V. This is consistent with previous research. With regards to social network analysis they indicated it may be misleading to use the number of postings by a student as an indicator of their contribution to the construction of knowledge. They do suggest that students can construct knowledge regardless of their network centrality, but those students with high centrality play an

important role in preparing the group for knowledge construction and engaging others in discussion.

Nieves and Osorio (2013) performed a literature review on the role social networks in knowledge creation revealing a complex relationship between the two. They address the value of social capital as a resource for knowledge acquisition and exchange and its assistance in knowledge creation. Strong and weak ties of interpersonal relationship have a paradoxical effect on knowledge construction. Strong ties have the benefit of speedy exchange of information, sharing of ideas, and tacit knowledge. Weak ties have the benefit of heterogeneous knowledge for innovative ideas. Their conclusion states there is not a universal solution to the optimal social network for innovation and knowledge creation.

The research by Zhao et al. in 2016 explored behavioral patterns and differences in those behavioral patterns of students from online discussion forums. Social network structures and knowledge construction were used to examine the characteristics of the online discussion forums. Social network analysis was utilized to identify student centrality and network density. The IAM (Gunawardena et al., 1997) was utilized to assess knowledge construction. A total of 47 students and 623 discussion posts were used for the data. The researchers found there was a relatively dense network structure which included participants assuming the lead role who stimulated and activated a collaborative environment, as well as marginal, or peripheral, participants. As found with previous research, the majority of constructed knowledge construction remained at IAM phase levels I, II, and III, with a minority achieving phase level IV and V.

Social Construction of Knowledge and Nurse Practitioner Education

The literature search revealed there is limited research published in the arena of social construction of knowledge, medicine, and nursing, with minimal research regarding nurse practitioners. In 2010, James et al. conducted an ethnographic and hermeneutic study examining the forms of knowledge used by nurses and how they constructed knowledge. The study included observations, conversations, and interview of nurses in their daily practice environment. Technical information, observations, interactions with colleagues, and holistic evaluation of patients were the elements of knowledge used to create knowledge. Their conclusions were that separation of the elements were found to be insufficient to create knowledge and by interconnecting the elements of these pieces of information there is a more holistic understanding of the patient. Knowledge construction was promoted through the continuous, dynamic interplay of these elements along with an openness and questioning by the nurse.

Knowledge construction was examined by Mthembu and Mtshali (2013) through nursing community service-learning programs. Their qualitative, grounded theory approach explored the pedagogy of a community service-learning program. They were able to identify eight determinants of knowledge construction: authentic health-related problems, academic discourse-dialogue, cognitive coaching (scaffolding), interactive communities of learners, active learning, continuous reflection, collaborative learning, and inquiry-based learning. The results suggested that knowledge is constructed as nursing students interact with authentic communities and is mediated by prior experiences. This research is reflective of the literature regarding situated cognition.

Hassanian et al. (2015) explored knowledge creation in nursing using a grounded theory approach with a focus on nursing education. More importantly, they examined the conversion of knowledge to creating knowledge in order to reduce ambiguity and gain personal growth. The conversion of knowledge to created knowledge occurred through mind processes, individual and group reflection, praxis, and research. As with the findings of James et al. (2010), they found that knowledge creation is dynamic. There is continual reflection (individual and group), contemplation, and critical review of shared and stored knowledge in the process of building new knowledge.

In 2006, de Wever et al. examined patient management in online discussions and how the assigned roles of participants impacted knowledge construction among 6th year medical students. The students were divided into groups of four to five students and were to discuss four authentic case studies. The groups had either a student or instructor as moderator and with or without a developer of alternatives. The developer provided alternatives for patient management. The moderator monitored discussions, asked critical questions, and inquired opinions of the group. The IAM (Gunawardena et al., 1997) was used for content analysis on the discussion threads. Similar to previous research findings, the majority of the discussion occurred at IAM phase 1, 2, and 3; with IAM phase 4 and 5 were rare. The results found a significant difference between instructor and student moderators, but only when a developer of alternatives was involved. The researchers concluded that when the moderator and developer role are assigned to students, the content analysis results support the findings of Saritas (2008) and Brierton et al. (2016).

Measures of Social Construction of Knowledge in Online Forums

Early instruments for measuring knowledge construction in the online environment were developed in the 1990's and demonstrated a teacher-centered instructional model (Gunawardena et al., 1997). The limitation of this type of model was that it continued to focus on traditional teaching in a new medium as well as being inappropriate for analyzing informal learning (Gunawardena et al., 1997).

Significant research with four social construction of knowledge instruments designed for the online environment has been done. They include the Pattern of Knowledge Construction by Zhu (1996), Content Analysis Method by Newman et al. (2004), Transcript Analysis Tool (TAT) by Fahy et al. (2000), and the Interaction Analysis Model (IAM) by Gunawardena et al. (1997). The instrument that will be used for this study is the IAM (Gunawardena et al., 1997) and will be discussed further in the methodology.

Pattern of Knowledge Construction

Zhu (1996) describes the use of an electronic conferencing software in a graduate distance learning course. The course was a seminar taught on two different campuses and utilized video and audio technologies. Emails were used for outside class discussions and communications. Zhu evaluated a total of 408 notes on two randomly selected weeks of a 16-week course. A specific coding for analysis of online conference discussions was constructed. The coding integrated the theory of group interaction (Hatano & Inagaki, 1991) and the theory of question analysis (Graesser & Person, 1994). The focus of the research was to understand how students contribute in a conference and evaluate how ideas develop and evolve. One key item that was necessary was for the researcher to have

a familiarity of the content in order to determine each students' role in the conference.
Student roles were categorized into four classes: contributor, wanderer, seeker, and
mentor. Contributors were identified as all participants of the discussion. Wanderers were
described as those who appeared lost in the discussion. Seekers were defined as those
who recognized a lack of information and sought additional information. Mentors were
those who guided or assisted in idea development of others.

Eight categories of notes or comments were identified: type 1 question, type 2
question, answer, information sharing, discussion, comment, reflection, and scaffolding.
The categories are further divided into interactions types: vertical or horizontal. Vertical
interactions are those in which the participants are seeking out answers and not
contributing to or constructing knowledge. The type 1 question is a vertical interaction.
Horizontal interactions involve participants expressing and exchanging ideas which will
contribute to knowledge construction. The seven other categories are horizontal
interactions. Table 1 provides an overview of the categories.

Table 1

Category and Interaction Type

Category	Characteristic	Type of Interaction
Type 1 Question	Asks for information or requests answer	Vertical
Type II Question	Inquiry, Initiating a dialogue	Horizontal
Answer	Answering information seeking questions	Horizontal
Information Sharing	Sharing information	Horizontal
Discussion	Elaborate, exchange & express ideas & thoughts	Horizontal
Comment	Judgmental	Horizontal
Reflection	Evaluation or self-appraisal of learning	Horizontal
Scaffolding	Providing guidance or suggestions to others	Horizontal

Content Analysis Method

Newman, Webb, and Cochrane (2004) developed a research instrument based on the theories of group learning, deep learning, and critical thinking. They suggest that group learning involves active participation which, in turn, promotes deep learning, and is required for the development of critical thinking skills. Measurements of deep learning are determined lacking vigor when tested outside of original context, culture, or educational level. Newman et al. developed a set of indicators for critical thinking based on Henri (1992), Garrison (2001), and their own experiences. A total of 46 paired indicators in 10 categories are presented. The categories are relevance, importance, novelty, outside knowledge, ambiguities, linking ideas, justification, critical assessment, practical utility, and width of understanding. The paired indicators are binary opposites: positive (+) or negative (-). The positive indicator contributes to critical thinking development while a negative indicator detracts from critical thinking development (Newman et al., 2004; Marra et al., 2004). The script or passage is coded with a "+" or "-" and a ratio is calculated from -1 (all uncritical, all surface) to +1 (all critical, all deep).

While the technique tended to work well, there were some practical issues were identified by the researchers. Certain indicators relied on subject knowledge of the script or passage and having a subject matter expert is necessary. The indicators for ambiguity, practical utility, and width of understanding were low in numbers. It was suggested that if future research also found lacking numbers of these indicators, then there would be consideration for removing them. One main disadvantage of the techniques was the time required to analyze scripts or passages. A critique by Marra et al. (2004) indicated the

numerous codes of the technique tended to promote a fragmented view of discussions, although it defined the application for the researcher.

Transcript Analysis Tool

The research team of Fahy et al. (2000) at Athabasca University adapted the analytic tool by Zhu (1996). The tool underwent rigorous testing in a graduate level distance education course and underwent three adaptations prior to their final product. The final adaptation is the modified transcript analysis tool (MDE TAT). The development of their tool included five classification categories vertical questioning; horizontal questioning; statements; reflections; and scaffolding. Vertical questioning places emphasis on data acquisition or a question that is addressed to the person most likely to provide a correct answer. The purpose of horizontal questioning is to initiate a dialogue in order to foster collaboration to elicit an answer or solution. Statements provide information or clarify information and do not provoke dialogue. With reflections, there is discussion and revelations regarding the participants' internal beliefs, conflicts, and insights. The assumption is that other participants have an interest and will response with support. Scaffolding is where the person invites others to participate, either by name or by their comments. The final reliability of the tool was found to be 70%. The researchers have continued to investigate the application of the tool and improving reliability.

<div align="center">

Nurse Practitioners

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It is estimated that over one billion visits for health care services were provided by nurse practitioners in the United States in 2019 (AANP, 2020). As of 2019, there were over 290,000 nurse practitioners in the United States and the number is expected to

increase in the next decade (Auerbach et al., 2020; O'Neil-Mundinger & Carter, 2019; Yang et al., 2019). Health care delivery settings for nurse practitioners include outpatient clinics, hospitals, emergency departments, home health, urgent care clinics, nursing homes, public health departments, and private practice (AANP, 2020; Holley, 2016). Nurse practitioners provide health care services which include diagnosing and managing acute, chronic, complex, and critical health issues, health promotion, disease prevention, health education and counseling (AANP, 2020; Yang et al., 2019).

Nurse practitioners deliver care to six focused populations that include family/individual across the lifespan, adult-gerontology, neonatal, pediatrics, women's health/gender related, and psychiatric/mental health (AANP, 2020; Chan et al., 2020; Holley, 2016; Kleinpell et al., 2018). Data collected by the American Association of Nurse Practitioners in 2019 revealed that 89.7% of nurse practitioners are certified in primary care while 8.9% are certified in acute care. While many nurse practitioners hold certification in one specialty, they are allowed to hold multiple certifications (AANP, 2020).

Nurse Practitioner Education

The first nurse practitioner education program was started in 1965 and the first master's level program was established in 1967 (Brennan, 2020; Mack, 2018). This was in response to the Medicare Act of 1965, expanding care to elderly and low-income patients and the increased need for health care providers (Brennan, 2020). By 1973, there were more than 65 nurse practitioner programs in the United States (AANP, 2019). The first clinical doctorate program in the Unites States was founded in 1994 (Brennan, 2020). Forty-five years after the Medicare Act was signed into law by President Lyndon

Johnson, the Affordable Care (ACA) was signed into law by President Barack Obama in 2010 (Richard-Eaglin, 2017). As millions of Americans were able to obtain health insurance, there was a need for additional health care providers (Mack, 2018; Richard-Eaglin, 2017). In response to the workforce needs, the number of nurse practitioner programs has increased to over 400 across the United States (AANP, 2019). Students entering into nurse practitioner programs are required to have formal education as a registered nurse (AANP, 2020; AACCN, 2019; APRN Consensus Work Group, 2008; NONPF, 2017). Nurse practitioner students select one of six the population foci upon entry into their education (AANP, 2020).

In 2008, the Advanced Practice Registered Nurse (APRN) Consensus Model for APRN Regulation: Licensure, Accreditation, Certification & Education (Figure 7) was developed through the APRN workgroup and the National Council of State Boards of Nursing APRN Advisory Committee and has been widely accepted by APRN organizations in the United States.

Figure 7

The APRN Regulatory Model (APRN Consensus Workgroup & the National Council of State Boards of Nursing, 2008. p.10)

+The certified nurse practitioner (CNP) is prepared with the acute care CNP competencies and/or the primary care CNP competencies. At this point in time the acute care and primary care CNP delineation applies only to the pediatric and adult-gerontology CNP population foci. Scope of practice of the primary care or acute care CNP is **not setting specific** but is based on patient care needs. Programs may prepare individuals across both the primary care and acute care CNP competencies. If programs prepare graduates across both sets of roles, the graduate must be prepared with the consensus-based competencies for both roles and must successfully obtain certification in both the acute and the primary care CNP roles. CNP certification in the acute care or primary care roles must match the educational preparation for CNPs in these roles.

Prior to this report, there was no uniform model of regulation of APRNs among the states (Mack, 2018). A clear definition of the APRN was necessary prior to addressing licensure, accreditation, certification, and education (APRN Consensus Workgroup, 2008). The APRN was defined as a nurse:

- "who has completed an accredited graduate-level education program preparing him/her for one of the four recognized APRN roles;

- who has passed a national certification examination that measures APRN, role and population-focused competencies and who maintains continued competence as evidenced by recertification in the role and population through the national certification program;

- who has acquired advanced clinical knowledge and skills preparing him/her to provide direct care to patients, as well as a component of indirect care; however, the defining factor for all APRNS is that a significant component of the education and practice focuses on direct care of individuals;

- whose practice builds on the competencies of registered nurses (RNs) by demonstrating a greater depth and breadth of knowledge, a greater synthesis of data, increase complexity of skills and interventions, and greater role autonomy;

- who is educationally prepared to assume responsibility and accountability for health promotion and/or maintenance as well as the assessment, diagnosis, and management of patient problems, which includes the use of prescription of pharmacologic and non-pharmacologic interventions;

- who has clinical experience of sufficient depth and breadth to reflect the intended license; and

- who has obtained a license to practice as an APRN in one of the four APRN

  roles." (p.7)

The model states that APRN education must meet the following requirements: 1) formal

academic education with graduate degree or post-graduate certificate that is accredited by

a nursing or nursing-related organization, 2) be awarded pre-approval/accreditation or

full accreditation status prior to admitting students, 3) comprehensive at the graduate

level, 4) prepare graduates to practice in one of the four recognized APRN roles, 5)

prepare graduates with the core competencies for one of the APRN roles in at least one of

the six recognized population foci, 6) include graduate level core courses on advanced

physiology/pathophysiology, advanced health assessment, advanced pharmacology, 7)

provide additional content specific to the role and population in the core courses, 8)

provide a basic understanding of decision making principles, 9) prepare graduates to

assume responsibility and accountability for health promotion/maintenance, assessment,

diagnosis, management of patient problems including prescription of pharmacologic and

non-pharmacologic interventions, and 10) ensure comprehensive and sufficient clinical

and didactic coursework to prepare graduates to practice in the APRN role. The model

recognizes four APRN roles: the certified registered nurse anesthetist (CRNA), the

certified nurse-midwife (CNM), the clinical nurse specialist (CNS), and the certified

nurse practitioner (CNP). It was necessary to have a clear description of each of the roles

in order to determine educational expectations. The role of the certified nurse

practitioner was described as:

"For the certified nurse practitioner (CNP), care along the wellness-illness

continuum is a dynamic process in which direct primary and acute care is provided across

settings. CNPs are members of the health delivery system, practicing autonomously in areas as diverse as family practice, pediatrics, internal medicine, geriatrics, and women's health care. CNPs are prepared to diagnose and treat patients with undifferentiated symptoms as well as those with established diagnoses. Both primary and acute care CNPs provide initial, ongoing, and comprehensive care, includes taking comprehensive histories, providing physical examinations and other health assessment and screening activities, and diagnosing, treating, and managing patients with acute and chronic illnesses and diseases. This includes ordering, performing, supervising, and interpreting laboratory and imaging studies; prescribing medication and durable medical equipment; and making appropriate referrals for patients and families. Clinical CNP care includes health promotion, disease prevention, health education, and counseling as well as the diagnosis and management of acute and chronic diseases. Certified nurse practitioners are prepared to practice as primary care CNPs and acute care CNPs, which have separate national consensus-based competencies and separate certification processes" (p.8).

Adult Gerontology Acute Care Nurse Practitioner Education

The American Association of Critical Care Nurses is one of the national certification agencies for the adult gerontology acute care nurse practitioner and further delineates key components of the role to include performing comprehensive histories, physical examination, & screening activities; diagnosing and managing patients with acute, critical, and/or complex chronic illnesses & injuries; ordering, performing, supervising & interpreting diagnostic studies; prescribing medications, durable medical equipment & advanced therapeutic interventions; specialized skills in the performance of procedures; providing health promotion, disease prevention, health education &

counseling; collaborating & communicating with members of the interprofessional team; assessing, educating & providing referrals for the patient, family & caregiver; and facilitating transitions across the care continuum (AACN, 2019).

The American Association of Critical Care Nurses (2019) delineates the educational requirements for students seeking certification as an adult gerontology acute care nurse practitioner (AGACNP). These requirements are related to the APRN Consensus Model and incorporate additional curriculum for the AGACNP. The educational requirements are:

- the program is through a college or university that offers an accredited master's or higher degree in nursing focused on the AGACNP;

- competencies to care for the entire adult population (young adults, older adults & frail elderly) must be included;

- the program must be in compliance with the National Task Force Criteria for Evaluation of Nurse Practitioner Programs (NTFC);

- direct and indirect clinical supervision must be congruent with AACCN and accreditation guidelines;

- the curriculum includes biological, behavioral, medical & nursing sciences for the practice of an AGACNP and must include advanced pathophysiology, advanced pharmacology, advanced physical assessment, legal & ethical responsibilities, and supervised clinical practice relevant to the acute care specialty; and

- the curriculum is consistent with the AGACNP competencies, there is a minimum of 500 supervised clinical hours, clinical hours are focused on the direct care of acutely ill adult gerontology patients & completed in the United States, and the

supervised clinical experiences are directly related to the knowledge and role of the AGACNP.

Since 1980, nurse practitioner education has been based on competency and remains the standard today (AANP, 2020; Gravina, 2017; Tractenberg et al., 2019). Educational programs are required to meet national competency-based standards (AANP, 2020; APRN Consensus Workgroup, 2008). Competency-based education in nursing is an educational model which focuses on outcomes and the student must demonstrate achievement of knowledge and skills to provide safe patient care in order to progress and graduate (Fukada, 2018; Distler, 2015; Gravina, 2017; Kesten et al., 2015; NCBSN, 2005; Nieminen et al., 2011; Schumacher &. Risco, 2017). Shumacher and Risco (2017) suggest that a competency-based education is learner focused and allows for earlier identification of at-risk students. Gravina (2017) along with Schumacher and Risco (2017) state that while competency-based education has been the focus of nursing programs, there are still programs that are based on the traditional completion of credit hours. Chan et al. (2020) recognized this is in part due to the large number of nurse practitioner competencies put forth by national agencies. They assessed for redundancy among core nurse practitioner competencies utilizing a Delphi approach. One hundred and thirty-nine competencies were evaluated by a panel of experts. The number of competencies were reduced from 139 to 49 after three rounds of questionnaires. This study resulted in a better understanding of measurable competency outcomes to support a competency-based education.

Nurse Practitioner Competency

Competency, as it relates to the health care profession, is defined by Frank et al. (2010) as "an observable ability of a health professional, integrating multiple components such as knowledge, skills, values, and attitudes." The APRN Consensus Model (2008) does not specifically define competencies, but it explains the relationship of competencies with licensure, education and role preparation (Holley, 2016; Mack, 2018; Rounds et al., 2012). Figure 8 illustrates the APRN Consensus Model and its relationship with competencies. In the 12 years since the model's release, nurse practitioner programs and certifying bodies have undertaken measures to be congruent with the model (AACN, 2019; AACCN, 2019; NONPF, 2017).

Figure 8

The relationship of educational competencies with licensure, role preparation, education, and credentialing. (APRN Consensus Workgroup & the National Council of State Boards of Nursing, 2008. p.14)
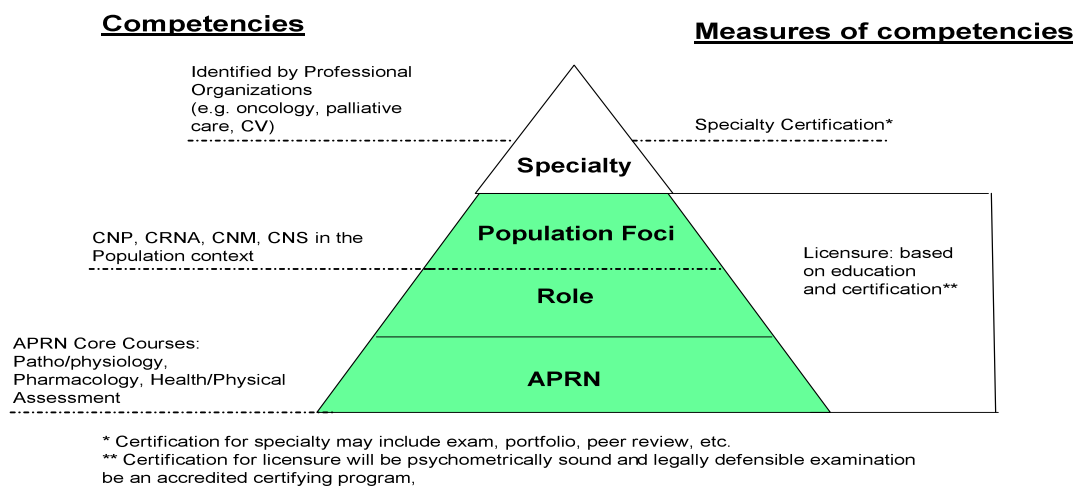
The National Organization for Nurse Practitioner Faculties (NONPF) has developed a set

of competencies that are inclusive of the core competencies and each of the specialty

population-specific roles and can be observed or measured (NONPF, 2017). There are

nine domains of competencies: scientific foundations, leadership, quality, practice

inquiry, technology & information literacy, policy, health delivery systems, ethics, and

independent practice. Each domain has specific key competencies for nurse practitioner

student to achieve. Table 2 provides an overview of the NONPF core competencies for

the nurse practitioner.

Table 2

NONPF competency domains with core competencies (NONPF, 2017)

Domain	NP Core Competencies
Scientific Foundations	1. Critically analyzes data & evidence for improving advanced nursing practice. 2. Integrates knowledge from the humanities and sciences within the context of nursing science. 3. Translates research & other forms of knowledge to improve practice processes & outcomes. 4. Develops new practice approaches based on the integration of research, theory, & practice knowledge.
Leadership	1. Assumes complex & advanced leadership roles to initiate & guide change. 2. Provides leadership to foster collaboration with multiple stakeholders. 3. Demonstrated leadership that uses critical and reflective thinking. 4. Advocates for improved access, quality, and cost-effective health care. 5. Advances practice through the development & implementation of innovations incorporating principles of change. 6. Communicates practice knowledge effectively, both orally and in writing. 7. Participates in professional organizations and activities that influence advanced practice nursing and/or health outcomes of a population focus.
Quality	1. Uses best available evidence to continuously improve quality of clinical practice. 2. Evaluates the relationships among access, cost, quality, and safely and their influence on health care. 3. Evaluates how organizational structure, care processes, financing, marketing, and policy decisions impact the quality of health care. 4. Applies skills in peer review to promote a culture of excellence. 5. Anticipates variations in practice and is proactive in implementing interventions to ensure quality.

Table 2 (cont.)

Domain	NP Core Competencies
Practice Inquiry	1. Provides leadership in the translation of new knowledge into practice.
	2. Generates knowledge from clinical practice to improve practice and patient outcomes.
	3. Applies clinical investigative skills to improve health outcomes.
	4. Leads practice inquiry, individually or in partnership with others.
	5. Disseminates evidence from inquiry to diverse audiences using multiple modalities.
	6. Analyzes clinical guidelines for individualized application into practice.
Technology & Information Literacy	1. Integrates appropriate technologies for knowledge management to improve health care.
	2. Translates technical and scientific health information appropriate for various users' needs.
	3. Demonstrates information literacy skills in complex decision making.
	4. Contributes to the design of clinical information systems that promote safe, quality, and cost-effective care.
	5. Uses technology systems that capture data on variables for the evaluation of nursing care.
Policy	1. Demonstrates an understanding of the interdependence of policy and practice.
	2. Advocates for ethical policies that promote access, equity, quality, & cost.
	3. Analyzes ethical, legal, and social factors influencing policy development.
	4. Contributes in the development of health policy.
	5. Analyzes implications of health policy across disciplines.
	6. Evaluates the impact of globalization on health care policy development.
	7. Advocates for policies for safe & effective healthy practice environments
Health Delivery Systems	1. Applies knowledge of organizational practices & complex systems to improve health care delivery.
	2. Effects health care change using broad based skills including negotiation, consensus-building, & partnering.
	3. Minimizes risk to patients & providers at the individual & systems level.
	4. Facilitates the development of health care systems that address the needs of culturally diverse populations, providers, & other stakeholders.
	5. Evaluates the impact of health care delivery on patients, providers, other stakeholders, & the environment.
	6. Analyzes organizational structure, functions & resources to improve the delivery of care.
	8. Collaborates in planning for transitions across the continuum of care.
Ethics	1. Integrates ethical principles in decision making.
	2. Evaluates the ethical consequences of decisions.
	9. Applies ethically sound solutions to complex issues related to individuals, populations, & systems of care.
Independent Practice	1. Functions as a licensed independent practitioner.
	2. Demonstrates the highest level of accountability for professional practice.
	3. Practices independently managing previously diagnoses & undiagnosed patients.
	4. Provides patient-centered care recognizing cultural diversity & the patient or designee as a full partner in decision-making.
	5. Educates professional & lay caregivers to provide culturally & spiritually sensitive, appropriate care.
	6. Collaborates with both professional & other caregivers to achieve optimal care outcomes.
	7. Coordinate transitional care services in & across care settings.
	8. Participates in the development of professional standards & evidence-based care.

Adult Gerontology Acute Care Nurse Practitioner Competencies

The American Association of Critical Care Nurses (AACCN, 2019) has developed a set of validated, observable, and measurable competencies for the adult gerontology acute care nurse practitioner based on the Synergy Model for Patient Care. The eight competency domains are:

1) clinical judgement, 2) advocacy/moral agency, 3) caring practices, 4) response to diversity,

5) facilitation of learning, 6) collaboration, 7) systems thinking, and 8) clinical inquiry.

Table 3 provides an overview of the domains with AGACNP competencies. A study of practice or job analysis is conducted every five years to validate the knowledge, skills, and abilities for safe and effective practice of the AGACNP (AACN, 2019). The analysis validated the AGACNP competencies and the certification examination to assess knowledge of content (AACN, 2019).

Table 3

AACCN domains with AGACNP competency description (AACN, 2019)

Domain	AGACNP Competency Description
Clinical Judgement	The clinical reasoning, which includes clinical decision making, critical thinking and a global grasp of the situation, couples with APRN skills acquired through a process of integrating formal & informal experiential knowledge and evidence-based guidelines.
Advocacy/Moral Agency	The working on another's behalf when the other is not capable of advocating for him/herself. Serving as the moral agent in identifying & helping to resolve ethical & clinical concerns within and outside the clinical setting.
Caring Practices	APRN activities that create a compassionate, supportive & therapeutic environment for patients & staff, with the aim of promoting comfort & healing, and preventing unnecessary suffering. Includes vigilance, engagement & responsiveness of caregivers; pain management, infection control, risk assessment and the NP/patient relationship
Response to Diversity	The sensitivity to recognize, appreciate & incorporate differences into the provision of care. The differences can be spiritual beliefs, ethnicity, family configuration, lifestyle values, & use of complementary alternative therapies.
Facilitation of Learning	The ability to formally & informally facilitate learning for patients, staff & the organization.
Collaboration	Working with others to promote & encourage each person's contributions to achieve optimal & realistic outcomes. Includes initiating referrals, providing consultation and coordination of inter- and intra-disciplinary teams to develop or revise plans of care focused on the concerns of the patient, family or both.
Systems Thinking	The body of knowledge & tools that allow the APRN to manage whatever environmental & system resources exist for the patient/family and staff, within or across healthcare and non-healthcare systems. Include analysis & promotion of cost-effective resource utilization that results in optimal patient outcomes.
Clinical Inquiry	The ongoing process of questioning & evaluating practice, providing informed practice & innovating through research & experiential learning.

Determining Level of Nurse Practitioner Competency

Benner (1982) recognized that nursing had become increasingly complex and was heterogeneous in the levels of proficiency. She stated that nurses progress through five levels of proficiency: novice, advanced beginner, competent, proficient, and expert. Two aspects of skilled performance are reflected as nurses progress through the levels

(Benner, 1982). First is a change in their paradigm from abstract principles to past, concrete experiences. The second is a change in perceptions and understanding to view a situation as a complete whole in which key parts are relevant (Benner, 1982). Through a qualitative study of 67 nurses, she defined each of the five levels. The novice (Level 1) nurse is a beginner with no experience of a situation and learn using objective attributes or given rules to guide actions (Benner, 1982). The advanced beginner (Level 2) nurse is able to demonstrate a marginally acceptable performance, relying on previous experiences (Benner, 1982). The competent (Level 3) nurse is consciously aware of their actions and uses both abstract and analysis for a problem (Benner, 1982). This nurse has a feeling of mastery and the ability to manage various situations. The proficient (Level 4) nurse has enough experience to perceive situations as a whole and has a deep understanding of a situation (Benner, 1982). The expert (Level 5) nurse has an extensive amount of previous of experience and can grasp situations intuitively. This nurse functions with from a deep understanding of the situation.

Summary

In summary, the research reveals that asynchronous online discussions are an important tool in online learning, support student interaction, and can assist with knowledge sharing & creation, and critical thinking. Although, learning outcomes can be influenced by the instructional design of the discussion board. As the discussion evolves and connections are created, students are positioned within the network. Their location in the network can identify at-risk students and predict academic success. At-risk students tend to be on the periphery of the network, while those at the center of the network tend to perform better. Social construction of knowledge is the result of interactions and

sharing of each individuals' social capital However, the majority of asynchronous online discussions demonstrate lower levels of knowledge construction as measured by the Interaction Analysis Model (Gunawardena, et al., 1997) with minimal achievement of higher levels. Knowledge construction and social networks have a close relationship with each other.

Nurse practitioner education had expanded into the online environment and asynchronous online discussions are a major tool used in online programs. Education for nurse practitioners is based in competency and online programs are required to meet national standards. Students progressing and completing a nurse practitioner program must meet the national competency standards to become certified. Being able to identify at-risk students is an important part of competency-based education.

The literature review revealed the relationship between social network centralities and social construction of knowledge. Research examining social network centralities, social construction of knowledge, and nurse practitioner competency has remained unexplored.

CHAPTER 3 METHODOLOGY

Study Design

This study used a retrospective, non-experimental, mixed-method design to explore the relationships between social network centralities, social construction of knowledge, and competency among advanced practice nursing students participating in an asynchronous, online discussion. Approval for this study was obtained from the University of New Mexico Health Science Center Institutional Review Board for Human Subjects in Research.

Sample

The sample used for this study was a non-probability, convenience sample of nine female students participating in an asynchronous online discussion board forum during the summer 2018 Master's of Science in nursing (MSN) course "Management of the Complex/Chronically Ill Adult-Gerontology Patient" and was used for data analysis. The course was selected for the complex, ill-structured nature of the discussion board forum. This particular course occurs in the 4th term of a six-term program. This course was supported by scaffolding of previous content. The prior content included advanced pathophysiology, advanced health assessment, advanced pharmacology, nursing research, nursing theory, health promotion, and management of the acutely illnesses. The timeline of courses is illustrated in Figure 9.

Figure 9

Progression of courses in the MSN AGACNP program

Term 1
- Nursing Theory
- Nursing Research
- Advanced Pathophysiology

Term 2
- Health Promotion
- Advanced Health Assessment
- Advanced Pharmacology

Term 3
- Health Policy
- Advanced Diagnostics & Skills
- Management of Acute Illnesses

Term 4
- Management of Complex/Chronic Illnesses
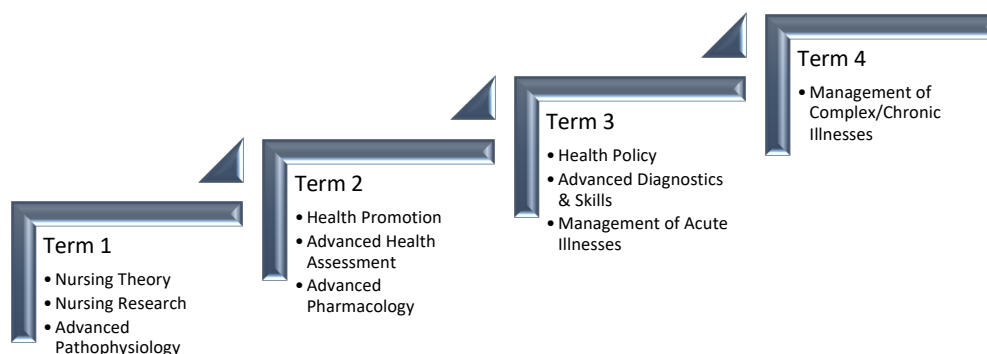
Instructional Design

The course focused on the complex and chronically ill adult/gerontology patient with an emphasis on complex and chronic health problems common to this patient. Clinical practice guidelines provide the basis for diagnosis and management of the adult/gerontology patient. The process of iatrogenesis was also discussed. The five course objectives were:

1. Adapt current treatment guidelines for the adult/gerontology patient with complex and chronic illnesses to incorporate associated comorbidities;

2. Select and interpret diagnostic/laboratory tests for the evaluation of complex and chronically ill adult gerontology patients;

3. Discuss the impact of age-related changes on complex and chronic illnesses;

4. Predict potential iatrogenic complications for the complex and chronically ill adult/gerontology patient; and

5. Demonstrate basic clinical competence in providing care for the complex and chronically ill adult/gerontology patient.

Discussion Board Design

A student was assigned a complex clinical scenario (Grand Rounds) to present in the discussion (Appendix A). Information for the scenario included a patient history and physical, laboratory data, and diagnostic data. Each student in the course selected the case scenario they were to present without knowing its content. The student presenting the Grand Round was required to meet the following criteria:

- Accurately determine the patients' medical issues and create an evidence-based plan of care addressing the interaction of the acute and chronic health issue;

- Appropriately manage both the acute and chronic health conditions;

- Incorporate concepts of advanced health assessment, advanced pharmacology, advanced pathophysiology, health promotion & protection, diagnostic & laboratory interpretation, and therapeutic interventions; and

- Include the assessment and plan for the patient.

The presentation was a 5- to 8- minute video. Other students in the course were required to view the video and discuss the patient management, providing suggestions/recommendations that are evidence-based, or asking and answering questions. The discussion responses were encouraged to be free flowing, with no limitations on who to respond to or number of responses. Once the initial video was posted, the participants had seven days to participate in the discussion board.

<div align="center">

Instrument

</div>

Interaction Analysis Model

The instrument used for this study was the Interaction Analysis Model (IAM) developed by Gunawardena et al. (1997). The IAM was originally designed for

evaluating conference discussions and since then, it has been the most commonly used instrument for assessment of asynchronous online discussion in education (Gunawardena et al. 1997; Hall, 2014; Lucas et al., 2014). It is based on the model by Henri (1992). The IAM's grounded theory approach through socio-constructivism and sociocultural learning makes it highly applicable to use in research for assessing collaborative learning with interactive groups (LaPointe & Gunawardena, 2004).

The IAM (Figure 10) has five main phases for coding. The main phases are: 1) sharing/comparing of information, 2) discovery & exploration of dissonance, 3) negotiation of meaning/co-construction of knowledge, 4) testing & modification of proposed synthesis, and 5) application of newly constructed meaning.

Hall (2014) presented information regarding the inter-rater reliability of the IAM in a review of 22 publications in which the IAM was used. She identified five different methods used to evaluate inter-rater reliability Cohen's kappa, Krippendorff's alpha, Cronbach's alpha, Other, and method not provided. The results were Cohen's kappa ranged from 0.61 to 0.94; Krippendorff's alpha ranged from 0.4 to 0.93; Crohnbach's alpha ranged from 0.87 to 0.99; Other method ranged from 0.839 to 0.93, and 'method not provided' ranged from 0.80 to 0.90. With 17 of the publications having results greater than 0.80, this indicates a high level of inter-rater reliability. The trustworthiness and transferability of the IAM across various research designs, contexts, and content supported its selection for this study.

Figure 10

The IAM developed by Gunawardena et al., 1997, p. 414

PHASE I: SHARING/COMPARING OF INFORMATION. Stage one operations include:
A. A statement of observation or opinion   [PhI/A]
B. A statement of agreement from one or more other participants   [PhI/B]
C. Corroborating examples provided by one or more participants   [PhI/C]
D. Asking and answering questions to clarify details of statements   [PhI/D]
E. Definition, description, or identification of a problem   [PhI/E]

PHASE II: THE DISCOVERY AND EXPLORATION OF DISSONANCE OR INCONSISTENCY AMONG IDEAS, CONCEPTS OR STATEMENTS. (This is the operation at the group level of what Festinger [20] calls cognitive dissonance, defined as an inconsistency between a new observation and the learner's existing framework of knowledge and thinking skills.) Operations which occur at this stage include:
A. Identifying and stating areas of disagreement   [PhII/A]
B. Asking and answering questions to clarify the source and extent of disagreement   [PhII/B]
C. Restating the participant's position, and possibly advancing arguments or   [PhII/C]
     considerations in its support by references to the participant's experience,
     literature, formal data collected, or proposal of relevant metaphor or analogy to
     illustrate point of view

PHASE III: NEGOTIATION OF MEANING/COCONSTRUCTION OF KNOWLEDGE
A. Negotiation or clarification of the meaning of terms   [PhIII/A]
B. Negotiation of the relative weight to be assigned to types of argument   [PhIII/B]
C. Identification of areas of agreement or overlap among conflicting concepts   [PhIII/C]
D. Proposal and negotiation of new statements embodying compromise,   [PhIII/D]
     co-construction
E. Proposal of integrating or accommodating metaphors or analogies   [PhIII/E]

PHASE IV: TESTING AND MODIFICATION OF PROPOSED SYNTHESIS OR COCONSTRUCTION
A. Testing the proposed synthesis against "received fact" as shared by the   [PhIV/A]
     participants and/or their culture
B. Testing against existing cognitive schema   [PhIV/B]
C. Testing against personal experience   [PhIV/C]
D. Testing against formal data collected   [PhIV/D]
E. Testing against contradictory testimony in the literature   [PhIV/E]

PHASE V: AGREEMENT STATEMENT(S)/APPLICATIONS OF NEWLY CONSTRUCTED MEANING
A. Summarization of agreement(s)   [PhV/A]
B. Applications of new knowledge   [PhV/B]
C. Metacognitive statements by the participants illustrating their understanding that   [PhV/C]
     their knowledge or ways of thinking (cognitive schema) have changed as a
     result of the conference interaction

Data Collection

Once IRB approval (Appendix B) was obtained, the data collection and analysis

process began. The major risk of this study was the loss of confidentiality of the

discussion board participants. The appropriate measures were taken to protect the rights

and welfare of human research subject participants as recommended by the University of

New Mexico Health Science Center IRB. In order to minimize this risk, all of the

participants were de-identified and assigned a name from the 2024 hurricane name list,

that was kept separate. Any printed documents were removed promptly from the printer

and the documents were kept in a locked cabinet. All printed documents were shredded

upon completion of the review. Electronic data was kept on a biometric protected,

encrypted laptop.

The post for the discussion board were manually extracted (copy & paste) from

BlackBoard Learn and entered as single lines in an Excel spreadsheet. Two columns were

created: column A contained the de-identified name of the participant, column B

contained the discussion board posting content, column C was for IAM coding, and

column D was for competency coding. Figure 12 illustrates the data collection tool and

coding.

Figure 11

Data collection tool

Participant	DB Post Content	IAM (phase level)	Competency (Benner level)

Qualitative content analysis for social construction of knowledge was performed using the IAM. The phases were coded as ordinal data. While a discussion post may have more than one sentence coded at different phases of the IAM, the overall gestalt of the post was coded and used for data analysis. A second reviewer coded the discussion board data for the phases of IAM. The coding system for the IAM phases is as follows:

1. Sharing/Comparing of Information
2. Discovery & Exploration of Dissonance or Inconsistency
3. Negotiation of Meaning/Co-Construction of Knowledge
4. Testing & Modification of Proposed Synthesis of Co-Construction
5. Agreement Statements/Applications of Newly Constructed Meaning

Content analysis for AGACNP competency was performed using the phases Benner's (1982) Novice to Expert. The phases were coded as ordinal data. Similar to the content analysis for the IAM, the discussion post may have had more than one sentence and the overall competency level of the post was coded and used for data analysis. A second reviewer coded the discussion board data for the level of competency. The coding system for competency is as follows:

1. Novice
2. Advanced Beginner
3. Competent
4. Proficient
5. Expert

Figure 12 illustrates a sample of the Excel coding sheet for IAM and competency.

Figure 12

Sample of the Excel coding sheet used in the coding process of IAM and competency.

Name	DB Posting 6	IAM	Competency
Kristy	Ileana, Great presentation! I think the only question I have for you is about the order you placed all the differential for AMS. Why did you place barbiturates #6? I think I would place the barbiturates further up in the differential as he may be over using them or because the kidney's and liver function are altered, not metabolizing even his prescribed dose. Causing the AMS. What do you think?	1	2
Miriam	Kristy, I agree that barbiturates could be causing his AMS. Is he getting this because of his asterixis? I did not see a history of seizures. He is also on Periactin, an antihistamine that can cause drowsiness, and Zolpidem, which induces sleep. Since neither this patient's kidneys nor his liver are working properly, all these drugs can accumulate and make him drowsy. This scares me as he is alone at home and has a history of falling. I am curious about whether this patient will be appropriate to return home without help.	3	2
Kristy	Miriam, Great thought , you are right about returning home alone without home health or family. I know we can't assume family is going to be able to help out every time but I wish we could have more then just a home health visit for these types of patients. I just don't think it is ever enough and they end up in the hospital from a fall like you said. It is overwhelming to find the best way to discharge a patient like this home at all. Would you consider a SNF?	3	2

Quantitative methods with social network analysis was performed using Microsoft Excel with the plug-in NodeXL Basic. This plug-in is designed for users with little programming experience. It contains the four worksheets Edges, Vertices, Groups, and Overall Metrics. NodeXL uses algorithms to generate centralities and graph visualization through sociograms (Social Media Foundation, 2020). The researcher selected NodeXL for social network analysis due to the ease of its use.

In preparation for social network analysis, social edge vertices were created. A post from one participant to another constitutes a social edge and assists in determining the centralities of the network. The edges for social network analysis were determined by the discussion board participants with the post initiator in Vertex 1 and the participant the post was directed to in Vertex 2. If a post was directed at more than one participant, a separate vertex was created. Figure 13 illustrates the NodeXL edges.

Figure 13

Sample of the created social edge vertices.

	A	B
1		
2	Vertex 1	Vertex 2
9	Tara	Kristy
10	Gilma	Tara
11	Miriam	Tara
12	Willa	Tara
13	Olivia	Tara
14	Miriam	Ileana
15	Gilma	Ileana
16	Ileana	Gilma
17	Gilma	Ileana
18	Yolanda	Gilma
19	Tara	Gilma

To calculate the social network centralities, the following process was entered into

NodeXL:

1. Social edges were created as described previously;
2. Type was set to "Directed";
3. Graph Metrics were set to "Select All" and then calculated

To create the sociogram visual image, the following filters were set:

1. Layout was set to Fruchterman-Reingold
2. Autofill columns of vertices used the settings of Vertex Label = "Vertex", Fill color = "Betweenness", Vertex size = "Betweenness"

Additional quantitative analysis for descriptive and correlation calculations were

performed using SPSS software. Hierarchical clustering was performed with the program

"R" using the "tm" and "SnowballC" packages for text mining, replacement, and word

stemming.

Summary

A mixed-method design of the study was used to explore the relationships

between social network centralities, social construction of knowledge, and nurse

practitioner competency among adult gerontology acute care nurse practitioner students

who participated in an asynchronous online discussion in the Summer of 2018. The

students were in their 4th term of a six-term program and had progressed through the

program as a cohort. The discussion board design was a complex case scenario assigned

to a student moderator. Qualitative evaluation was performed using content analysis for

social construction of knowledge and nurse practitioner competency. Social construction

of knowledge was coded with the phases of the Interaction Analysis Model

(Gunawardena et al., 1997) and nurse practitioner competency was coded using the

Novice to Expert model (Benner, 1982). Quantitative analysis was performed using

social network analysis utilizing the plug-in NodeXL with Microsoft Excel.

CHAPTER 4 RESULTS

Qualitative and quantitative methods were used in the analysis of the data.

Descriptive statistics were used to analyze social network centralities and coded data

(social construction of knowledge and competency level). Measures of central tendency

were used to identify trends in the data. A review of discussion board content was

performed during June and July 2020. The discussion board content analyzed was

selected from the summer 2018 MSN course "Management of the Complex/Chronically

Ill Adult/Gerontology Patient."

Analysis of Discussion Board Data

Discussion Post

A total of nine female students participated in the discussion. There was a total of

38 discussion posts selected for analysis. There were five discussion posts that were

unable to be coded for social construction of knowledge or competence and, therefore,

deleted from analysis. The content from the deleted discussion posts contained comments

of "Thank you" and "You are welcome." Consequently, data from a total of 33 discussion

posts were used for data analysis. The number of posts by each student ranged from two

to eleven with a median of three. Aggregate word count of the postings totaled 3468. The

word count for discussion posts ranged from 22 to 301 with a mean of 102. Table 4

illustrates the discussion board characteristics.

Table 4

Discussion board characteristics

	Range	Median	
Discussion Postings	2 – 11	3	
	Range	Mean	Std Deviation
Wordcount per post	23 – 301	105	76

Research Question 1: Centralities of the Network

Social network analysis was used to answer the first research question: "What type of centrality is demonstrated by each of the individuals in the network?" Social network analysis results provided betweenness, closeness, eigenvector, indegree, and outdegree centralities of each individual in the network. Betweenness centrality ranged from 0.0 to 24.33. A high result of betweenness indicated the influencer in the network, or the individual who has the shortest path of information flow in the network, thereby influencing the network. A low result of betweenness indicated lack of influence in the network. Closeness centrality ranged from 0.067 to 0.125. A high result of closeness indicated an individual has a more direct exchange of information with others in the network. A low result of closeness indicated an individual was dependent on others to exchange information. Eigenvector centrality ranged from 0.033 to 0.167. A high result of eigenvector indicated an individual who is well connected in the network. A low result of eigenvector indicated an individual who is less connected and is located on the periphery of the network. Indegree centrality ranged from 1 to 8 and identified the consumer of the network. Outdegree centrality ranged from 1 to 7 and identified the producer of the network. Table 5 illustrates the characteristics of the centralities.

Table 5

Descriptive analysis of centralities

Centrality	Range	Mean	Std Deviation
Betweenness (Influencer)	0.0 – 24.33	3.77	7.86
Closeness (Information Exchange)	0.067 – 0.125	0.088	0.018
Eigenvector (Connectedness)	0.033 – 0.167	0.111	0.015
	Range	Median	
Indegree (Consumer)	1 - 8	2	
Outdegree (Producer)	1 – 7	2	

Subgroups, or clusters, within a network often emerge (Hansen et al., 2020). The subgroups define the boundaries of information flow and influence among participants (Hansen et al., 2020). Those participants within a subgroup have more connections with other individuals in the subgroup than with others outside of the subgroup (Hansen et al., 2020). Once the overall network centralities were calculated, the dynamic filters of NodeXL were used to determine subgroups within the network. The vertices were grouped by cluster using the Clauset-Newman-Moore algorithm. Two subgroups were identified through group clustering. Table 6 differentiates the group by centralities and Figure 14 illustrates the two subgroups resulting from the Clauset-Newman-Moore algorithm.

Table 6

Groups identified with centralities

Participant	Betweenness	Indegree	Outdegree	Closeness	Eigenvector
Group 1					
Ileana	24.33	8	7	0.125	0.167
Gilma	3.00	5	3	0.091	0.130
Olivia	0.00	2	3	0.083	0.120
Yolanda	0.00	1	2	0.071	0.059
Rosa	0.00	1	1	0.067	0.033
Group 2					
Miriam	3.33	2	6	0.100	0.151
Tara	3.33	4	3	0.100	0.151
Kristy	0.00	3	2	0.077	0.094
Willa	0.00	2	2	0.077	0.094

Figure 14

Visualiz image of the 2 subgroups from the Clauset-Newman-Moore algorithm
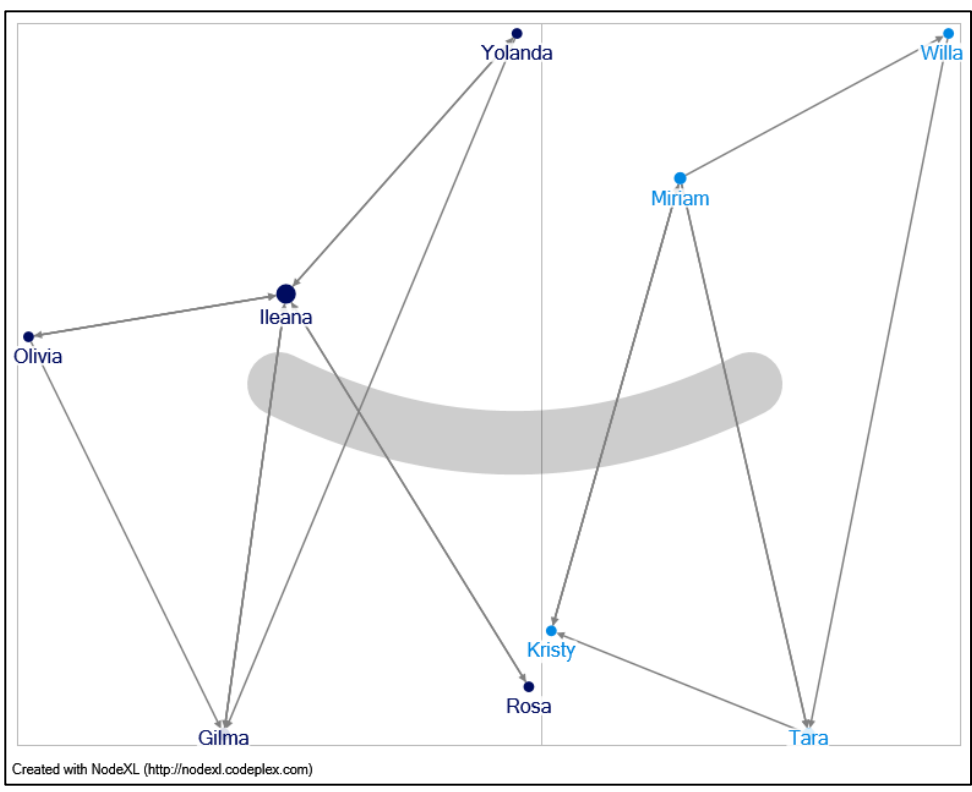
Research Question 2: Levels of Social Construction of Knowledge

The coding process using the IAM was performed separately by two coders, the researcher and a 2nd coder, to assess for inter-rater reliability. The 2nd coder was given instructions on how to use the IAM and a copy of the IAM (Gunawardena et al., 1997). Krippendorff's alpha was calculated to determine inter-rater reliability. The first calculation of Krippendorff's alpha resulted 0.1936, which is not sufficient for inter-rater reliability. The coders had discussion on coding with the IAM and a second round of coding was performed. The second calculation of the Krippendorff's alpha resulted 0.8231 which is sufficient for inter-rater reliability (Krippendorff, 2004, p. 241).

Content analysis was utilized to answer the second research question: What levels of social construction of knowledge are demonstrated by AGACNP students participating in asynchronous online discussion? The IAM has five phases of social construction of knowledge, ranging from sharing of information to application of newly constructed meaning (Gunawardena et al., 1997). Following the instructions provided by one of the developers of the model each discussion board post was coded a phase. It was possible that a discussion post could have statements from different phases of the IAM, but the highest achieved phase was assigned as a reflection the gestalt of the post. The data was examined at two levels of unit of analysis: the individual post and then by each participant.

Unit of Analysis by Post

The unit of analysis was one post. Of the discussion posts, 21.2% were coded as Phase I, 30.3% as Phase II, 34.9% as Phase III, 6.1% as Phase IV, and 3.0% at Phase V. Table 7 illustrates the coded phases social construction of knowledge.

Table 7

Social Construction of Knowledge of the discussion board

Social Construction of Knowledge	Number	Percent
Phase I (sharing/comparing of information)	7	21.2%
Phase II (discovery & exploration of dissonance or inconsistency	10	30.3%
Phase III (negotiation of meaning/co-construction of knowledge)	13	39.4%
Phase IV (testing & modification of propose synthesis or co-construction	2	6.1%
Phase V (agreement statements/applications of newly constructed knowledge)	1	3.0%

Additional examination of discussion post wordcounts by phase of IAM revealed posts coded in phases I and II had wordcounts ranging from 23 to 145 and those posts coded in phases III, IV, and had wordcounts ranging from 29 to 301. Phase IV and V had only one post. This Table 8 illustrates the wordcounts for each IAM phase.

Table 8

Discussion board post wordcounts by IAM phase

IAM Phase	Wordcount Range	Mean
I	23 – 79	45
II	40 – 145	90
III	29 – 301	136
IV	110	
V	238	

Unit of Analysis by Participant

Further investigation of the data was performed with the unit of analysis at the participant level. The highest level achieved by the participants was assigned at this level.

The distribution of highest phase level achieved revealed 44.4% were at Phase I and II while 55.6% were Phase III, IV and V. Table 9 presents the highest IAM levels achieved by the group.

Table 9

Highest IAM phases achieved by the group

Highest IAM Phase Achieved	Number	Percent
Phase I	1	11.1%
Phase II	3	33.3%
Phase III	2	22.2%
Phase IV	2	22.2%
Phase V	1	11.1%

In order to perform correlation analysis with network centralities, it was necessary to identify the highest level of IAM achieved by each participant. Table 10 illustrates the highest level of social construction of knowledge achieved by the individual participants.

Table 10

Highest IAM phase achieved by each participant

Participant	Range	Highest IAM Phase Achieved
Group 1		
Ileana	1 - 4	4
Gilma	3 - 4	4
Olivia	1 - 3	3
Yolanda	1 - 2	2
Rosa	1	1
Group 2		
Miriam	1 - 3	3
Tara	3 - 5	5
Kristy	2	2
Willa	2	2

Phase I of the IAM is where participants in the network are sharing and comparing information. Gunawardena et al. (1997) identify these as a statement of observation or opinion, a statement of agreement from one or more other participants, corroborating examples provided by one or more participants, asking and answering questions to clarify details of statements, and a definition, description, or identification of a problem. In the selected discussion board, posts that demonstrated this agreement with other participants were stated as:

> "I agree, fluids and antibiotics and re-evaluate after 24 hrs will also tell how the patient is responding" and "I agree that a PA/lateral would be best to rule out hepatic hydrothorax"

An example of a post that shared an opinion was:

> "A good case manager would be able to help him find placement in a decent SNF that he will be able to afford."

In the coding process there were key words and phrases the coders that these posts were at the phase I of the IAM, phrases such as "I agree…" The students posted only an opinion that did not reflect any construction of knowledge. Table 11 provides a summary of the statements and rationale for the coding at phase I.

Table 11

Key words and phrases with rationale for coding phase I

Key words/phrase	Rationale for Coding of Phase Level I
"I agree, fluids and antibiotics…"	The student is expressing agreement with the management and does not offer any additional suggestions
"I agree that a PA/lateral…"	The student is expressing agreement with management
"A good case manager would be able to help him find placement…"	The statement is one of opinion

Phase II of the IAM is where participants in the network begin to explore or discover dissonance or inconsistency among ideas, concepts or statements. Gunawardena et al. (1997) describes these statements as identifying and stating areas of disagreement, asking and answering questions to clarify the source and extent of disagreement, and restating the participant's position and possibly advancing arguments. In the selected discussion, posts that express disagreement or present an argument were as:

"I disagree about the CXR, because it is a quick way to rule out obvious respiratory causes of shortness of breath" and "I think the only question I have for you is about the order you placed all the differential for AMS. Why did you place barbiturates #6? I think I would place the barbiturates further up in the differential as he may be overusing them or because the kidney's and liver function are altered, not metabolizing even his prescribed dose"

This post presented an argument for the inclusion of a medical diagnosis and supported the statement with supporting facts:

"The one that I would feel acutely concerned for that I did not see in your presentation is sepsis. This pt meets 3/4 SIRS criteria with known infectious

source as well as evidence of end organ damage (Cr more than double baseline). I

think a lactate could be really helpful for this pt to determine whether he is

hypoperfusing his organs including his brain which will cause AMS. This could

also be the cause of his thrombocytopenia."

Some key phrases and sentences were noted by the coders supporting their rationale for

their coding of phase II. There was a direct statement of disagreement or questioning

another students' post. Table 12 provides a summary of the statements and rationale for

the coding.

Table 12

Key words & sentences and rationale for coding phase II

Key words/sentence	Rationale for Coding of Phase Level II
"I disagree about the CXR, because it is a quick way to rule out…"	The student is expressing disagreement regarding patient management and is supporting it with personal knowledge & literature
"Why did you place barbiturates #6? I think I would place…"	The student is expressing disagreement regarding prioritization
"I would feel acutely concerned… I think a lactate could be…the pt meeds ¾ SIRS criteria...could also be a cause of…"	The student expresses disagreement and provides supporting facts for why

Phase III of the IAM is where participants in the network begin to negotiate

meaning and co-construct knowledge. Gunawardena et al. (1997) describes these

statements as negotiation or clarification of the meaning of terms, negotiation of the

relative weights to be assigned to types of arguments, identification of areas of agreement

or overlap among conflicting concepts, proposal and negotiation of new statements that

embody compromise & co-construction, proposal of integrating or accommodating

metaphors or analogies. One participant posted a statement that demonstrated negotiation

of the relative weights to be assigned to types of arguments:

"I guess if my diagnostics where all negative for hepatic causes I would

order a CXR. I guess my hesitation to ordering it originally would be trying to

think of the cost to the patient as well as the radiation exposure as it may be an

unnecessary test at this time. Although, I do not think it would be a bad idea to

cover my bases. So, I guess I am on the fence about ordering it originally. If I did

the US and LVP and he still has SOB, then I would definitely order a CXR at that

time or if his SOB became worse before any of the procedures could be

performed"

Other participants posted statements that identified areas of agreement/overlap among

conflicting concepts:

"I don't think that having a hepatitis panel would change your course of

treatment but maybe put prognosis into perspective especially if a patient had

alcoholic cirrhosis and say hepatitis B or C" and "His white count is slightly

elevated at 10.7, he is slightly tachycardic and slightly hypotensive, yet he is

afebrile at this point. I would consider sepsis but I think I would not initially do a

workup for that as I do not think it is the cause of his AMS but I would workup

him for sepsis if his ammonia came back normal."

Phase III is defined by negotiating, so a holistic view of the post was necessary. There

was not a key word, phrase, or sentence that was clear in coding. It was the combination

of sentences taken as a gestalt and in the context of the discussion topic that gave the

coders insight into coding this phase. Table 13 provides key information and the

rationale for the coding of phase III.

Table 13

Sentences that provide the overall gestalt of phase III coding

Sentences	Rationale for Coding of Phase Level III
"I guess if my diagnostics where all negative… I guess my hesitation to ordering it originally… I do not think it would be a bad idea… If I did the US and LVP and he still has SOB, then I would definitely order…"	The student is considering the other student's disagreement and is negotiating on when the management plan would change; compromising on changing the management plan
"I don't think that having a hepatitis panel would change your course… but maybe put prognosis into perspective…"	The student is negotiating with the other student on diagnosing; negotiating meaning
"yet he is afebrile at this point. I would consider sepsis but I think I would not initially do a workup… I would workup him for sepsis if his ammonia came back normal…"	The student is recognizing the argument of another and negotiating and compromising on the management plan

Phase IV of the IAM is where participants in the network test and modify propose

synthesis or co-construction. Gunawardena et al. (1997) describes these statements as

testing the propose synthesis against 'received fact' as shared by participants, testing

against cognitive schema, personal experience, formal data collected, contradictory

testimony in the literature. There were four discussion posts coded as phase IV. One

participant posted a statement which demonstrated testing against cognitive schema:

> "Sometimes I think I jump the gun with tests and diagnostics so I can
>
> either support a suspected diagnosis or explore different diagnoses. But I must
>
> take a step by step approach."

Another participant posted this statement which demonstrated contradictory testimony in the literature:

"I would actually hold the ferrous sulfate and would not give Venofer at this point. My preceptor (I am doing a renal rotation, so we give a lot of mircera, venofer, and oral Fe), always holds iron when a patient has an infection brewing because 'iron feeds Infection'"

Another post had a statement that demonstrated testing against personal experience:

"I had not heard or had to give a patient Rifaxamin. We had a patient in the PACU that was on Neomycin because they were not responding to lactulose. I am finding new medications daily.

Phase IV is defined by testing and modifying, once again a holistic view of the post was necessary to 'get a feel' for the gestalt of the post. The context of the discussion topic was necessary for the coders to have insight into coding this phase. Table 14 provides key information and the rationale for the coding of phase IV.

Table 14

Sentences that provide the overall gestalt of phase IV coding

Sentences	Rationale for Coding of Phase Level IV
"Sometimes I think I jump the gun… But I must take a step by step approach…"	The student testing against their personal schema, constructing knowledge based on other posts
"I would actually hold the ferrous sulfate and would not give Venofer at this point… My preceptor…always holds iron when a patient has an infection brewing because 'iron feeds Infection'…"	In the context of the discussion topic, this student is testing against testimony in the literature; electing to not follow recommendations at this time
"I had not heard or had to give…We had a patient… that was on Neomycin because they were not responding to lactulose. I am finding new medications daily…"	The student is testing against personal experience in managing this patient and is incorporating new knowledge into their schema

Phase V of the IAM is where participants in the network reveal applications of newly constructed meaning. Gunawardena et al. (1997) described these statements as summarization of agreements, application of new knowledge, metacognitive statements by participating that show their ways of thinking have changes as a result of the interaction. Only one discussion post was coded as phase V. The participant posted the following statements which demonstrated their cognitive schema had changed:

"I had a patient in clinicals that told me the truth only when his wife stepped out of the room. This makes me want to be hyperaware of who is in the room when doing my assessment and discussing the plan of care with a patient. I think from now on I might start off by saying 'Is it okay if I perform my exam and discuss the results and future plan of care with your (spouse, etc) in the room?'"

Only one student achieved phase V. This was easier to code due to clear statements by the student that their thought process had changed as a result of the discussion. Table 15 provides key information and the rationale for the coding of phase V.

Table 15

Sentences that provide the overall gestalt of phase V coding

Statement	Rationale for Coding of Phase Level V
"...I think from now on I might start off by saying..."	The student demonstrates their change in thinking & cognitive schema as a result of another student's post

Research Question 3: Levels of Nurse Practitioner Competency

The coding process using the Benner's (1982) levels of competency was performed separately by two coders, for inter-rater reliability. The 2nd coder was given instructions on the levels of competency. Krippendorff's alpha was calculated to determine inter-rater reliability. The first calculation of Krippendorff's alpha resulted 0.6032, which was not sufficient for inter-rater reliability. The coders had discussion on coding with the levels of competency and a second round of coding was performed. The second calculation of the Krippendorff's alpha resulted 0.8061 which was sufficient for inter-rater reliability.

Content analysis was utilized to answer the third research question: What levels of nurse practitioner competency are demonstrated by students who participated in the discussion? The competency coding using the five phases of Benner's (1982) novice to expert was performed on the discussion board posts. As with the social construction of knowledge, the data was examined at two levels of unit of analysis: the individual post and by each participant.

Unit of Analysis by Posts

Of the discussion board posts, 0.0% of the posts were coded as novice, 21.2% were coded advanced beginner. The remaining 78.8% were coded as competent, proficient, or expert. Similar to the IAM coding, the overall gestalt of the post was coded as the level of competency. Table 16 illustrates the phases of competency.

Table 16

Competency level achieved with the unit analysis being the post

Competency	Number	Percent
Novice	0	0.0%
Advanced Beginner	7	21.2%
Competent	17	51.5%
Proficient	8	24.3%
Expert	1	3.0%

Unit of Analysis by Participant

Further investigation of the data was performed with the unit of analysis at the participant level. The highest level of competency achieved by the participants was assigned at this level. The distribution of highest phase level achieved revealed only 11.1% did not demonstrate discussion at the competent level, while 88.9% had discussion at the competent level for above. Table 17 illustrates the highest level of competency achieved. In order to perform correlation analysis with network centralities, it was necessary to identify the highest level of competency achieved by each participant. Table 18 demonstrates the highest level achieved by the individual participants.

Table 17

Highest competency level achieved with unit of analysis being the participant

Highest Competency Level Achieved	Number	Percent
Novice	0	0%
Advanced Beginner	1	11.1%
Competent	3	33.3%
Proficient	4	44.4%
Expert	1	11.1%

Table 18

Highest competency level achieved by each participant

Participant	Range	Highest Competency Level Achieved
Group 1		
Ileana	2 - 4	4
Gilma	2 - 4	4
Olivia	2 - 3	3
Yolanda	2 - 3	3
Rosa	2	2
Group 2		
Miriam	2 - 5	5
Tara	3 - 4	4
Kristy	3 - 4	4
Willa	3	3

The advanced beginner are nurses who have some previous experience, but demonstrate marginally acceptable performance (Benner, 1982). Discussion posts that demonstrated this level of proficiency included statements as follows:

"Looking at all the information I think UTI and hyponatremia may is having an impact on patients AMS", "I would like to try the lactulose first and if unsuccessful I would now try Rifamixin as a second line treatment", and "The anemia that patients experience in infectious illness might well be a defensive response to deprive a pathogen of the nutrients it needs."

Some key phrases and sentences were noted by the coders supporting their rationale for their coding as an advanced beginner. These statements demonstrated the domain of clinical judgement competency based on the content, but the student demonstrated a lack of enough experience to be coded as competent. Table 19 provides a summary of the statements and rationale for the coding.

Table 19

Statements and rationale for coding as advanced beginner

Statement	Rationale for Coding of Advanced Beginner NP
"Looking at all the information I think UTI and hyponatremia may is having an impact on patients AMS…"	Clinical Judgement competency
	The content is related to pathophysiology is basing it only information collected
"I would like to try the lactulose first…"	Clinical Judgement competency
	The statement reflects content on pharmacology and its' relation to pathophysiology; but basing the decision on previous experience
"The anemia that patients experience in infectious illness might well be a…"	Clinical Judgement competency
	The content is related to pathophysiology, but the student relays unsureness

The competent nurse is one who uses both abstract and analysis for a problem and has gained enough experience for mastery of situations (Benner, 1982). Discussion posts that demonstrated the competent level of proficiency included statements such as:

"I would place the barbiturates further up in the differential as he may be over using them or because the kidney's and liver function are altered, not metabolizing even his prescribed dose", "SDH and cerebral edema secondary to acute hyponatremia would be up there followed closely by sepsis", and "this pt meets 3/4 SIRS criteria with known infectious source as well as evidence of end organ damage (Cr more than double baseline). I think a lactate could be really helpful for this pt to determine whether he is hypoperfusing his organs including his brain which will cause AMS."

Some key phrases and sentences were noted by the coders supporting their rationale for their coding as a competent. These statements demonstrated the domain of clinical

judgement competency based on the content and the demonstrated enough mastery of the content to be coded as competent. Table 20 provides a summary of the statements and rationale for the coding.

Table 20

Statements and rationale for coding as competent

Statement	Rationale for Coding of Competent NP
"I would place the barbiturates further up in the differential…	Clinical judgement competency
	The statement demonstrates mastery of prioritization of differential diagnoses
"SDH and cerebral edema secondary to acute hyponatremia would be up there followed closely by sepsis	Clinical Judgement competency
	The statement demonstrates a mastery of the pathophysiologic process and prioritization of differential diagnoses
"…this pt meets 3/4 SIRS criteria with known infectious source… lactate could be really helpful for this pt to determine whether he is hypoperfusing… which will cause AMS."	Clinical Judgement competency
	The statement reflects the students' mastery of pathophysiology, diagnostic reasoning, and planning care

The proficient nurse has gained significantly more experience and is able to perceive situations as a whole with a deep understanding. Discussion posts that demonstrate this level of competency have the following statements:

"I would obtain ABGs to determine acid/base status and adequacy of ventilation:perfusion.Like you, I think that this patient's ascites is diminishing his respiratory excursion and causing hypoventilation. He obviously needs his abdomen drained. Still, I believe that a PCXR is warranted here. I would also order a phosphorus level. High phosphorus can lead to itching, and this patient has evidence of scratching and pruritis" and "I think it is less likely the PRIMARY problem since he has such bad hepatic failure as evident by the

ascites. I'm thinking primidone OD is less likely the main cause but I also think it

can be a combination of the differentials as well. Also since it's a once a day med

and not used PRN or for pain I think it is less likely that he ODed on them but it is

possible he was confused and took too many or the wrong medications all

together."

Some key phrases and sentences were noted by the coders supporting their rationale for

their coding as a proficient. These statements demonstrated the domain of clinical

judgement competency based on the content. The student showed mastery of the content

and their ability to perceive the situation as a whole with deep understanding and was

coded as proficient. Table 21 provides a summary of the statements and rationale for the

coding.

Table 21

Statements and rationale for coding as proficient

Statement	Rationale for Coding of Proficient NP
"I would obtain ABGs to determine acid/base status and adequacy of ventilation:perfusion… I think that this patient's ascites is diminishing his respiratory excursion and causing hypoventilation… order a phosphorus level. High phosphorus can lead to itching…"	Clinical Judgement competency The statement demonstrates a proficiency as the student is looking at the situation as a whole, connecting pieces of information together, & deep understanding in planning care; pathophysiology, diagnostic testing
"…less likely the PRIMARY problem since he has such bad hepatic failure as evident by the ascites… primidone OD is less likely the main cause… I think it is less likely that he ODed… it is possible he was confused and took too many…"	Clinical Judgement competency The student is considering the whole view of the situation & deep understanding in decision making; pharmacologic management, pathophysiology, planning care

The expert nurse has an extensive amount of previous experience and is able to grasp the situation intuitively and functions with a deep understanding of the situation (Benner, 1982). Only one discussion post was coded as expert and had the following statement that in the context of the discussion topic represented a holistic view of the patient:

"A good case manager would be able to help him find placement in a decent SNF that he will be able to afford. Medicare/Medicaid will cover most expenses, but he could still have difficulty supplementing those expenses."

Key phrases and sentences were noted by the coders to support their rationale for their coding as an expert. These statements demonstrated the domains of collaboration and system thinking competencies based on the content. The student showed their ability to intuitively see the situation as a whole with deep understanding and was coded as expert. Table 22 provides a summary of the statements and rationale for the coding.

Table 22

Statements and rationale for coding as expert

Statement	Rationale for Coding of Expert
"A good case manager would be able to help him find placement… Medicare/Medicaid will cover most expenses, but he could still have difficulty supplementing…"	Collaboration & Systems Thinking competencies The student has taken a holistic view of the patient and intuitively is planning long term care and addressing potential issues in the plan of care.

Research Question 4: Relationships Between Social Network Centrality, Level of Social Construction of Knowledge, & Level of Nurse Practitioner Competency

Correlational analysis was used to answer the fourth research question: How does centrality in the network, level of social construction of knowledge, and nurse practitioner competency relate to each other? The independent variables of level of social construction of knowledge and social network centralities was compared with the dependent variable of level of nurse practitioner competency. The highest level of social construction of knowledge and highest level of competency demonstrated by participants was used for analysis.

Social Network Centrality and Level Nurse Practitioner Competency

In order to explore the relationship between social network centrality and level of nurse practitioner competency, the data was required to be at the participant level. The researcher used the network centrality and highest level of nurse practitioner competency by participant. Due to the ordinal nature of the data, a Spearman *rho* correlation coefficient was calculated to explore the relationship between the independent variable of social network centralities (betweenness, indegree, outdegree, closeness, and eigenvector), and the dependent variable of the highest level of nurse practitioner competency achieved by the participant. A strong positive relationship was found between nurse practitioner competency and betweenness (rho (7) = 0.747, $p < 0.05$), closeness (rho (7) = 0.787, $p < 0.05$), and eigenvector (rho (7) =0.787, $p < 0.05$) indicating a significant relationship between the variables. Participants with closer connections within a network tend to demonstrate competency. A moderate positive correlation that was not significant was found between nurse practitioner competency and

indegree (*rho* (7) = 0.652, *p* > 0.05), outdegree (*rho* (7) = 0.647, *p* > 0.05). Competency

is not related to the producers and consumers of information in the network. Table 23

illustrates the results of the Spearman *rho* correlation coefficient for nurse practitioner

competency and social network centralities.

Table 23

Relationship between nurse practitioner competency and social network centralities

	Competency	Betweenness	InDegree	OutDegree	Closeness	Eigenvector
Competency	1					
Betweenness	**.747***	1				
InDegree	.652	.703*	1			
OutDegree	.647	.765*	.523	1		
Closeness	**.787***	.916**	.790*	.895**	1	
Eigenvector	**.787***	.916**	.790*	.895**	1.00**	1
N	9					

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Levels of Construction of Knowledge and Level of Nurse Practitioner Competency

To explore the relationship between level of social construction of knowledge and

level of nurse practitioner competency, the data was required to be at the participant

level. The researcher used the highest level of social construction of knowledge and the

highest level of nurse practitioner competency by participant. Due to the ordinal nature of

the data, the Spearman *rho* correlation coefficient was calculated for the relationship

between the independent variable of social construction of knowledge and the dependent

variable of nurse practitioner competency. A weak correlation that was not significant

was found (*r* (7) = 0.201, *p* > 0.05). In other words, competency is not related to social

construction of knowledge. Table 24 illustrates the results of the Spearman *rho*

correlation coefficient between nurse practitioner competency and social construction of

knowledge.

Table 24

Relationship between Nurse Practitioner Competency and Social Construction of

Knowledge

	Competency	Social Construction of Knowledge
Competency	1	
Social Construction of Knowledge	0.654	1
Sig. (2-tailed)	0.56	
N	9	

* Correlation is significant at the 0.05 level (2-tailed).

Social Network Centrality and Levels of Social Construction of Knowledge

A Spearman *rho* correlation coefficient was calculated to explore the relationship

between the independent variables of social network centralities (betweenness, indegree,

outdegree, closeness, and eigenvector), and the dependent variable of the highest level

achieved of social construction of knowledge by the participant. A strong positive

relationship was found between level of social construction of knowledge and

betweenness (*rho* (7) = 0.798, $p < 0.01$), indegree centrality (*r* (7) = 0.848, $p < 0.01$),

outdegree (*rho* (7) = 0.680, $p < 0.05$), closeness (*rho* (7) = 0.902, $p < 0.01$), and

eigenvector (*rho* (7) =0.902, $p < 0.01$) indicating a significant relationship between the

variables. Participants with stronger connections within the network tend to achieve

higher levels of construction of knowledge. Table 25 illustrates the results of the

Spearman *rho* correlation coefficient for and social network centralities and levels of

social construction of knowledge.

Table 25

Relationship between social network centralities and social construction of knowledge.

	IAM	Betweenness	InDegree	OutDegree	Closeness	Eigenvector
IAM	1					
Betweenness	**.798****	1				
InDegree	**0.848****	.703*	1			
OutDegree	**.680***	.765*	.523	1		
Closeness	**.902****	.916**	.790*	.895**	1	
Eigenvector	**.902****	.916**	.790*	.895**	1.00**	1
N	9					

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

In order to objectively explore the discussion posts for additional relationships, a

cluster analysis was performed using binary hierarchical clustering using the "R"

program. The hierarchical clustering can be used to show relationships between similar

data, in this case, discussion board posts. The data is represented as branches according to

similarity or dissimilarity. Branches that have the same height are considered similar to

each other, while branches having differences in height are considered dissimilar to each

other.

For the binary hierarchical clustering analysis, all text was converted to lower

case, the English stopwords, which do not contain important significance, were removed,

whitespaces were stripped, and all punctuation was removed. The discussion thread was

then converted into a matrix format. Similarity between each line was determined and

clustering of the lines was performed. Seven main clusters/themes were revealed. The

height value on the y-axis is a measure of dissimilarity. The leftmost cluster has a height of 0.95 which indicated that only 0.05 (5%) of the words are similar. The rightmost cluster has a height of 0.85, which indicated that 0.15 (15%) of the words are similar. However, this indicated no significant findings regarding the similarity or dissimilarity of discussion board themes. The results from the cluster analysis are illustrated in Figure 15.

Figure 15

Cluster analysis of the discussion posts
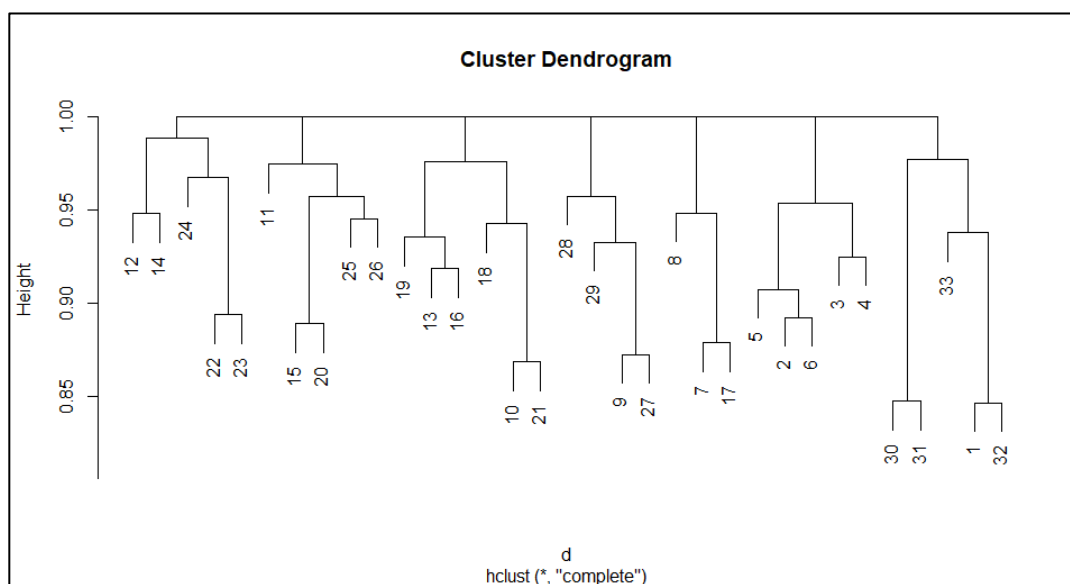
Summary of Findings

Exploration of the centralities of the network revealed one student participating in the discussion board had high centrality in all measures indicating that student was the influencer, producer, and consumer of information, along with having close ties within the network. One student had low centrality in all measured which suggests that student remained on the periphery of the and did not have close ties within the network. Two groups were identified through the social edge analysis. Examination of the levels of

social construction of knowledge revealed an even distribution of discussion posts among low (phase I & II) and high (phases III, IV, & V) levels of knowledge construction. The highest phase level achieved by students ranged from phase I (sharing knowledge/information) to phase V (newly constructed meaning). Investigating the levels of nurse practitioner competency revealed the majority of the discussion posts demonstrated competent knowledge and above.

Three of the social network centralities (betweenness, closeness, and eigenvector) had a significant correlation with the level of nurse practitioner competency. In other words, the more connected a student was in the network, the higher level of competency was achieved. Indegree and outdegree did not have a significant correlation with nurse practitioner competency. The level of social construction of knowledge did not have a significant correlation with the level of nurse practitioner competency, indicating students who demonstrate higher levels knowledge construction do not necessarily achieve higher level of nurse practitioner competency. All five of the social network centralities had a significant correlation with level of social construction of knowledge. Otherwise stated, the more connected a student was in the network, the higher level of knowledge construction was reached.

CHAPTER 5 DISCUSSION

The primary focus of this research was to determine the relationships between social network centralities, social construction of knowledge, and nurse practitioner competency among adult gerontology acute care nurse practitioners participating in an asynchronous online discussion. This study explored four research questions. The first research question addressed the types of centralities demonstrated by individuals in the network. The results of the study indicate the participant who achieved higher network centralities across all measurements was the moderator of the discussion. It is unsurprising that the moderator would be interacting and connecting with the other students in the discussion and therefore have high centrality as suggested by previous research (deWever, 2006). Ileana was assigned the role of the moderator for the discussion post and a facilitator for the discussion. Her high betweenness, in-degree ,and out-degree suggest she facilitated the flow of information among the participants which may have contributed to others achievement of higher level of social construction of knowledge. Through her posts, Ileana interacted with all of the participants in the discussion. As the moderator, she responded to questions and comments from other participants, along with presenting supporting rationale for her management of in the case scenario or deciding to change her management based on others' suggestions and recommendations. Figure 16 illustrates her centrality and connections within the network. She did achieve a higher level of knowledge construction (Phase IV) and competency (Proficient).

Figure 16

Ileana's centrality and connections within the network
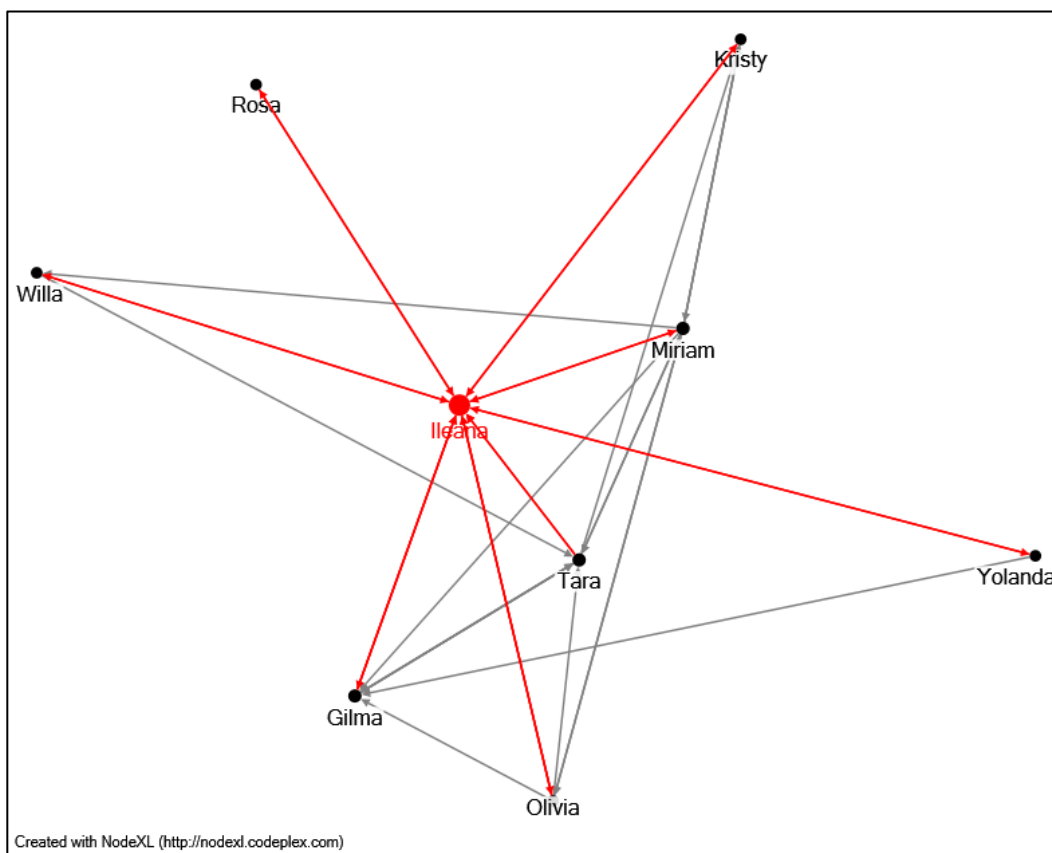
Participant Position in the Network

Determination of participant position was based on calculations in NodeXL. Graph visualization is based on the calculated size of the participant. The calculated metric of Ileana was 10.0; Miriam 2.7; Tara 2.7; Gilma 2.5; Kristy 1.5; Willa 1.5; Olivia 1.5; Yolanda 1.5; and Rosa 1.5. Table 26 illustrates the NodeXL results of the calculated metrics of the participants. Quantitative and visual examination of all participants and their position in the network revealed Ileana to be at the center of the network. Miriam, Tara, and Gilma were further from the center of the network. Olivia, Kristy, Willa, Yolanda, and Rosa were located at periphery of the network. Figure 13 provides a graph

visualization of the participants' positions in the network based on their calculated

metrics. The position of each participant in the network is important when looking at the

relationship with competency and social construction of knowledge.

Table 26

Quantitative properties of participant positions in the network.

Participant	Calculated Size of the Participant
Centrally Located Ileana	10.0
Interiorly Located Miriam	2.7
Tara	2.7
Gilma	2.5
Peripherally Located Kristy	1.5
Willa	1.5
Olivia	1.5
Yolanda	1.5
Rosa	1.5

Figure 17

Participants' positions in the network
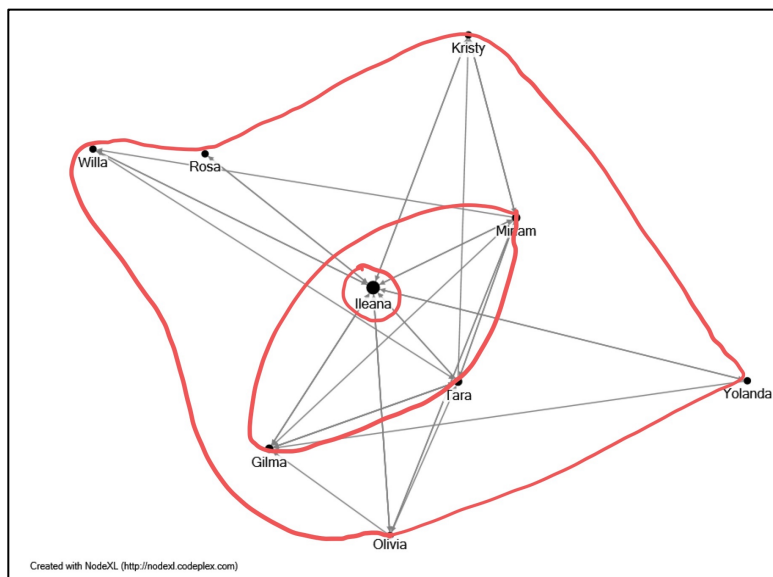
The second research question addressed the levels of social construction of knowledge demonstrated by AGACNP students participating in an asynchronous online discussion. The results indicate that there was an even distribution between lower phase (I & II) and higher phase (III, IV, & IV) levels of social construction of knowledge. This is in contrast to the literature which found the majority of social construction of knowledge in an asynchronous online discussion remains in the lower phases (I & II) (Brierton et al., 2016; Carbrero et al., 2008; Heo et al., 2010; Lucas et al 2014; Saritas, 2008). One other interesting finding regarding the lower levels of social construction of knowledge, was the higher number of posts in Phase II when compared to Phase I. This is in contrast to previous research where the majority of knowledge construction was in Phase I (Gunawardena et al., 2016; Zhao et al., 2016). This may be related to the fact these participants have progressed to this point in the program as a cohort resulting in a familiarity in the group and a willingness to disagree and challenge each other. The complex nature of the discussion board topic was part of the instructional design which is known to support knowledge construction (Aviv et al., 2003; Brierton et al., 2016; Durrington et al., 2006; DiPascuale & Hunter, 2018; Foo & Quek, 2019; Zhao et al., 2016)

The third research question addressed the levels of adult gerontology acute care nurse practitioner competency demonstrated by nurse practitioner students who participated in the discussion. The results indicate the majority of nurse practitioner students demonstrated higher levels of competence in their discussions. The topic for the discussion was managing a complex patient. The majority of competency demonstrated by the students was in the domain of clinical judgement. This would indicate students

have had sufficient scaffolding to achieve competency in this domain. Online and hybrid nurse practitioner programs utilize asynchronous online discussion on a regular basis and these forums provide nurse practitioner faculty with an opportunity to assess student competency (Distler, 2015; Fukada, 2018; Massey et al., 2019; NONPF, 2017; Raymond et al., 2016).

The fourth research question addressed the relationships between social network centralities, levels of social construction of knowledge, and levels of nurse practitioner competencies among AGACNP students participating in an asynchronous online discussion. The results of this research indicate there was a significant relationship between social network centralities and level of nurse practitioner competency. There was no statistically significant relationship between level of social construction of knowledge and level of nurse practitioner competency. This suggested that social construction of knowledge is not necessary for competency or that competency i9s necessary for social construction of knowledge. Differences may be related to comments that demonstrate high levels of social construction of knowledge yet reflect novice or advanced beginner competency. An example of the statement *"…I think from now on I might start off by saying…"* was an example of phase V of social construction of knowledge but reflected an advanced beginner competency level. Similarly, a statement that demonstrates a lower level of social construction of knowledge construction may reflect a higher level of competency. One example is the statement *"A good case manager would be able to help him find placement…Medicare/Medicaid will cover most expenses…"* this is a sharing of information or opinion from phase I of the IAM but is due to the systems thinking and holistic view of the patient, it is coded as expert.

There was a significant correlation between level of IAM achieved and all centralities. The results of this study suggest that those who were at the center or just surrounding the center tended to achieve a higher IAM level in the discussion; while those on the periphery tended to achieve a lower IAM level in the discussion. Table 27 illustrates the level of IAM and network position centralities. This would suggest that participants who are more centrally located and have close connections are more likely to take the discussion to a higher level of social construction of knowledge. Chen and Huang (2019) used in-degree centrality as prestige in the network. While this was not related to social construction of knowledge, the students located on the periphery in their study were identified as being at-risk students. The majority of the participants in this study were located on the periphery and could be considered at-risk students which was also found in the research by Yen et al., (2019) and Zhao et al. (2016). Although this may not be necessarily true of all students who are on the periphery. Faculty should assess the students who are on the periphery to determine the need for additional support in the students' success as based on previous research (Calderon & Sood, 2020; Chen & Huang, 2019; Desai et al., 2020; Durairaj & Umar, 2015; He et al., 2014; Yen et al., 2019). The support required varies across disciplines and should be based on context of learning outcomes (Chen & Huang, 2019; Yen et al., 2019). In the case of the discussion board used for this study, it could mean referring the student to content from previous terms, additional Socratic questioning, or outside discussion that is one on one with the faculty.

Table 27

Highest IAM level achieved and participant position in the network

Participant	IAM Level	Betweenness	Indegree	Outdegree	Closeness	Eigenvector
Centrally Located						
Ileana	4	24.33	8	7	0.125	0.167
Interiorly Located						
Miriam	3	3.33	2	6	0.100	0.151
Tara	5	3.33	4	3	0.100	0.151
Gilma	4	3.00	5	3	0.091	0.130
Peripherally Located						
Olivia	2	0.00	2	3	0.083	0.120
Kristy	3	0.00	3	2	0.077	0.094
Willa	1	0.00	2	2	0.077	0.094
Yolanda	2	0.00	1	2	0.071	0.059
Rosa	1	0.00	1	1	0.067	0.033

There was a significant correlation between level of competency achieved and the social network centralities of betweenness, closeness, and eigenvector. The results of this study revealed participants who were at the center or just surrounding the center tended to demonstrate a higher level of competency in the discussion; while participants on the periphery tended to achieve a lower level of competency in the discussion. Indegree and outdegree did not have a significant correlation with level of competency. Table 28 illustrates the level of competency and network position centralities. These findings suggest that those participants who are more centrally located in the network and have close connections tend to have higher levels of competency. These findings taken together also suggest that participants who are more centrally located and well-connected are able to facilitate discussion, but they not necessarily have to be highly competent in the topic. The relationship between competency level and social network centralities has not been explored in previous research.

In looking at Tara, she achieved Phase V level of knowledge construction and the proficient level of competency. Her position in the network was interiorly located with connections with participants within both sub-groups, as compared to Gilma and Miriam. Her position in the network could be interpreted as being the bridge of information between the two subgroups. She had an out-degree of 3, with two responses to Group 1 (Ileana and Gilma) and one to Group 2 (Kristy). Her in-degree was 4, being addressed by two from sub-group 1 (Gilma and Olivia) and two from sub-group 2 (Miriam and Willa). Figure 18 illustrates Tara's position and connections in the network and connections.

Table 28

Highest competency level achieved and participant position in the network

Participant	Competency Level	Betweenness	Indegree	Outdegree	Closeness	Eigenvector
Centrally Located						
Ileana	4	24.33	8	7	0.125	0.167
Interiorly Located						
Miriam	5	3.33	2	6	0.100	0.151
Tara	4	3.33	4	3	0.100	0.151
Gilma	4	3.00	5	3	0.091	0.130
Peripherally Located						
Olivia	4	0.00	2	3	0.083	0.120
Kristy	3	0.00	3	2	0.077	0.094
Willa	2	0.00	2	2	0.077	0.094
Yolanda	3	0.00	1	2	0.071	0.059
Rosa	3	0.00	1	1	0.067	0.033

Figure 18

Tara's position and connections in the network

Created with NodeXL (http://nodexl.codeplex.com)
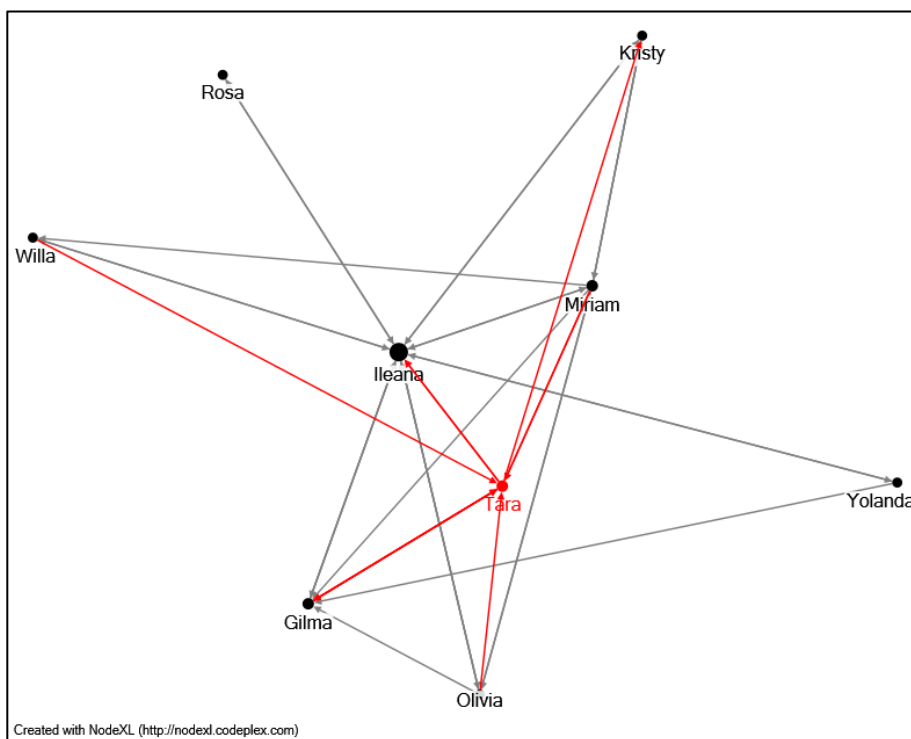
Limitations, Implications for Practice, & Recommendations for Future Research

Participants

  Sample Size. The discussion board was chosen for this project due to the convenience of the sample. The small sample size was a limitation for this research. While a larger sample size could be suggested, the literature recommends small- or medium-sized groups offer the opportunity for students to achieve a deeper level of learning (Afify, 2019). An alternative would be to evaluate the same group of students over multiple discussion boards to examine patterns and trends. The sample consisted of adult gerontology acute care nurse practitioner students which represent a small

percentage of nurse practitioner students overall, expanding to include other nurse practitioner specialties is recommended for future studies.

Gender. Based on the names in the discussion post, the assumption is that 100% of the participants were female. There were no participants with male names from the discussion board. According to the US Bureau of Labor Statistics (2020), 11.9% of the nursing workforce is male. Perceptions of managing a complex patient may differ between males and females. It is recommended that future research of discussion board in the nursing and nurse practitioner population include not only male participants, but also the gender self-identification of participants, to evaluate variances in social network centralities, social construction of knowledge, and nurse practitioner competency.

Culture. This study did not address culture, culture identity, or acculturation of participants in its analysis. The present study was based on a discussion board at a university in the southwest United States and interpretation of the results was through the lens of local faculty cultural norms and beliefs. With the increase in online nurse practitioner programs and the popular use of asynchronous online discussions, it is possible the cultural background of participants may be more diverse. In this time of diversity and inclusion, having information regarding the cultural background of discussion board participants may provide additional insights into how a diverse population, in terms of cultural background, culture identity, and acculturation, influences social construction of knowledge, social network centrality, and nurse practitioner competency.

Prior Nursing Experience. The study did not assess the prior nursing experience of the participants due to lack of access to the information. Nursing is a heterogenous discipline (AANP, 2020) and participants may have high expertise in one area and not in another. By having the various levels of expertise (or novices to experts) participating in an online discussion may be beneficial for sharing knowledge and social construction of knowledge (Mthembu & Mtshali, 2013). This may also determine centralities in the network based on the discussion board topic. It is recommended for future research to examine the nursing background of participants and how it may influence social construction of knowledge, social network centrality, and nurse practitioner competency.

Instructional Design

The instructional design for the discussion board used an ill-structured complex problem for students to address. This provided for an enriching discussion that demonstrated social construction of knowledge and competency development. The results of this study recommended that ill-structured problems be continued for use in discussion boards. This particular complex case study was appropriate for adult gerontology acute care nurse practitioner students and reflected a real-life situation for the construction of knowledge as suggested by Mthembu and Mtshali (2013). Complex case studies are recommended for discussion boards with other nurse practitioner specialties. The students should have ample time to participate in the discussion, reflect on the content, provide suggestions, and explore other management options for the complex case study patient. Nurse practitioner faculty should allow the students to have enough to participate in discussion boards to support knowledge construction and competency achievement. Students should be in the role of a discussion moderator to facilitate social construction

of knowledge and competency (deWever, 2006). The student moderator signed up for this discussion board without knowing the topic, therefore, reduced the chance of the student selecting a topic of their expertise.

Social Network Centralities

Results of the social network centralities of this study indicate the student moderator for the network influences the flow and sharing of information, while some students remain on the periphery. Nurse practitioner faculty should design online discussions to give all students an equal opportunity to moderate a discussion board, especially since the results demonstrated a strong correlation with achievement of competency (deWever, 2006). The results of this study also found that students located on the periphery of the network had lower levels of construction of knowledge and tended to have lower levels of competency than those who were more centrally located. Faculty should also use social network analysis to assist to identify the at-risk student(s) in order to provide timely intervention for academic success as supported by previous research (Calderon & Sood, 2020; Chen & Huang, 2019; Joksimovic et al., 2016; Martono & Salam, 2017; Yen et al., 2019). The literature review demonstrated that social network centrality and nurse practitioner education was limited and there was no research in the area of social network centrality and nurse practitioner competency. Further research in this area is recommended.

Social Construction of Knowledge

The results of this study revealed an even distribution of knowledge construction between lower phases (I & II) and higher phases (III, IV, & V) which contrasts other studies which have indicated knowledge construction remained lower phases (Brierton et

al., 2016; Cabrera et al., 2008; Heo et al., 2010; Lucas et al., 2014; Saritas, 2008; Zhao et al., 2016). As other research suggests, this may be due to the ill-structured design of the discussion board through use of a complex case scenario (Aviv et al., 2003; DiPasquale & Hunter, 2008; Durrington et al., 2006; Lucas et al., 2014; Woods & Bliss). This study also revealed the wordcounts of discussion posts achieving higher levels of social construction of knowledge which may suggest that participants are able to advance their own knowledge construction through the development of their own post.

Social construction of knowledge and the nurse practitioner discipline remains under-researched. Additional research on social construction of knowledge should be explored in other nurse practitioner specialties as well as with interprofessional disciplines.

Qualitative Analysis

Interaction Analysis Model. The IAM was developed to assess and evaluate conference discussions and has been the most commonly used instrument for assessing social construction of knowledge in asynchronous online discussions (Gunawardena et al., 1997; Hall, 2014; Lucas et al., 2014). It was chosen for its' applicability to this study and accessibility of the developer. Coding for the IAM was accomplished following the developers' instructions. Second round of coding gave an inter-rater reliability for the IAM that was sufficient, achieving a Krippendorf's alpha of 0.8231 between the two different coders. After the initial coding of data, discussion between the coders found that one coder thought they over-coded while the other thought they under-coded. The IAM was designed to allow researchers to examine discussions in a holistic manner, allowing for flexibility across various contexts and contents and the group can internally determine

how the phases are determined (Marra et al., 2004). In reviewing the literature, this was the first time the IAM was used in the context of nurse practitioner discussions. It is strongly recommended that the IAM be use for future research exploring social construction of knowledge in asynchronous online discussions of nurse practitioners.

Novice to Expert Model. Benner's (1982) Novice to Expert model was developed to identify the characteristics and progression of competency of nurses. The model was chosen for its' ability to code levels of competency of asynchronous online discussion board posts. Inter-rater reliability for coding was sufficient, achieving a Krippendorf's alpha of 0.8061 between the two different coders. The coders in this study were in agreement that this model was an appropriate selection for this study due to its relevance in assigning competency levels. One recommendation is to use subject matter experts when coding online discussions for competency. It is also strongly recommended that competency levels of the model be use for future research exploring nurse practitioner competency in asynchronous online discussions.

Quantitative Analysis

Social Network Analysis. NodeXL was selected to determine social network centralities. The researcher was familiar with its use through prior doctoral coursework. The software required little knowledge on programming and the researcher found it easy to use. If there were questions on how to utilize the plug-in, answers were easily located through internet searches. As such, it is recommended for other researchers who are unfamiliar with or no programming experience to use NodeXL.

SPSS®. The researcher was very familiar with using SPSS from previous graduate and doctoral course work. There is a plethora of resources available in using SPSS. The

researcher relied on the textbook "How to Use SPSS®: A Step-by-Step Guide to Analysis and Interpretation" by Brian Cronk. It is highly recommended that researchers who are new to using SPSS and quantitative analysis to have the latest edition of this textbook as a resource to assist with their research analysis.

"R" Program. In order to create the hierarchical cluster dendrogram, the program "R" was utilized. The researcher had prior coursework in using "R" which assisted in its use, but for those who are not familiar with computer programming code, this will be challenging to use. It does offer some powerful statistical analysis, but it will be challenging to those researchers without knowledge on programming code.

Synergy Model for Patient Care

The Synergy Model for Patient Care states that for nurses to provide optimal patient care, patient characteristics must align with nursing competency (Becker, 2006). The nursing competencies of the model are evaluated on Benner's Novice to Expert (1982) levels of proficiency. The Synergy Model focuses on acute and critical care, which makes this model not useful for the primary care nurse practitioner population. It is recommended to continue using the competencies of the Synergy Model for Patient Care to guide future research in the examination of adult gerontology acute care nurse practitioner students.

Nurse Practitioner Competency

Demonstrating competency is the basis for national certification as a nurse practitioner (AANP, 2020; Gravina, 2017; NONPF, 2017; Richard-Eaglin, 2017; Tractenberg et al., 2019). Faculty must continually assess nurse practitioner students to determine competency throughout their education and for future practice. It is

recommended for faculty to continue using the nationally defined, nurse practitioner competencies as a measure of student progress in their education.

Novel Methodological Approach

The exploration of social network centrality, social construction of knowledge, and nurse practitioner used a novel methodological approach that had not been done in previous research. There was one main challenge in using this approach which involved the data. The coding process unit of analysis for competency and social construction of knowledge initially was at the level of the discussion post, but in order determine relationships with social network centrality and answer the research questions, the unit of analysis was changed to the level of the student. The researcher made the decision to use the highest phase level of IAM and competency achieved by the student. An alternative for future research would be to use the most frequent phase level of IAM by student.

<div align="center">

Conclusion

</div>

Nurse practitioner faculty have the responsibility to provide a quality education to nurse practitioner students. The nurse practitioner faculty having the knowledge and understanding of how students create social networks and construct knowledge can support student achievement of nurse practitioner competency. Although exploration of level of social construction of knowledge and level of nurse practitioner competency revealed no significant correlation, there was a significant correlation between social network centralities and level of nurse practitioner competency. This is information is important to effectively evaluate nurse practitioner competency progress in the online environment. This research study also adds to the literature regarding AGACNP student nurse practitioner competency, social network centralities, and social construction of

knowledge in asynchronous online discussions. The researcher has tremendously

expanded her teaching practice through an increased knowledge on social network

centralities, the process of knowledge construction, and nurse practitioner competencies.

APPENDICIES

APPENDIX A GRAND ROUND SCENARIO

01 History & Physical
CHIEF COMPLAINT: Altered mental status
HISTORY OF PRESENT ILLNESS:
A 71 year old man with a history of alcoholic cirrhosis, multiple GI bleeds, DMII, and recent admission for variceal hemorrhage and esophagitis with banding presents acutely for altered mental status.

The history from his most recent admission is pertinent for the following: Patient presented with melena and hematemesis. EGD was noted to show esophagitis and variceal bleeding. Banding was done. Patient was discharged on Ciprofloxacin for prophylaxis. On today's admission patient was transferred from a local urgent care by ambulance to our Emergency Department for altered mental status. Of note, subjective information from patient was difficult to obtain secondary to intermittent confusion.

Patient denies recent vomiting or blood in his stool. He states that it is somewhat difficult for him to breath, which he attributes to his abdominal fullness. He states that he takes his medications regularly but is unable to list exactly what he takes. He states that "lactulose sounds familiar," but he is unsure if he was taking it. Hes not sure if hes been taking any medications.

According to the patient, his last alcoholic drink was 5 years ago. He is complaining of pain along his bilateral inguinal area, which he states has been going on for the past few days.

ED course:
Patient's vitals were stable and was afebrile on presentation. He was placed on on Ceftriaxone, Octreotide, and Pantoprazole.
Paracentesis to assess for SBP was performed. Results are non-concerning, as PMN<250.
Other significant labs and imaging obtained:
WBC: 10.7
H/H: 8.2/25 MCV: 102
Na: 127
Cr: 1.75 (baseline 0.81)
PT/INR: 17.3/1.43
Bilirubin: 1.8, indirect 1.3
UA: +LCE, -Nitrites, +Blood, WBC 16
FOBT: +
CXR within normal limits
Liver U/S: No changes from prior. Cirrhotic liver, splenomegaly, ascites, no kidney stones.

PAST MEDICAL HISTORY:
Alcoholic cirrhosis
Esophageal Varicies
Esophagitis
Alcohol use disorder
Diabetes Mellitus Type 2
BPH

PAST SURGICAL HISTORY:
Previous right knee surgery after a motorcycle accident many years ago
Pending total knee replacement
Rotator cuff surgery

FAMILY HISTORY:
Patient does not know his family's health history, very little contact with them

SOCIAL HISTORY:
Tobacco: stopped smoking in 1959
Alcohol: Significant use previously - per patient, stopped 5 years ago
Drugs: denies use

Patient is separated from female significant other for many years.
Lives alone in a home that he owns.
Complains of recent stress in his life due to money problems
Has at least one friend who is always encouraging him to see a doctor

ALLERGIES:
No Known Allergies

HOME MEDICATIONS:
Cyproheptadine 4 mg PO QID
Ferrous Sulfate 325 PO BID
Finasteride 5 mg PO daily
Furosemide 120 mg PO daily
Lantus 10 Units Subcutaneous at bedtime
Humalog 20 Units Subcutaneous, TID before meals
Lactulose 20 gram PO BID
Lisinopril 5 mg PO daily
Multivitamin PO daily
Omeprazole 20 mg PO daily
Pantoprazole 40 mg oral PO BID
Primidone 250 PO at bedtime
Rifaximin 550 mg PO BID
Sodium bicarbonate 650 mg PO daily
Spironolactone 200 mg PO daily

Tamsulosin 0.8 mg PO IM q 2 weeks
Zolpidem 5 mg (1 TO 2 TAB) PO at bedtime

REVIEW OF SYSTEMS:
CONSTITUTIONAL: Denies fever, chills, **+ fatigue and weight gain**
HEENT: Denies changes in vision, scleral icterus, changes in hearing
CARDIOVASCULAR: Denies chest pain, palpitations, edema, syncope
RESPIRATORY: Denies, cough, wheezing, **+ shortness of breath**
GASTROINTESTINAL: **+ recent nausea/vomiting and hematemesis (not current)**, no diarrhea/constipation, abdominal pain, or melena
GENITOURINARY: Denies dysuria, nocturia, hesitation/urgency/frequency, incontinence
NEUROLOGICAL: headache, dizziness, syncope, **+ chronic weakness in left arm, + falls at home**, no ataxia, numbness or tingling in the extremities, change in bowel or bladder control
MUSCULOSKELETAL: Denies muscle pain, joint pain or stiffness, **+ back pain**
SKIN: Denies rashes, **+ itching with scratches on skin**
HEMATOLOGIC: Denies bleeding, anemia or bruising
IMMUNOLOGIC: Denies allergies
PSYCHOLOSOCIAL: Denies anxiety or irritability

PHYSICAL EXAMINATION:

Vital Signs: T 37.2C; P 106; RR 22; BP 98/57; SpO2 97% on @ liters NC;
        Weight 89.2kg; Height 175cm
General: Patient lying in bed, no acute distress, poor interaction
HEENT: mild scleral icterus, PERRL, moist oral mucosa
Lungs: Mild increased work of breathing, clear to auscultation in anterior and posterior lung fields, no crackles appreciated.
Heart: Normal rate, regular rhythm, no murmur, gallop, + edema.
Abdomen: No umbilical varices. Granulation tissue present in epigastric region. LLQ ecchymoses. Severely firm and distended. Positive fluid wave, Hypoactive bowel sounds. No pain on palpation. No rebound or guarding.
Musculoskeletal/Extremities: Bilateral radial and dorsalis pedis pulses +2, cap refill <2 seconds, 2+ pitting edema to mid-thigh.
Integument: Multiple spider angiomata present on anterior chest. No no caput medusa or palmar erythema. Multiple ecchymoses present on bilateral upper and lower extremities.
Neurologic: A&Ox3, Significant bilateral asterixis
Genitourinary: Foley inserted. No hematuria present in bag.
Psychiatric: Blunted affect, oriented to person, place, month, year. Partially oriented to situation.

UNM CoN Laboratory

TEST: **CBC W/DIFF**

Result Name	Results	Units	Reference Range
WBC	10.7	thous/uL	4.0 – 11.0
RBC	2.48	Mil/uL	4..5 -6.00
Hemoglobin	8.2	g/dL	14.0 – 18.5
Hematocrit	25	%	40.8 – 52.0
MCV	102	fL	80.0 – 100.0
MCH	33.8	pg	26.0 – 34.0
MCHC	32.2	g/dL	32.0 – 36.0
RDW	16.8	%	11.5 – 15.0
Platelets	111	thous/uL	150 – 450
MPV	---	fL	7.0 – 11.0
Neutrophils	76	%	
Lymphocytes	7	%	
Monocytes	17	%	
Eosinophils	1	%	
Basophils	0	%	
Neutrophil Abs#	8.2	thous/uL	1.5 – 7.7
Lymphocyte Abs#	0.7	thous/uL	1.0 – 4.8
Monocyte Abs#	1.8	thous/uL	0.0 – 0.9
Eosinophil Abs#	0.1	thous/uL	0.0 – 0.4
Basophils Abs#	0.0	thous/uL	0.0 – 0.2

UNM CoN Laboratory

TEST: **COMPREHENSIVE METABOLIC PANEL**

Result Name	Results	Units	Reference Range
Glucose	76	mg/dL	60 – 99
Blood Urea Nitrogen	17	mg/dL	6 – 27
Creatinine	1.75	mg/dL	0.50 – 1.20
Sodium	127	mmol/L	136 – 145
Potassium	4.9	mmol/L	3.5 – 5.1
Chloride	99	mmol/L	98 – 109
Carbon Dioxide	18	mmol/L	21 -32
Anion Gap	10	mmol/L	7 – 16
Calcium	7.6	mg/dL	8.5 – 10.1
Protein, Total	6.3	g/dL	6.4 – 8.2
Albumin	2.7	g/dL	3.4 – 5.0
Globulin	---	g/dL	2.4 – 4.0
Albumin/Globulin	---	Ratio	1.0 – 1.8
Bilirubin, Total	1.8	mg/dL	0.2 – 1.0
Osmolality, Calc Serum	---		
ALT	38	U/L	12 – 78
AST	28	U/L	8 – 39
Alkaline Phosphatase	148	U/L	46 – 116
eGFR	38	mL/min/1.73m^2	60 – 9999
Magnesium	1.9	mg/dL	1.8 – 2.4
Hemoglobin A1C	5.2	%	

Effective 4/2015, a new reference range will be in place for Alk Phos due to a new reagent formulation traceable to the IFCC (International Federation of Clinical Chemistry and Laboratory Medicine) ALP primary reference method procedure at 37degrees C.

eGFR Note: if the patient is less thatn 18 years old or the age/gender is not provided an eGFR will not be calculated.
For African American patients multiply the eGFR by 1.159
Effective 6/18/2014, eGFR is determined by using the Chronic Kidney Disease Epidemiology Collaboration (CKDEPI) creatinine calculation published in 2009.

UNM CoN Laboratory

TEST: **COAGULATION PANEL**

Result Name	Results	Units	Reference Range
PT	17.3	sec	11.8 – 15.0
INR	1.47		0.9 – 1.1
PTT	30	sec	22.0 – 36.0

Recommendation for Oral Anticoagulation Therapy
(American College of Chest Physicians – 2004)

Population	INR Range
Conventional Intensity	2.0 – 3.0, Target 2.5
High Intensity	3.0 – 4.0, Target 3.5

Therapeutic range for intravenous heparin therapy
65 – 110 seconds

UNM CoN Laboratory

TEST: **URINALYSIS, WITH CULTURE IF INDICATED**

Result Name	Results	Units	Reference Range
Color	Yellow		
Clarity	Hazy		
Glucose	Negative		Negative
Bilirubin	Negative		Negative
Ketones	Negative		Negative
Specific Grav, Urine	1.010		1.00 -1.035
Blood	Large		Negative
pH	6.0		5.0 – 8.0
Protein	30		Negative
Nitrite	Negative		Negative
Leukocyte Esterase	Large		Negative
Culture Indicated?	Yes		

Urine culture is performed if specimen demonstrates pyuria >4WBC or WBC clumps or positive leukocyte esterase or positive nitrite. Because the urethra is normally colonized by bacteria, culture is not performed when bacteriuria is not associated with pyuria. For immunocompromised patients, recommend ordering a Urinalysis and Urine Culture

Result Name	Results	Units	Reference Range
Bacteria	None	/hpf	None
Epithelial Cells	---	/hpf	
Hyaline Casts	---	/hpf	
RBC	7	/hpf	0.3
Uroglobin	---	mg/dL	0.2 – 1.0
WBC	16	/hpf	0 - 4

UNM CoN Laboratory

TEST: URINE DRUG SCREEN

Result Name	Results	Units	Reference Range
Amphetamines	Neg		Negative
Barbiturates	Pos		Negative
Benzodiazepines	Neg		Negative
Cocaine	Neg		Negative
Opiates	Neg		Negative

This immunoassay is not equally sensitive to all benzodiazepines. Negative results may still be obtained when certain benzodiazepines are present. Recommend testing urine for benzodiazepines by Gas Chromatograph/Mass Spectrometry (GC/MS) if there is a high clinical suspicion for the presence of benzodiazepines and the urine benzodiazepine screen is negative. Please provide the name of the suspected drug if this testing is requested.

Results are to be used for medical (i.e. treatment) purposes only. The submitted urine specimen was tested for the presence of the following drugs at or above the indicated detection limit:

Reporting limit of detection for EIA screen:
AMPHETAMINES……………. 1000 ng/mL
BARBITURATES…………….. 200 ng/mL
BENZODIAZEPINES …............ 200ng/mL
COCAINE METABOLITES….. 300 ng/mL
OPIATES……………………… 300ng/mL

UNM CoN Laboratory

 TEST: TROPONIN

Collected Date & Time:

Result Name	Results	Units	Reference Range
Troponin	<0.017(neg)	ng/mL	0.00 – 0.05

Troponin – I: A positive troponin is not always indicative of MI. Other conditions resulting in myocardial cell damage can contribute to elevated cardiac Troponin I levels. These conditions include, but are not limited to, myocarditis, cardiac surgery, angina, unstable angina, congestive heart failure, and non-cardiac related causes, such as, renal failure and pulmonary embolism
A Relative Index is only calculated when both the Total CK and CK-MB are elevated.
AID TO INTERPRETATION OF THE CK-MB RESULTS: The CK-MB Relative Index (REL INDEX) is a calculated value that is provided to improve the specificity of CK-MB testing with respect to source (myocardial or skeletal CK-MB). A value for REL INDEX is reported when CK-MB and Total CK exceed the upper reference limit. As with any other test value, a single REL INDEX result must be evaluated and interpreted in the context of the patient's history, physical findings and other laboratory measurements.

APPENDIX B IRB APPROVAL LETTER

HEALTH SCIENCES
OFFICE OF RESEARCH

Human Research Protections Program

June 8, 2020
Sharon Schaaf
SSchaaf@salud.unm.edu

Dear Sharon Schaaf:

On 6/8/2020, the HRRC reviewed the following submission:

Type of Review:	Initial Study
Title of Study:	Social Construction of Knowledge, Social Networks, and Competency Among Advanced Practice Nursing Students in Asynchronous, Online Discussions
Investigator:	Sharon Schaaf
Study ID:	20-296
Submission ID:	20-296
IND, IDE, or HDE:	None
Submission Summary:	Initial Study
Documents Approved:	• Schaaf Data Collection Tool.pdf • Schaaf HRP-582 Exempt Protocol Version 6-8-2020.pdf
Review Category:	Expedited: Category (4) Secondary research on data or specimens (no consent required)
Determinations/Waivers:	Informed Consent Not Applicable. HIPAA Authorization Addendum Not Applicable.
Submission Approval Date:	6/8/2020
Approval End Date:	None
Effective Date:	6/8/2020

The HRRC approved the study from 6/8/2020 to inclusive. If modifications were required to secure approval, the effective date will be later than the approval date. The "Effective Date" 6/8/2020 is the date the HRRC approved your modifications and, in all cases, represents the date study activities may begin.

Because it has been granted exemption, this research is not subject to continuing review.

If the study meets the definition of an NIH Clinical Trial, the study must be registered in the ClinicalTrials.gov database. Additionally, the approved consent document(s) must be uploaded to the ClinicalTrials.gov database.

505.272.1129 | The University of New Mexico Health Sciences Office of Research Human Research Protections Program
1 University of New Mexico | MSC08 4560 | Albuquerque, NM 87131
hsc.unm.edu/research/hrpo

APPENDIX C STATISTICAL ANALYSIS RESULTS

Spearman's *rho* correlational analysis of Competency and Social Network Centralities

Correlations			Competency	Betweenness	Indegree	Outdegree	Closeness	Eigenvector
Spearman's rho	Competency	Correlation Coefficient	1.000	.747*	.652	.647	.787*	.787*
		Sig. (2–tailed)	.	.021	.057	.060	.012	.012
		N	9	9	9	9	9	9
	Betweenness	Correlation Coefficient	.747*	1.000	.703*	.765*	.916**	.916**
		Sig. (2–tailed)	.021	.	.035	.016	.001	.001
		N	9	9	9	9	9	9
	Indegree	Correlation Coefficient	.652	.703*	1.000	.523	.790*	.790*
		Sig. (2–tailed)	.057	.035	.	.149	.011	.011
		N	9	9	9	9	9	9
	Outdegree	Correlation Coefficient	.647	.765*	.523	1.000	.895**	.895**
		Sig. (2–tailed)	.060	.016	.149	.	.001	.001
		N	9	9	9	9	9	9
	Closeness	Correlation Coefficient	.787*	.916**	.790*	.895**	1.000	1.000**
		Sig. (2–tailed)	.012	.001	.011	.001	.	.
		N	9	9	9	9	9	9
	Eigenvector	Correlation Coefficient	.787*	.916**	.790*	.895**	1.000**	1.000
		Sig. (2–tailed)	.012	.001	.011	.001	.	.
		N	9	9	9	9	9	9

*. Correlation is significant at the 0.05 level (2–tailed).

**. Correlation is significant at the 0.01 level (2–tailed).

Spearman's *rho* correlational analysis of IAM and Competency

			IAM	Competency
Spearman's rho	IAM	Correlation Coefficient	1.000	.654
		Sig. (2-tailed)	.	.056
		N	9	9
	Competency	Correlation Coefficient	.654	1.000
		Sig. (2-tailed)	.056	.
		N	9	9

Spearman's *rho* correlational analysis of IAM and Social Network Centralities

Correlations

			IAM	Betweenness	Indegree	Outdegree	Closeness	Eigenvector
Spearman's rho	IAM	Correlation Coefficient	1.000	.798**	.848**	.680*	.902**	.902**
		Sig. (2–tailed)	.	.010	.004	.044	.001	.001
		N	9	9	9	9	9	9
	Betweenness	Correlation Coefficient	.798**	1.000	.703*	.765*	.916**	.916**
		Sig. (2–tailed)	.010	.	.035	.016	.001	.001
		N	9	9	9	9	9	9
	Indegree	Correlation Coefficient	.848**	.703*	1.000	.523	.790*	.790*
		Sig. (2–tailed)	.004	.035	.	.149	.011	.011
		N	9	9	9	9	9	9
	Outdegree	Correlation Coefficient	.680*	.765*	.523	1.000	.895**	.895**
		Sig. (2–tailed)	.044	.016	.149	.	.001	.001
		N	9	9	9	9	9	9
	Closeness	Correlation Coefficient	.902**	.916**	.790*	.895**	1.000	1.000**
		Sig. (2–tailed)	.001	.001	.011	.001	.	.
		N	9	9	9	9	9	9
	Eigenvector	Correlation Coefficient	.902**	.916**	.790*	.895**	1.000**	1.000
		Sig. (2–tailed)	.001	.001	.011	.001	.	.
		N	9	9	9	9	9	9

**. Correlation is significant at the 0.01 level (2–tailed).

*. Correlation is significant at the 0.05 level (2–tailed).

References

Afify, M. (2019). The influence of groups size in the asynchronous online discussions on

the development of critical thinking skills, and on improving students'

performance in online discussion forum. *International Journal of Emerging

Technology in Learning, 14*(5), 132-152.

https://doi.org/10.3991/ijet.v.14i05.9351

Allen, I. & Seaman, J. (2017). Digital learning compass distance education enrollment

report 2017. Babson Survey Research Group. Retrieved from:

https://files.eric.ed.gov/fulltext/ED580868.pdf

American Association of Colleges of Nursing. (2013). 2012-2013 enrollment and

graduations in baccalaureate and graduate programs in nursing.

http://www.aacn.nche.edu/downloads/ids/2013/EG12.pdf

American Association of Critical Care Nurses (2019). Adult-gerontology acute care nurse

practitioner exam handbook. *AACN Certification Corporation*

American Association of Nurse Practitioners., (2020). Discussion paper: Nurse

practitioner curriculum. Retrieved from:

https://www.aanp.org/advocacy/advocacy-resource/position-statements/nurse-

practitioner-curriculum.

American Association of Nurse Practitioners. (2020). Discussion paper: Scope of practice

for nurse practitioners. Retrieved from:

https://www.aanp.org/advocacy/advocacy-resource/position-statements/scope-of-

practice-for-nurse-practitioners.

American Association of Nurse Practitioners. (2020) Discussion paper: Standards of

    practice for nurse practitioners. Retrieved from:

    https://www.aanp.org/advocacy/advocacy-resource/position-statements/standards-

    of-practice-for-nurse-practitioners.

American Association of Nurse Practitioners. (2019). Planning your NP Education.

    Retrieved from: https://www.aanp.org/student-resources/planning-your-np-

    education

American Nurse Credentialing Center (2017). Certification: General testing and renewal

    handbook. *American Nurse Credentialing Center Certification.*

Andersen, T. (2004). Teaching in an online context. In T. Anderson & Elloumi (Eds.).

    Theory and practice of online learning, 33-60. Mahwah, NJ: Lawrence Erlbaum.

APRN Consensus Workgroup & the National Council for State Boards of Nursing APRN

    Advisory Committee. (2008). Consensus model for APRN regulation: Licensure,

    accreditation, certification & education. Retrieved from:

    https://ncsbn.org/Consensus_Model_Report.pdf

Auberbach, D., Buerhaus, P., & Staiger, D. (2020). Implications of the rapid growth of

    the nurse practitioner workforce in the US. *Health Affairs, 39*(2), 273-279. doi:

    10.1377/hlthaff.2019.00686.

Aviv, R., Erlich, Z., Ravid, G., & Geva, A. (2003). Network analysis of knowledge

    construction in asynchronous learning networks. *Journal of Asynchronous

    Learning Networks, 7*(3), 1 – 23.

Becker, D., Kaplow, R., Muenzen, P., & Hartigan, C. (2006). Activities performed by

    acute and critical care advanced practice nurses: American Association of

Critical-Care Nurses study of practice. *American Journal of Critical Care, 15*(2), 130-148.

Benner, P. (1982). From novice to expert. *The American Journal of Nursing, 82*(3). 402-407.

Borgatti, S. & Ofem, B. (2011). Social network theory and analysis. In Daly, A. (Ed.) *Social Network Theory and Educational Change* (pp. 17-29)*. Cambridge, MA: Harvard Education Press.

Brandes, U., Borgatti, S., & Freeman, L. (2016). Maintaining the duality of closeness and betweenness centrality. *Social Networks, 44*, 153-159. http://dx.doi.org/10/1016.j.socnet.2015.08.003.

Brennan, C. (2020). Tracing the history of the nurse practitioner profession in 2020, the year of the nurse. *Journal of Pediatric Health Care, 34*, 83-84. https://doi.org/10.1016/j.pedhc.2019.12.005

Brierton, S., Wilson, E., Kistler, M., Flowers, J., & Jones, D. (2016). A comparison of higher order thinking skills demonstrated in synchronous and asynchronous online college discussion posts. *North American Colleges and Teachers of Agriculture, 60*(1).

Burchard, J. & Cornwell, B. (2018). Structural holes and bridging in two-mode networks. *Social Networks, 55*, 11-20. https://doi.org/10.1016.j.socnet.2018.04.001

Burt, R. (1992). Structural holes: The social structure of competition. Harvard University Press: Cambridge, MA.

Burt, R., Kilduff, M., & Tasselli, S. (2013). Social network analysis: Foundations and frontiers on advantage. *Annual Review of Psychology, 64*, 527-527. doi: 10.1146/annurev-psych-113011-143828.

Cabrero, B., Ramirez, L., Sanchez, A., Diaz, G., & Espindola, S. (2008). Analysis of patterns of interactions and knowledge construction in online learning environments: A methodological strategy. *Revisa: Electronica de Investigacion Educativa, 10*(1).

Calderon, O. & Sood, C. (2020). Evaluating learning outcomes of an asynchronous online discussion assignment: a post-priori content analysis. *Interactive Learning Environments, 28*(1), 3-17. doi: 10.1080/104984820.2018.1510421.

Chan, T., Lockhart, J., Schreiber, J., & Kronk, R. (2020). Determining nurse practitioner core competencies using a delphi approach. *Journal of the American Association of Nurse Practitioners, 32*(3), 200-217. doi: 10.1097.jXX.0000000000000382.

Chen, B. & Huang, T. (2019). It is about timing: Network prestige in asynchronous online discussions. *Journal of Computer Assisted Learning, 35,* 503-515. doi: 10.111.jcal.12355.

Collins, K., Groff, S., Mathena, C., & Kupczynski, L. (2019). Asynchronous video and the development of instructor social presence and student engagement. *Turkish Online Journal of Distance Education, 20*(1), 53-70.

Courtney, M. & Wilhoite-Mathews, S. (2015). From distance education to online learning: Practical approaches to information literacy instruction and collaborative learning in online environments. *Journal of Library Administration, 55,* 261-272. doi: 10.1080/01930826.2015.1038924

Covelli, B (2017). Online discussion boards: The practice of building community for

    adult learners. *The Journal of Continuing Higher Education, 65*(2), 139-145. doi:

    10.1080/07377363.2017.1274616.

Desai, U., Ramasamy, V., & Kiper, J. (2020). A study on student performance evaluation

    using discussion board networks. Paper Session: *SIGCSE, March 11-14, 2020.*

    Portland, OR.

De Wever, B., Van Winkle, M., & Valcke, M., (2006). Discussing patient management

    online: The impact of roles on knowledge construction for students interning at

    the paediatric ward. *Advances in Health Sciences Education, 13*, 25-42. doi:

    10.1007/s10459-006-9022-6

DiPasquale, J. & Hunter, W. (2018). Critical thinking in asynchronous online

    discussions: A systematic review. *Canadian Journal of Learning and Technology,*

    44(2), 1-25

Distler, J. (2015). Online nurse practitioner education: achieving student competencies.

    The Nurse Practitioner, 40(11), 44-49.

Donlan, P. (2019). Use of the online discussion board in health professions education:

    Contributions, challenges, and considerations. *Journal of Continuing Education in*

    the Health Professions, 39(2), 124-129. DOI: 10.1097/CEH.0000000000000252.

Doolittle, P. (2014). Complex constructivism: A theoretical model of complexity and

    cognition. *International Journal of Teaching and Learning in Higher Education,*

    26(3), 485-498.

Durairaj, K., & Umar, I. (2015). A proposed conceptual framework in measuring

    interaction and knowledge construction level in asynchronous forum among

university students. *Prodecia - Social and Behavioral Sciences, 176,* 451-457.

doi: 10.1016/l.sbspro.2015.01.496

Durrington, V., Berryhill, A., & Swafford, J. (2006). Strategies for enhancing student

interactivity in an online environment. *College Teaching, 54*(1). 190-193.

Fahy, P., Crawford, G., Ally, M., Cookson, P., & Keller, V. (2000). The development and

testing of a tool for analysis of computer mediated conferencing transcripts. *The

Alberta Journal of Educational Research, 55*(1), 85-88.

Foo, S. & Quek, C. (2019). Developing students' critical thinking through asynchronous

online discussions: A literature review. *Malaysian Online Journal of Educational

Technology, 7*(2), 37-52. http://dx.doi.org/10.17220/mojet.2019.02.003

Frank, J., Snell, L., Cate, O., Holmboe, E., Carraccio, C., Swing, S., & Harris, K. (2010).

Competency-based medical education: Theory to practice. *Medical teacher,

32*638-645.

Freeman, L. (1978). Centrality in social networks conceptual clarification. *Social

Networks, 1*, 215-239.

Fukada, M. (2018). Nursing competency: Definition, structure, and development. *Yonago

Acta Medica, Review Article: Special Contribution.*

Garrison, D., Andersen, T., Archer, W. (2000). Critical inquiry in a text-based

environment: Computer conferencing in higher education. *The Internet and

Higher Education 2*(2-3), 87-105.

Garrison, D., Andersen, T., & Archer, W. (2001). Critical thinking, cognitive presence,

and computer conferencing in distance education. *American Journal of Distance

Education, 15*(1), 7-23.

Graesser, A. & Person, N. (1994). Question asking during tutoring. *American Educational Research Journal, 31*(1), 104-137.

Granovetter, M. (1973). The strength of weak ties. *American Journal of Sociology, 76*(6), 1360-1380.

Gravina, E. (2017). Competency-based education and its effect on nursing education: A literature review. *Teaching and Learning in Nursing, 12*, 117-121. http://dx.doi.org/10.1016.j.teln.2016.11.004.

Gunawardena, C., Flor, N., Gomez, D., & Sanchez, D. (2016). Analyzing social construction of knowledge online by employing interaction analyses, learning analytics, and social network analysis. *The Quarterly Review of Distance Education, 17*(3), 35-66.

Gunawardena, C., Lowe, C., & Anderson, T. (1997). Analysis of global online debate and the development of an interaction analysis model for examining social construction of knowledge in computer conferencing. *Journal of Educational Computing Research, 17*(4), 397-431.

Hall, B. (2014). In support of the interaction analysis model (IAM) for evaluating discourse in a virtual learning community.

Hansen, D., Shneiderman, B., Smith, M. (2020). Twitter: Information flows, influencers, and organic communities. In *Analyzing Social Media Networks with NodeXL (pp. 161-178)..* Morgan Kaufmann

Harmon, O., Alpert, W., & Histen, J. (2014). Online discussion and learning outcomes. *International Advances in Economic Research, 20*, 33-44. doi: 10.1007/s11294-013-9453-9

Hassanian, Z., Ahanchian, M., Ahmadi, S., Gholizadeh, R., & Karimi-Moonaghi, H.

(2015). Knowledge creation in nursing. *Global Journal of Health Science, 7*(2),

44-54.

Hatano, C. & Inagaki, K. (1991). Sharing cognition through collective comprehensive

activity. In Resnick, L., Levine, H., & Teasley, S. (Eds.). *Perspectives on socially*

shared cognition (pp. 331-349). Washington, DC: American Psychological

Association

He, W., Xu, G., & Kruck, S. Online IS education for the 21st century. *Journal of*

Information Systems Education, 25(2), 101-105

Henri, F. (1992). Computer conferencing and content analysis. In: Kaye A. R. (eds)

Collaborative Learning Through Computer Conferencing. NATO ASI Series

(Series F: Computer and Systems Sciences), vol 90. Springer, Berlin, Heidelberg

Heo, H., Lim, K., & Kim. Y. (2010). Exploratory study on the patterns of online

interaction and knowledge co-construction in project-based learning. *Computer &*

Education, 55, 1381-1392. doi: 10.1016/j.compedu.2010.06.012

Hoffman, L. & Guttendorf, J. (2017). Preparation and evolving role of the acute care

nurse practitioner. *American College of Chest Physicians, 152*(6), 1339-1345.

http://dx.doi.org/10.1016.j.chest.2017.08.007.

Hoffman, M., Steinley, D., Gates, K., Prinstein, M., & Brusco, M. (2018). Detecting

clusters/communities in social networks. *Multivariate Behavioral Research,*

53(1), 57-73. doi: 10.1080/00273171.2017.1391682

Holley. S. (2106). Ongoing professional performance evaluation: Advanced practice

    registered nurse practice competency assessment. *The Journal for Nurse*

    Practitioners, 12(2), 67-74. http://dx.doi.org/10.1016.j.nurpra.2015.08.037.

Iacobucci, D., McBride, R., Popovich, D., & Rouziou, M. (2017). In social network

    analysis, which centrality index should I use?: Theoretical differences and

    empirical similarities among top centralities. *Journal of Methods and*

    Measurement in the Social Sciences, 8(2), 72-99.

Jaggars, S. & Xu, D. (2016). How do online course design features influence student

    performance? *Computers & Education, 95*, 270-284.

    https://dx.doi.org/10.1016/j.compedu.2016.01.014

Jamali, M. & Abolhassani, H. (2006). Different aspect of social network analysis.

    Proceedings from IEEE/WIC/ACM International Conference on Web Intelligence

James, I., Andershed, B., Gustavsson, B., & Ternestedt, B. (2010). Knowledge

    construction in nursing practice: Understanding and integrating different forms of

    knowledge. *Qualitative Health Research, 20*(11), 1500-1518. doi:

    10.1177/1049732310374042

Jo, I., Park, & Lee, H. (2016). Three interaction patterns on asynchronous online

    discussion behaviors: A methodological comparison. *Journal of Computer*

    Assisted Learning, 33, 106-122. doi: 10.111/jcal.12168.

Joksimovic, S., Manataki, A., Gasevic, D., Dawson, S., Kovanovic, V., & de Kereki, I.

    (2016). Proceedings of the Sixth International Conference on Learning Analytics

    & Knowledge, 315-323. https://doi.org/10.1145/2883851.2883928

Kesten, K., Brown, H., & Meeker, M. (2015). Assessment of APRN student competency

    using simulation: A pilot study. *Nursing Education Perspectives*, 332-334. doi:

    10.5480/15-1649

Kleinpell, R., Cook, M., & Padden, D. (2018). American association of nurse

    practitioners national nurse practitioner sample survey: Update on acute care

    nurse practitioner practice. *Journal of the American Association of Nurse*

    Practitioners, 30(3), 140-148. Doi: 10.1097/jXX.00000000000000300.

Knestrick, J., Wilkinson, M., Pellathy, T., Lange-Kessler, J., Katz, R, & Compton, P.

    (2016). Predictors of retention of students in an online nurse practitioner program.

    Journal for Nurse Practitioners, 12(9), 635-640.

Krippendorff, K. (2004). *Content analysis: An introduction to its methodology* (2nd ed.).

    Sage.

LaPointe, D. & Gunawardena, C. (2004). Developing, testing and refining of a model to

    understand the relationship between peer interaction and learning outcomes in

    computer-mediated conferencing. *Distance Education, 25*(1), 83-106.

Lucas, M., Gunawardena, C., & Moreira, A. (2014). Assessing social construction of

    knowledge online: A critique of the interaction analysis model. *Computers in*

    Human Behavior, 30, 574-582. http://dx.doi.org/10.1016/j.chb.2013.07.050

Mack, R. (2018). Increasing access to healthcare by implementing a consensus model for

    advanced practice register nurse practice. *The Journal for Nurse Practitioners,*

    14(5), 419-424. https://doi.org/10.1016/j.nupra.2018.02.008.

Markel, S. (2001). Technology and education online discussion forums: it's in the

    response. *Online Journal of Distance Learning Administration, 4*(2).

Marra, R., Moore, J., & Klimczac, A. (2004). Content analysis of online discussion

    forums: A comparative analysis of protocols. *Educational Technology Research*

    and Development, 52(2). 23-40.

Martono, F. & Salam, U. (2017). Students' learning in asynchronous discussion forums:

    A meta-analysis. *International Journal of Information and Communication*

    Technology Education, 13(1), 48-60. doi: 10.4018/IJICTE.2017010105.

Massey, D., Johnston, A., Byrne, J., & Osborne, D. (2019). The digital age: A scoping

    review of nursing students' perceptions of the use of online discussion boards.

    Nurse Education Today, 81, 26-33. https://doi.org/10/1016/j.nedt.2019.06.013

Mthembu, S. & Mtshali, F. (2013). Conceptualisation of knowledge construction in

    community service-learning programmes in nursing education. *Culationis, 36*(1).

    1-10. http://dx.doi.org/10.4102/curationis.v36i1.69

National Center for Education Statistics (2019). Retrieved from:

    https://nces.ed.gov/pubs2019/2019144.pdf

National Council for State Boards of Nursing Advisory Committee. (2008). Consensus

    model for APRN regulation: licensure, accreditation, certification, and education.

    https://www.ncsbn.org/Consensus_Model_for_APRN_Regulation_July_2008.pdf

National Organization of Nurse Practitioner Faculties (NONPF) (2016). Adult-

    gerontology acute care and primary care NP competencies. National Organization

    of Nurse Practitioner Faculties.

Newman, D., Webb, B., & Cochrane, C. (2004). A content analysis method to measure

    critical thinking in face-to-face and computer supported group learning. Retrieved

    from:

https://pdfs.semanticscholar.org/267e/42e7d3ec60d054ea9eebd50589512c3801d3

.pdf?_ga=2.140643506.1409175232.1563989456-1916335133.1563989456

Nieminen, A., Mannevaara, B., & Fagerstrom, L. (2011). Advanced practice nurses;

scope of practice: a qualitative study of advanced clinical competencies.

Scandinavian Journal of Caring Sciences, 25, 661-670. doi: 10.111/j.1471-

6712.2011.00876.x

Nieves, J. & Osorio, J. (2013). The role of social networks in knowledge creation.

Knowledge Management Research & Practice, 11, 62-77. doi:

10.1057/kmrp.2012.28

Nimmon, L., Artino, A., & Varpio, L. (2019). Social network theory in interprofessional

education: Revealing hidden power. *Journal of Graduate Medical Education*,

247-250.

Novotny, N., Stapleton, S., & Hardy, E. (2016). Enhancing critical thinking in graduate

nursing online asynchronous discussions. *Journal of Nursing Education, 55*(9),

514-521. doi: 10.3928/01484834-20160816-05.

O'Neil-Mundinger, M. & Carter, M. (2019). Potential crisis in nurse practitioner

preparation in the United States. *Policy, Politics, & Nursing Practice, 20*(2), 57-

63. doi: 10.1177/1527154419838630.

Osborne, D., Byrne, J., Massey, D., & Johnston, A. (2018). Use of online asynchronous

discussion boards to engage students, enhance critical thinking, and foster staff-

student/student-student collaboration: A mixed method study. *Nurse Education

Today, 70,* 40-46. https://doil.org/10.1016/j.nedt.2018.08.014

Raymond, A., Jacob, E., Jacob, D., & Lyons, J. (2016). Peer learning a pedagogical

approach to enhance online learning: A qualitative exploration. *Nurse Education

Today,* 165-169. http://dx.doi.org/1016.j.nedt.2016.05.016

Richard-Eaglin, A. (2017). Predicting student success in nurse practitioner programs.

Journal of the American Association of Nurse Practitioners, 29, 600-605.

Ringler, I., Schubert, C., Deem, J., Flores, J., Friestad-Tate, J., & Lockwood, R. (2015).

Improving the asynchronous online learning environment using discussion

boards. *Journal of Educational Technology, 12*(4), 15-27.

Riquelme, F., Gonzalez-Cantergiani, P., Molinero, X., & Serna, M. (2018). Centrality

measure in social networks based on linear threshold model. *Knowledge-Based

Systems, 140*, 92-102. https://doi.org/10.1016/j.knosys.2017.10.029.

Romero, C., Lopez, M., Luna, J., & Ventura, S. (2013). Predicting students' final

performance from participation in on-line discussion forums. *Computer &

Education, 68*, 458-472. doi: 10-.1026/j.compedu,2013.06.009

Rounds, L., Zych, J., & Mallary, L. (2012). The consensus model for regulation of

APRNs: Implications for nurse practitioners. *Journa of the American Academy of

Nurse Practitioners,* 1-6. doi: 10.1111/j.1745-7599.2012.00812.x.

Saritas, T. (2008). The construction of knowledge through social interaction via

computer-mediated communication. *The Quarterly Review of Distance

Education, 9*(1), 35-49.

Schoch, D. & Brandes, U. (2016). Re-conceptualizing centrality in social networks.

European Journal of Applied Mathematics, 27, 971-985.

https://dx.doi.org/10.1017/S0956792516000401.

Schumacher, G. & Risco, K. (2017). Nurse practitioner program curriculum

development: A competency-based approach. *The Journal for Nurse

Practitioners, 13*(2), e75-e81.

Shavelson, R. (2010). On the measurement of competency. *Empirical Research in

Vocational Education and Training, 2*(1), 41-63.

Shelton, B., Hung, J., & Lowenthal, P. (2017). Predicting student success by modeling

student interaction in asynchronous online courses. *Distance Education, 38*(1),

59-69. https://doi.org/10.1080.01587919.2017.1299562.

NodeXL. (2020). Social Media Foundation. Retreived from:

https://www.smrfoundation.org/nodexl/

Tractenberg, R., Wilkinson, M., Bull., A., Pellathy, T., & Riley. J. (2019). A

developmental trajectory supporting the evaluation and achievement of

competencies: Articulating the mastery rubric for the nurse practitioner (MR-NP)

program curriculum. *PLoS One, 14*(11), e0224593.

https://doi.org/10.1371/journal.pone.0224593.

United States Bureau of Labor Statistics. (2020). Labor force statistics from the current

population survey. Retrieved from: https://www.bls.gov/cps/cpsaat11.htm

Vygotsky, L. (1978). Interaction between learning and development. In M. Cole, V.

John-Steiner, S.Scribner, & E, Souberman (Eds.), *Mind in Society.* Cambridge,

MA: Harvard University Press.

Woods, K. & Bliss, K. (2016). Facilitating successful online discussions. *The Journal of

Effective Teaching, 16*(2), 76-92.

Yang, K., Johantgen, M., Trinkoff, A., Izdik, S., Wince, J., & Tomlinson, C. (2020).

    Medical Care Research and Review, 1-14. doi: 10.1177.1077558719901216.

Yen, C., Bozkurt, A., Tu, C., Sujo-Montes, L., Rodas, C. (2019). A predictive study of

    students' self-regulated learning skills and their roles in social network interaction

    of online discussion board. *Journal of Educational Technology Development and*

    Exchange, 11(1). doi: 10.18785/jetde.1101.02.

Zhang, J. & Luo, Y. (2017). Degree centrality, betweenness centrality, and closeness

    centrality in social network. *Advances in Intelligent Systems Research, 132,* 300-

    303.

Zhao, C., Liang, Y., & Liu, Q. (2016). Analysis of social network and knowledge

    construction levels in online discussion. *2016 International Conference on*

    Education Innovation through Technology.

Zhu, E. (1996). Meaning negotiation, knowledge construction, and mentoring in a

    distance learning course. In *Proceedings of Selected Research and Development*

    Presentations at the 1996 National Convention of the Association for Educational

    Communications and Technology (18th National Convention, Indianapolis).