TEACHING ADVANCED PRACTICE NURSE ROLE DEVELOPMENT
USING STUDENT DEVELOPED CASES

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Abstract

A paradigm shift is occurring in graduate education for nurses in the United States. The developing roles for nurses are a result of many factors, challenging how nurses are prepared in an evolving system. Case study writing was used as an innovative method of teaching at the graduate level to assist professionals new to a role to articulate their vision and develop concrete plans for role enactment. The focus will be on masters prepared advanced practice nurses, but discussion will include the Doctorate of Nursing Practice and will allow for meaningful dialogue internationally.

KEYWORDS: Advanced practice nursing, role acquisition, and case writing

INTRODUCTION

The education and development of advanced practice nurses is certainly not new, “specialty” nurses evolved as early as the 1900’s and nurse-anesthetists and nurse-midwives have a history dating back almost 100 years [Hamric, Spross, & Hanson, 2005, pp. 4-45]. However, the issues of role confusion (more than physician replacement/support); lack of clearly defined roles, role domains and goals; factors within the culture/environment that undermine the roles; and the need to use more evidence-based approaches for developing, implementing, and evaluating the roles; have continued to create barriers in the acceptance of the role of the advanced practice nurse by other health care professionals, patients, and the community [Bryant-Lukosius, DiCenso, Browne, & Pinelli, 2004]. Authors examining training needs of advanced practice nurses describe the need for a focus on professional role relationships and more effective communication which would benefit members of multi-disciplinary teams, as well as ongoing professional development [Nicolson, Burr, & Powell, 2005].

Adequately describing the functional role of a profession requires the identification of specific outcomes and careful articulation of the role. Confusion occurs if a degree, such as the advanced practice nurse degree at the masters’ level, proposes varied outcomes and does not adequately articulate the functional role. Role refers to a variety of functions including: educator, manager, clinician, and leader to name a few. Role preparation tends to occur in an academic setting where through completion of an individualized curriculum the graduate is prepared to function within the scope of practice of the identified role. Curricular content is determined by professional associations who represent experts in the role [Fulton & Lyon, 2005].

In the United States, a new role, Doctor of Nursing Practice (DNP), has been suggested and supported by the National Organization of Nurse Practitioner Faculties (NONPF) and the American Association of Colleges of Nursing (AACN) since 2002. The Position Statement on the Practice Doctorate in Nursing [AACN, October 2004] describes the paradigm shift in graduate education in nursing and identifies a number of factors that have converged to develop momentum for a shift. These factors include: aging of the population; expansion of knowledge underlying practice; increased complexity of
patient care; concerns about quality of care/patient safety; nursing shortages; nursing faculty shortages; lack of leaders in practice; and increased expectation for education of other health professionals (e.g. doctorates of practice for pharmacists and physical therapists). Fulton & Lyon [2005] in their discussion requesting further dialogue regarding the DNP, suggest that there is a lack of professional role competencies for the DNP focus areas, which suggests a lack of buy-in by professional nursing organizations.

In other words, role confusion for the DNP presently exists. NONPF perceives the DNP for advanced practitioners who require more clinical expertise and knowledge and who would be experts in one of three practice arenas: health care, leadership, or teaching [NONPF, 2003]. In contrast, AACN has stated that the proposed DNP will differ from the doctor of philosophy (PhD) in nursing on several points. The following differences for the practice doctorate as compared to the PhD include: a different emphasis on theory; less research methodology; focus on evaluation and use of practice research rather than performance of research; difference in dissertation requirements; clinical practicum/residency requirements; and emphasis on scholarly practice, practice improvement, innovation and testing of interventions and care delivery models, evaluation of health care outcomes, and expertise to inform health care policy and leadership in establishing clinical excellence [Marion et al., 2003; AACN, 2004, Apold, 2008].

There is no doubt that there is a paradigm shift occurring in graduate education for nurses in the United States. The evolving roles for nurses are a direct result of the changing technology, health care delivery systems, and science and the nurse of tomorrow requires educational preparation to participate in this evolving health care delivery system [Apold, 2008]. The purpose of this paper is to describe an innovative method of teaching at the graduate level that assists professionals new to a role to use the case study method to articulate their vision of the new role and develop concrete plans for role enactment. The focus will be on masters prepared advanced practice nurses, but use of this method as the DNP role evolves will be feasible and appropriate.

An international perspective on the definition of the advanced practice nurse includes competence in five areas of practice: clinical skills, research, teaching, consultancy, and leadership [Pearson & Peels, 2002]. The author acknowledges that the role of the advanced practice nurse is different in the United States from other countries; however, these international areas identified are consistent with the role definition of Advanced Practice Nurses in the United States. Consideration of "role development" for nursing education, using the example of the case method approach for role clarification, will transfer to international nursing education. Helping students identify specific areas for role clarification, role development, and role implementation in their present clinical areas, guided by research and basic principles, and allowing application of those techniques to effect change is a step forward for nursing education. This is the goal of one of the first courses students take in a master's level nursing program in the United States.

Therefore, it might not be surprising that clinically expert registered nurses, who pride themselves on their expert knowledge and the care they give, are among those who are confused about where they fit in the present health care system. They find themselves in an increasingly complex environment, surrounded by shrinking resources, seriously ill patients, fewer staff, and frustration at every turn. [IOM, 2004; Smith, Cronenwett, & Sherwood, 2007]. These students, some out of school more than 15 to 20 years, return to the world of academe in search of answers. They have begun to recognize the need for nurse leaders and their desire to enhance their own skills but fear being taken away from the bedside, their first true passion in nursing. This describes the twenty students who inspired this manuscript and who participated in a core course for the master's nursing program, thirteen new to the program, with many more questions than answers.

DESCRIPTION OF THE ASSIGNMENT

The course, a two-credit core course for the four graduate program nursing tracks, was titled “Role Acquisition for the Advanced Practice Nurse”. The tracks for study in the nursing graduate program include: Psychiatric Nurse Practitioner (PsychNP); Family Nurse Practitioner (FNP); Health Care and Management; and Clinical Nurse Leader (CNL). The course goal is to explore the change in roles from baccalaureate to master’s-prepared nurse, and to examine professional behaviors inherent in changing these roles. Cultural and ethical issues that influence the ‘advanced practice’ nursing role are addressed
with special attention being given to advanced communication skills. Case studies are used to enhance the application of theory into practice.

The major assignment for the course is a “Role Acquisition Paper”, with a goal of synthesizing the semester’s learning and reading in a concrete manner by recounting a case study and identifying how the situation might have been improved, changed, or included a different outcome if an advanced practice nurse had been utilized. It involved the students choosing a clinical scenario from their past/present practice and experience as a nurse and documenting that scenario as a case study. Direction for the case study was simply that it be complete, with a beginning, middle, and end, and that it incorporates evidenced-based practice information on the topic as a result of a review of the literature. Further specifics about the review of literature were provided, namely that the manuscripts included be: research-based, current (within the past five years), and from nursing, medicine, or other related disciplines. Students were encouraged to provide an historical perspective of the topic and to consider the roles of the advanced practice nurse in managing the current issue in the scenario. The conclusion of the case study included a summary of the currently available information on the topic, speculation of the future management of the case, and identification of the key role of the advanced practice nurse and anticipated outcomes (for the patient, institution, community) with advanced practice nurse involvement. The length of the case study was suggested at 7 to 10 pages, double-spaced, with the following headings and points awarded accordingly.

Section I  Case study - (20 pts).
Section II Summary of the Issue & Review of the literature - (50 pts)
Section III Summary of Literature & Future Direction – (20 pts)
Section IV Format & Reference List - APA format, proper grammar, spelling, etc. (10 pts).

This assignment was worth 20% of their grade for the course. Involving the use of a case study, it was imperative that students remained mindful of patient confidentiality. All personal information, (including patient, family, staff and hospital/unit or agency names) were removed and the use of substitute or false names/initials with the statement (not real name) were inserted to assure readers that the individuals in the case study could not be identified. Finally, no reference to the institution/agency where the student worked at the time of the case study was included. The protocol for this manuscript was reviewed by the Institutional Review Board at Fairfield University and found to be exempt according to 45CFR46.101(b).

In addition to this major assignment, students recorded reading journals throughout the semester, relating real-life experiences and thoughts to the weekly readings. These reading journals reflected the student’s understanding of the readings compared to previously held knowledge regarding the topic being studied. Students were encouraged to raise questions, articulate areas where they agreed or disagreed and why, and present new knowledge acquired. Lastly, they completed a final reflection of the semester on an electronic portfolio where they identified ways their practice, thinking, and vision of themselves as nurses and future advanced practice nurses had changed over the course of the semester. In the reflection, they also listed ways they had grown, challenges they faced, and goals they set in four areas: personal growth, clinical growth, communication skills, and professional behavior. The reflective learning that took place as a result of these reading journals supplemented and enhanced the final Role Acquisition Papers and case studies.

KEY ROLE ISSUES IDENTIFIED BY THE CASE STUDIES

Students identified key areas within their case studies where the advanced practice nurse could provide benefit to the scenario. Broadly these included the following:

- Allocation of resources (e.g. costs related to effective home care treatment versus the need for hospitalization related to factors like dehydration, uncontrolled diabetes, mental health – which could be identified more quickly and treated more easily by the continuity of care provided by an advanced practice nurse); [Katon, Roy-Byrne, Russo, & Cowley, 2002; Xiao, Barber, & Campbell, 2004];

- Quality Improvement interventions (e.g. outcome data demonstrating how patient care improved with continuity of care and quicker assessment of problems before they spiraled out of control) [Sidani, 2006];
- **Collaboration/communication/consultancy** (e.g. mental health and primary care in case of depression/hypo-thyroidism; APN consulting with families in the care of elderly with dehydration, diabetes care, heart care; APN providing coaching and guidance in cancer care, palliative care, institutional and home health) [Bryant, 2007; Cox & Miller, 2005; Gardner, Chang, & Duffield, 2006; Grimes, Thornell, Clark, & Viney, 2007; Hanson & Spross, 2005];
- **Minority communities needs** (e.g. access to care issues, role of APN) [Sisk et. al., 2006];
- **Societal/technological factors** contributing to the need for more involvement/leadership of advanced practice nurses (e.g. increase in outpatient surgery; patient population older with more co-morbidities; increase need for palliative care options in intensive care units; chronic illness issues such as diabetes, heart disease, obesity all of which require careful coordination and continuity of care; need for care-giver support systems especially with specialty patients like organ transplant recipients; need for medical emergency response teams with advanced practitioners in hospitals) [Scarpa, 2004; Grimes et. al., 2007; Treece, 2007]; and
- **Patient needs** suited to advanced practice nursing care (e.g. mental health, palliative care, sexuality, hydration, diabetes control, medication management, lifestyle changes for improved health, heart disease, cancer patients, care-givers of chronically and or terminally ill patients). [Coyne, 2003; HPNA Paper, 2007]

Some of the tools used by students as they researched their topic areas included:
- evidenced-based practice guidelines
- statistics on extent of disease within certain populations
- comparisons of costs of various methods of caring for patients
- library resources including data bases for research searches
- institutional protocols and policies
- committee work and policy/protocol development

**EXAMPLES OF CASE STUDIES AND STUDENT REFLECTIONS**

Examples of specific case studies will help to clarify the application of course content and how students formed visions of the role of advanced practice nursing. Student reflections provide evidence of their growth and application of concepts from the course to real-life scenarios in the form of case studies.

**Allocation of resources & Quality Improvement interventions**

The first student example is a case study of the integration of psychiatric mental health and primary health care for a patient suffering neuropsychiatric complications associated with thyroid conditions based on real-life experience [Davis & Tremont, 2007]. Given the lack of knowledge and skill of many primary care physicians in managing mental health symptoms, the student provided support demonstrating a long recognized need for the presence of mental health care in a primary care setting [Katon, Roy-Byrne, Russo, & Cowley, 2002]. Paramount to the care of this particular patient, the student identified the need to find a primary care practitioner who would feel comfortable consulting with a mental health nurse. In order to effectively manage this patient’s thyroid condition and the co-morbid psychiatric symptoms, collaboration between primary care and psychiatric mental health practitioners was of vital importance. The student identified with the role of the APN as collaborator and used the work of Hanson & Spross [2005] to recognize that the success of APN’s as clinicians and leaders is often found to be inherent in their proficiency as collaborators. The major focus of this case was on interventions and collaboration that would result in quality improvement of care, better patient outcomes, and decreased health care costs.

The plan developed for this case study included four parts: 1) direct action at the policy level to modify current reimbursement structures and pay for treatment provided; 2) develop and implement integrated care models which would enhance patient follow up and adherence to both medical and mental health regimens; 3) document the cost savings, as a result of the integrated model (e.g. decreased: emergency room visits, inpatient medical and mental health services, burden to crisis centers and walk-in clinics, unscheduled office visits, and out-of-pocket expenses to patients); and 4) demonstrate how an integrated model decreases the time between screening and engagement by a mental health professional to decrease the marked disparity for ethnic, racial, economic, and cultural groups.

Connections between the case study, the identified role of the APN, and the students understanding of that role are evident in this self-reflection:
“I now am aware that the role requires promotion and increased understanding of the profession to the public, other disciplines, and other registered nurses. Use of political activism, collaboration, and mentoring are ways of accomplishing this. Furthermore, the expectation of improvement upon current practice and possibly even the conceptualization of novel models or even paradigm shifts by anticipating trends is a fundamental function of the APNs role in the health care delivery system. Maintaining cultural sensitivity, high quality, professional character, and ethical standards are of utmost importance. Ideas, which I wasn’t unfamiliar with, but for which I had not gained a full appreciation of until recently.”

Collaboration/communication/consultancy & Allocation of Resources

One student examined the struggle of a home health care agency that was trying to incorporate the use of a Psychiatric Advanced Practice Nurse. Due to a lack of orientation of the staff to the role of the APN there was confusion about the areas for consultation (e.g. patient issues versus staff issues), which led to an underutilization of the APN and lack of recognition of the benefits, and potential services that could be provided. Hamric, Spross and Hanson [2005] “highlight the importance and value of incorporating consultation as a core competency of the nurse practitioner role” (p.227). Without clear expectations, enactment of the role will be difficult. “The more precisely the word consultation is defined; the more likely consultation will be utilized for its intended purpose” [Hamric, et al., 2005, p.229]. Consultancy can assist with the effort to retain staff, since job satisfaction among staff members is crucial. “Studies have shown that they (APN) improve the management of symptoms, decrease inappropriate emergency department and hospital use, decrease costs, and improve the retention and satisfaction of staff” [Neal, 2004, p. 383].

The APN is in a position to assist the nurses with patients whose problems often make management of their cases complex and stressful. Such assistance will not only improve the level of care of the patient but will, at the same time, enhance the job satisfaction of the nurses who have benefited from this consultation. The student who identified and shared this case study outlined a feasible plan for introduction of the APN in their new role; with a full orientation to outline areas of expertise and availability thereby better explaining and enhancing their role within the agency. In addition, planned monthly meetings would provide opportunities to identify staff needs, provide in-service education and to review any complex cases. Finally, evaluation of the APN could take the form of nurses evaluating the effect of the APN’s role by survey or focus group, and the APN could keep track of number of consultations, categories, time spent, and in this way identifies areas for improvement and expansion. This case study focused on the APN role of consultation. The student took an example from life experience and created a plan to improve this specific role of the advanced practice nurse, using research on the benefits of this role and potential staff and patient outcomes.

This student’s reflection on learning from this class:

“My role as a nurse has changed, in my mind and at my job as a home care nurse. The stimulating discussions, about nursing, were discussions I have not been involved in for many years. I felt my nursing job was just a way to earn my living. I am starting to feel differently about this. I am starting to feel passion for nursing again and a sense of pride in the profession. When I see patients I feel much more knowledgeable about there illness and see myself seeing them, someday, in an APRN role.”

Finding the passion again, seeing nursing as a profession rather than a job, and envisioning the changes that can be made were outcomes of this assignment and course for this student.

Societal/technological factors

Two case studies identified the five characteristics of direct clinical care provided by an APN that add to the quality of care a patient receives as well as enhancing the communication skills between staff nurses and other health professionals. One case study represents the societal factor of more acutely ill patients in general medical-surgical units and more complex technology, while the second case study reflects the APN’s role in meeting patient needs. Hamric, Spross and Hanson [2005] identify these five characteristics as: use of a holistic perspective, formation of partnerships with patients, expert clinical thinking and skillful performance, use of research evidence as a guide to practice, and use of diverse approaches to health and illness management [p. 146].
The first case study looked at Intensive Care Unit (ICU) nurses who have ICU patient assignments yet lead Rapid Response Teams (RRT) to manage compromising patients on the medical surgical units, serving as mentor and role model by bringing critical care expertise to the bedside [Morse, Warshawsky, Jacqueline, & Pecora, 2006]. The student argued that the role of the APN as Clinical Nurse Leader would be ideal for this position. The best plan would involve the RRT leader not having a patient assignment; improvement in ICU patient care and medical-surgical patient outcomes is more likely with this model. “The initiation of the RRT program affected the nurses who were caring for patients in the ICU due to the fact that the charge nurse would be summoned sometimes as many as 4 to 5 times in a 12-hour shift” [Grimes et al., 2007, 89]. The role of the APN in this plan would be to bring critical care to the patient in need, a critical care unit without walls. The student incorporated Hamric, Spross and Hanson’s [2005, 152] definition of partnership and holism into the role of the APN by recognizing the holistic nature of the RRT and forming partnerships with other disciplines to utilize the necessary tools for the best patient outcomes. In addition, the APN’s clinical thinking and skillful performance and expertise will provide role modeling to help staff nurses to grow in their expertise, assessment, evaluation, and clinical skills. In addition, bringing their research evidence to the bedside as a guide for their practice and demonstration of unique approaches will add to staff development and interdisciplinary education, collaboration, and care of the patient.

This student found both personal and professional benefit to the course and used the research done for her case study to put a proposal in at work. She reflects on her experience thus:

“This semester wasn't what I had anticipated. I thought I would come to class, get assignments, and go home. I didn't anticipate the amount of classroom interaction. I came to every class and part of the reason not to miss a class was the discussions I knew would take place. Everyone had something to offer or share and I found that very beneficial. I am currently a critical care educator and I have been having some role conflict lately. This course has helped me sort through some of that conflict. I really enjoyed Benner's Novice to Expert and I am able to relate the content from that material to today's real nursing world. I have taken some of the concepts from Hamric and have applied them to my role as of today and have tried to envision what that role will look like as a Clinical Nurse Leader. I can see some tough challenges ahead in getting administration to buy into the roles of the Advanced Practice Nurse…I think it will put nursing onto a new playing field and our patients will benefit greatly. Utilizing the course materials I was able to put a proposal together for a MET team separate than the current model and I was able to use my acquisition paper to help me put that together. I was able to review the literature and find the evidence to support my proposal.”

The case study exemplar for meeting patient needs focused on the same five characteristics of the APN outlined above but examined them in relationship to the Clinical Nurse Leader (CNL) role [Rusch & Bakewell-Sachs, 2007, Tornbeni, Stanhope, & Wiggins, 2006] in the care of a 57-year-old man with advanced cutaneous T-cell lymphoma /Sezary Syndrome. This patient was admitted for chemotherapy but was suffering with a large open wound on his shoulder that had copious amounts of foul-smelling discharge and the broken scapula bone visible. The student outlined the reasons why this patient was so difficult to care for and developed a plan of care that maintained his dignity, honored his goals, and met his needs while utilizing the strengths of the CNL. The plan developed outlined four priorities: 1) pain control; 2) time alone while still providing the necessary care; 3) wound care; and 4) treatment goals. While the patient’s needs were met, he was continually frustrated by the desire to go home, yet having set backs that sometimes landed him in the ICU. Care coordination looked into options to transfer the patient closer to his home and included religious ministries and social work to provide added support, discuss palliative care, and adopt a Do Not Resuscitate (DNR) order. Collaboratively, a plan was created to bring the patient closer to his goals. This intense clinical experience is a perfect example of how this student envisioned the new role of the CNL as collaborator of care, providing the holistic perspective of the patient, using evidence-based-practice, and coordinating services for the best patient outcome – life with dignity, comfort, and family in the midst of a terminal illness.

The student’s reflection on her experience included insight into the role of the CNL:

“I have discovered in my research that the CNL role is more than a collection of skills. The CNL is expected to specialize with a group of patients to utilize collaboration, while working with staff
to bring to patient care evidence-based practice to optimize patient outcomes. They are expected to be effective leaders. Not managers, but role models to mentor those around them and lead by example. They examine and establish standards of practice and introduce change where necessary. They identify gaps in care and promote education to close the gaps.

OTHER STUDENT COMMENTS

Other student comments outlined the effect the class had on them and reflect how the modeling of the case study may have affected their thinking:

“The most memorable experience of the semester was when the advanced practice nurse came to visit the class to discuss her role. This presentation tied the ideas and objectives of the semester together for me. The presentation enforced the amount of opportunities that are available to nurse practitioners. The opportunities seem both challenging and exciting. Her professionalism and experience was inspiring. I know that I am capable of performing at the level that she attained. The other factor that helped me grow and think as an advanced practice nurse was the discussion that was brought up in lecture. The ideas and topics discussed in class allowed me to think at a new intensity. When I practice in the clinical setting, I feel that I am no longer thinking like a staff nurse but as a manager or leader. I see problems and I try to think if I were a clinical leader how I would approach the situation. I strive to be a leader on the floor each time I work even though I do not have the actual designated job. Before taking this course I was actually afraid to step up and be a leader, but now I have the courage to do so.”

In regard to working with diverse populations, cultures, terminally ill, and uninsured, a student reflects that this course has opened his/her eyes to the possibilities inherent in the role of the APN:

“I work daily with chronically ill dialysis patients and it is very difficult as they are waiting for transplants and I noticed many patients getting sicker and failing as time goes on. Also understanding ones culture plays a huge role in healthcare. I currently work with many orthodox Jewish patients and there are so many restrictions with care… You need to change the way you practice to accommodate the patient’s beliefs…. I have gained great knowledge in what lies ahead in the future role of APNs. I am looking forward to starting in this new role in the future months as I begin my clinical studies… I agree with Hamric on making the patient part of their care, especially in critical care situations and end of life. I do understand end of life issues are the toughest, which includes not only the patient but the family.”

CONCLUSIONS

There were many benefits to students using the case study approach to examine role development. Students brought the depth and breadth of their clinical experience into the classroom and identified scenarios that would benefit from an advanced practice nurse’s presence, which helped them to directly apply the theoretical concepts they were learning in class. They were able to make connections between their real-life experiences and the readings from Hamric, Spross and Hanson [2005] as well as Benner [2001]. Both texts incorporate nurses’ stories and make connections to the role of the advanced practice nurse. Other benefits were that the class provided a safe environment for the venting of real-life frustrations with their present role as a baccalaureate nurse. Rather than becoming a “gripe session”, students found themselves providing suggestions to each other for solutions and role-modeling possible communication techniques to enhance communication and resolve specific issues. The case study approach provided a rich arena by which students could plan a response to a specific situation, client, or institutional policy, given the role and leadership of the advanced practice nurse.

It is interesting to note that many of the students described in their final reflections that they had already begun incorporating the solutions they outlined in their case studies with good effect. This implementation of solutions allowed a trial and error period by which students practiced various aspects of the advanced practice nurse role and developed a clearer picture of the vision for that role for themselves. Having students develop case studies using scenarios from clinical experiences was a beneficial teaching tool to make the advanced practice nurse role come alive. The key issues students identified have been documented in the literature as areas where advanced practice nurses can make a difference. In addition, the creative plans and solutions that students developed using evidence-based
practice guidelines and research, was a hands-on method to practice the skills necessary to be a visionary and competent advanced practice nurse.

In conclusion, as Fulton & Lyon [2005] stated in making sense of the DNP: “We need to be asking ourselves different questions about how and what we teach at all levels including the undergraduate level. Perhaps if we taught nurses differently our graduate-prepared nurses would not be identifying the need for additional training and would be able to maneuver comfortably in the world of knowledge to solve problems amenable to nursing interventions.”(p.3) The use of case studies for clarification and implementation of the Advanced Practice Nurse Role, is one way to approach teaching differently at the graduate level. This method will transfer to the development of the Doctor of Nursing Practice in the United States and to international methods of advanced nurse education.

REFERENCES


Hanson, C. M., and Spross, J. A. “Collaboration”. In A. B. Hamric, J. A. Spross and C. M. Hanson (Eds.), *Advanced practice nursing: An integrative approach. 3rd Ed.* (Elsevier Saunders, 2005), pp. 341-378.


Naumes, W. and Naumes, M.J. *The art & craft of case writing. 2nd ed.* (Sharpe, 2006).


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