# Nurse practitioner education: a research-based curriculum structure

**Glenn Gardner** PhD RN, Professor of Clinical Nursing, Royal Brisbane and Women's Hospital, Centre for Clinical Nursing, Brisbane, Queensland, Australia; and Queensland University of Technology, School of Health Sciences, Brisbane, Queensland, Australia
**Anne Gardner** MPH PhD RN and Assistant Director of Nursing Research, The Canberra Hospital, Research Centre for Nursing Practice, Canberra, Australian Capital Territory, Australia; and University of Canberra, School of Health Sciences, Canberra, Australian Capital Territory, Australia
**Margaret Proctor** MScN RNSenior Lecturer, University of Canberra, School of Nursing, Canberra, Australian Capital Territory, Australia

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## Abstract

**Background.** The process and content of nurse practitioner educational preparation has received scant research attention, despite increasing interest in and investigations into nurse practitioner services in Australia and internationally.
**Aims.** The aim of this paper is to report a study investigating the educational process and content required for nurse practitioner preparation.
**Methods.** A trial of practice was conducted with four nurse practitioner candidates over a 12-month period. The candidates practised in different specialities, giving rise to four models of the nurse practitioner role. The trial had multiple aims related to the role and scope of practice of the nurse practitioner. An action learning model was used, in which participating nurse practitioner candidates 'worked-into-the-role' of extended practice and learned from experience through clinical mentoring, reflection and action. Data collection methods centred on transcripts from group work activities related to a collaborative engagement with and reflections on clinical practice. This resulted in the collaborative production of data to inform a research-based nurse practitioner curriculum structure.
**Findings.** The findings relate to the content and learning process required for nurse practitioner education and are described in terms of three broad areas of study: clinical practice, clinical sciences and nursing studies.
**Conclusions.** A curriculum structure that describes content and process for nurse practitioner education was developed from the findings. A further outcome of this trial was confirmation of importance of the clinical environment for nurse practitioner education. Inherent in this aspect of clinical learning is the role of a committed clinical mentor who can facilitate purposeful learning.
**What is already known about this topic**
There is a move towards recommending master's level programmes for nurse practitioner and advanced practice preparation. There is scant published research into nurse practitioner education. There is lack of conformity and consensus regarding differentiation between advanced practice nursing and the extended practice of nurse practitioners.

**What this paper adds**

- Research-derived knowledge on the generic learning needs, and a framework for model-specific learning needs, for nurse practitioner education.
- A research-derived nurse practitioner curriculum with three broad competency-related areas of study and relevant learning processes.
- Evidence that the clinical environment is an essential learning milieu for the nurse practitioner student as is the role of a committed clinical mentor who can facilitate purposeful learning.
- Differentiation of advanced practice and nurse practitioner roles through the notion of extended practice that is defined by a scope of practice supported by specific legislation.

## Introduction

The changing nature of health services is reflected in changing relations between healthcare professionals. Current demands and systems cannot support the hierarchical, individualistic and paternalistic processes that have characterized these relationships in the past, and no single healthcare provider can adequately meet the complex requirements of consumers. New approaches to health services emphasize multidisciplinary, collaborative team approaches to care (Offredy 2002). In this environment, the nurse practitioner is emerging as a level and type of service provider that is innovative, accessible and able to respond to the health care needs of specific populations (Dyer et al. 1997, O'Keefe & Gardner 2003).

The nurse practitioner has been a focus of interest in state health departments in Australia since 1990 (NSW Health Department 1992). However, despite increasing interest in and investigations of the role internationally, there is little research-based knowledge about nurse practitioner education. This paper reports research into the content and process requirements of nurse practitioner education, using the following operational definition:

A nurse practitioner is a registered nurse who works within a multidisciplinary team. The role includes extended practice in the autonomous assessment and management of clients using nursing knowledge and skills gained through postgraduate education and clinical experience in a specific area of nursing. The role may include, but is not limited to, the direct referral of patients to other health care professionals, the prescribing of a designated and agreed list of medications, and the ordering of a designated and agreed list of diagnostic investigations. (ACT Government 2002, p. 10)

## Literature review

### Search methods

An extensive literature search was conducted as a basis for the work. The databases searched were CINAHL, Medline and AUSThealth, and papers from the last 20 years were retrieved. Secondary sources were followed up and the Journal of Advanced Nursing, Nurse Education Today and the Journal of Nursing Education were hand-searched. Database search terms used were 'nurse practitioner', 'nurse practitioner education', 'nurse practitioner curriculum', 'nurse practitioner courses', 'advanced practice education', 'specialist nursing education', and 'specialist nursing educational research'. In addition, an Internet search was conducted using the terms 'nurse practitioner', 'nurse practitioner courses' and 'nurse practitioner education'.

### Findings

The findings from this search indicated that there is little published research on nurse practitioner education. However, there is a body of literature related to nurse practitioner courses and descriptions of the learning requirements.

Information in the literature about the education required for nurse practitioners is drawn from investigations of the attributes (Atkins & Ersser 2000) and competencies

(Crumbie 2001) of nurse practitioners, and trends in the health industry (Pulcini & Marion 2000). A further issue for consideration in designing nurse practitioner curricula is the question of balancing core and specialist content. Several authors (Davidson 1996, Dyer et al. 1997, Woods 1997, Cukr et al. 1998, McCabe & Grover 1999) claim that a generalist core curriculum needs to be supplemented by specialist classes in the area of practice choice. Bellack et al. (1999) found that content requirements for nurse practitioner curricula ranged from policy through to economics and financing. They also found that a number of barriers, such as excessive curriculum content, inadequate funding and inadequate clinical learning opportunities, posed challenges to achieving the clinical competency aims of the curriculum.

The literature on the academic level of education is extensive, with a trend to recommending master's level preparation programmes for advanced practice (Fowkes et al. 1994, American Academy of Nurse Practitioners 2003, Davidson 1996, de Leon-Demare et al. 1999, Atkins & Ersser 2000, van Soeren et al. 2000). However, this apparent conformity of view masks a complex semantic confusion about the nature of advanced practice. For instance, in the United Kingdom nurse clinicians and nurse consultants (both under the advanced practice nurse title) are expected to be prepared to master's level, but the level and type of education for nurse practitioners vary (Woods 1997). In New Zealand, nurse practitioners must have a master's level of education (Nursing Council of New Zealand 2001).

In Australia, health care is funded, and nursing is regulated, at state and territory level and there is emerging agreement across these jurisdictions that the minimum entry requirement for practising as a nurse practitioner is likely to be at master's level (Royal College of Nursing, Australia 2000).

The difficulty for curriculum planners is that, whilst there is information in the published literature (van Soeren et al. 2000) and on a range of web sites (e.g. that of Bournemouth University 2003) relating to existing nurse practitioner courses, there is a lack of research-based information about nurse practitioner education. Furthermore, the literature primarily deals with the broad topic of advanced practice nursing and does not clearly identify the specifics of what a nurse practitioner is, what they need to know and how they can best learn.

## The study

### Aim

The aim of this study was to investigate the educational requirements of nurse practitioners and to use the findings to inform curriculum development.

### Methodology

Action learning methodology was used to investigate the topic. This is a process whereby individuals learn from experience through reflection and action (Revans 1998, Marquardt 1999, McGill & Beaty 2001). It seeks to link the world of learning with the world of action through a reflective process, in which questioning and examination of practice experiences promote insight and improved understanding to inform future action (Weinstein 1998). This approach was considered appropriate for

the study, in that the reflections and discussions created in co-operative learning groups provided a basis for generating data related to learning requirements for nurse practitioners.

## Participants

A nurse practitioner trial-of-practice was conducted with four nurses (three women and one man) aged between 35 and 52, who were advanced practice specialists in the areas of sexual health, wound care, mental health and military nursing. Whilst this sample size is small in a statistical sense, it is appropriate for this qualitative research approach (Weinstein 1998). The study was conducted in Canberra, in the Australian Capital Territory (ACT), in 20012002. Following a notice in the city's major newspaper calling for applications, these nurses were selected from an applicant field of 12 because they met all the following inclusion criteria:

Possession of a postgraduate qualification in their specialty; A minimum of three years' experience in the specialty; and Support from their employer and a multidisciplinary clinical team in their specialty.

In most states of Australia, the title of 'Nurse Practitioner' is protected by legislation; therefore, the four participants were titled 'nurse practitioner candidates' to denote their educational status. In the overall study, the relationship between us and the candidates was that of co-investigators. We facilitated group work for data generation, and academics and clinicians were involved in teaching and assessing the candidates.

The period of data collection for the trial was 10 months, with an additional 2-month period for wind-down of case management and incorporation of final data. During this time the nurse practitioner candidates adopted the multiple roles of clinician, student and co-researcher. Their role as co-researchers was primarily related to the clinical outcomes of the study (MacLellan et al. 2002, O'Keefe & Gardner 2003) and they generated the data that informed the educational outcomes reported here. They conducted clinical practice in their specialty field, with a clinical support team providing on site education and mentoring. A standardized form of action learning supported by clinical and academic mentors was used with all four participants and gave rise to four speciality-related models of the nurse practitioner role. Co-ordination of all aspects of the trial, including data management, were centralized.

## Practice and learning processes

The action learning model simultaneously ensured patient safety and provided an environment for the acquisition of skills and knowledge needed for extended nursing practice. The action learning group met weekly to work on individual members' real life issues, with the aim of learning with and from each other and to generate data. The model developed for this trial involved experiential learning (Stanton & Grant 1999) and reflective practice (Teekman 2000).

During the project, nurse practitioner candidates spent four days each week in clinical practice and one day in clinical study. On clinical practice days, they provided a new

type of health service for their patient/client groups. In consultation with their clinical support team, they expanded and extended the boundaries of nursing practice in their field. Over time, this 'working-into-the-role' created the knowledge and processes to define the scope of practice for each of the four models. The data collected related to both the clinical service and learning needs and activities.

On the clinical study day, nurse practitioner candidates met with two investigators from the research team to participate in group work, and formal and informal teaching/learning sessions. The group work generated data on the generic and model-specific learning needs for each nurse practitioner model and informed formal education sessions that were arranged for subsequent weeks. These sessions were learner-directed, organized in response to identified learning needs, and delivered by experts in the field. On completion of the project each nurse practitioner candidate successfully completed a rigorous clinical and academic assessment that was built into the trial-of-practice methodology from the start. The purpose was to provide feedback to the candidates on completion of their practice and learning programme, and also provide evaluation feedback on the outcome of the practice/learning approach.

**Data collection**

Data generation activity was part of the group work sessions on clinical study days and intersected with the learning strategies described above. This was a collaborative engagement of the four nurse practitioner candidates and the investigators to analyse the week's accumulation of learning needs and learning issues. Analysis involved examination and discussion of each of these to identify their constituent parts. Each nurse practitioner candidate presented their learning needs and led group discussion about them. This discussion resulted in a collaborative production of knowledge related to generic and model-specific elements of the learning need/issue, its contribution to the nurse practitioner role, and how each need might be met. The discussion also helped to clarify the distinction between a nurse practitioner and an advanced practice nurse. Outcomes of this discussion were captured on a whiteboard using the template of headings shown in Table 1. Notes of group discussions were transcribed. The data generated contributed to the design of both content and process for a nurse practitioner curriculum.

| **Learning needs** | **Learning issues** | **Contribution to the nurse practitioner role** | **Generic elements** | **Specific learning activities** |
|---|---|---|---|---|
| Identified during the preceding week, resulting from the nurse practitioner 'working-into-the role' | Clinical knowledge and skills held and recognized as contributing to the nurse practitioner's scope of practice | The characteristic of the learning need or issue that was identified as extended nursing practice | Elements from the model-specific learning needs and issues that related to all four models | Strategies and activities that might contribute to acquisition of learning about both specific and generic elements |

Table 1 Generation of data from group work

The activity of data generation was supported by the nurse practitioner candidates maintaining a clinical log in which they documented the learning needs and issues identified in clinical practice during the previous week. They also maintained their own reflective journals. Whilst these records were not formally used as data, they contributed to reflective practice and, thus, the production of data through group discussions.

**Ethical considerations**

The study gained ethical approval from the human research ethics committees for the three research sites used in the investigation. For this phase of the study the relationship between the nurse practitioner candidates and us remained that of co-researchers. However, in this curriculum work the nurse practitioner candidates took an informed decision to confine their role to that of generating data from their clinical practice. This satisfied their need to remain focused on meeting their clinical learning requirements, leaving us to achieve the curriculum research outcome of the study. The ethical implications of this decision were minimal in that healthcare professionals external to the inquiry conducted both teaching and assessment of the candidates.

**Data analysis**

Data analysis was conducted using a qualitative descriptive approach and involved coding of the group work transcripts to identify the content and process requirements for a nurse practitioner curriculum. Data were organized each week according to five predetermined categories (see Table 1). A subsequent deductive analysis of the data in each of these categories resulted in defined content areas. Table 2 provides an example of the two-step process of analysis within the category 'learning needs'. Step 1 aggregated the data from and within each model; Step 2 demonstrated aggregation of data from and across the models to define and establish learning content areas.

Step 1: Identification of model-specific learning needs
Nurse practitioner model

| **Sexual health** | **Wound care** | **Military** | **Mental health** |
|---|---|---|---|
| Examples | | | |
| Clinical assessment of primary herpes | High risk factors for vein graft wound infection | Decision tree for emergency drug use | Drug interactions between antidepressants and mood stabilizers |
| Ciprofloxacin contraindications and drug interactions | Physical assessment of shingles | Flu vaccine –when is it appropriate and who will benefit? | Aetiology and prevalence of depression in older people |

Step 2: Coding and aggregation of learning needs

| Drugs or therapy | Assessment | Disease knowledge | Evidence-based practice |
|---|---|---|---|
| Examples | | | |
| Ciprofloxacin contraindications and drug | Physical assessment of shingles | Aetiology and prevalence of depression in older people | Case management dealing with conflicting opinions on patient care |
| Drug interactions between antidepressants and mood stabilizers | Clinical assessment of primary herpes | High-risk factors for vein graft wound infection | Evidence to support promotion of breast self-examination |

Table 2 Example of the analytical process (learning needs)

Analysis and interpretation of the 'learning needs and issues' data produced a content syllabus for these four models and a framework for the specialist learning component of a nurse practitioner curriculum. Analysis and interpretation of the 'contribution to the NP role' data informed judgment about the distinction between knowledge requirements for advanced practice and the requirements for nurse practitioner extension to this level of education and practice. The data in the 'generic elements' section were coded to inform a content syllabus for the generic component of a nurse practitioner curriculum. The 'learning activities' data informed the curriculum process for nurse practitioner education.

After coding of the data, a further analytical step, Step 2, involved aggregation of the coded data from the models into content categories, as demonstrated in Table 2. These content categories were ultimately organized into modules that can be structured within a curriculum framework. The following section explains this interpretive process.

## Findings

The immediate outcome of the project was the development of the advanced practice nurses into nurse practitioners with the requisite knowledge, attitudes and skills to enable them to practise autonomously in their area of specialization. How they attained these attributes was the subject of the inquiry. The study findings related to four areas that might inform the design of a nurse practitioner curriculum, namely: model-specific educational requirements, generic educational requirements, contribution to the nurse practitioner role, and learning activities.

### Model-specific educational requirements

At the start of the trial of practice, the nurse practitioner candidates had strong incentives to identify their model-specific learning needs and issues. They were in unfamiliar territory in terms of having primary responsibility for taking patients through to the completion or resolution of episodes of care. The need to be fully conversant with, and confident in, the knowledge underpinning the extended elements of their practice caused the candidates to scrutinize and interrogate all aspects of their decisions on patient care. They very quickly identified a need to expand their

knowledge and understanding, and appreciated that deeper understanding would improve their confidence in making unfamiliar and, initially, uncomfortable decisions.

As a result of this, there was an early focus on model-specific assessment skills, knowledge of diseases, drugs and therapies, evidence-based practice, and diagnostic processes. These areas were covered by the conceptual headings of:

**Assessment and diagnosis**

**Pathophysiology and pathology**

**Therapeutic options.**

These clearly inform the content of a model-specific clinical practicum component of a nurse practitioner curriculum. They draw on expert clinician knowledge and involve discipline-based knowledge from both nursing and medicine. The experiential learning approach used in this study catered for individual needs and enhanced motivation to learn, because learning was shaped around a need to perform better. It would, therefore, be appropriate for the content framework for these areas to be structured into a clinical practicum learning contract format.

## Generic educational requirements

The data in this section were coded to inform a content syllabus for the generic component of a nurse practitioner curriculum. Part of the process in the group work was to examine collaboratively model-specific learning needs and issues as they were presented, and in each case to identify the generic learning elements for the item of discussion. For example, the sexual health nurse practitioner candidate identified as a learning need 'comparison of mechanical and chemical treatment for warts'. The example generated discussion on the elements of this learning need that were specific to the sexual health model (treatment of warts) and those that were relevant to all four models (evidence-based decision-making and clinical effectiveness). As a further example, the mental health nurse practitioner candidate brought to the group a learning that need he defined as 'drug interactions between antidepressants and mood stabilizers'. The agreed element in this learning need that was common to all models was pharmacokinetics. Thus, most but not all learning needs and issues generated a generic educational requirement.

Generic educational requirements were extensive and related to the intellectual and clinical tools necessary to develop extended practice that was safe and efficacious. In addition, the candidates identified the need to acquire skills and knowledge related to clinical leadership and collaborative practice. Analysis of these wide and varied data identified conceptual generic educational requirements that related to:

clinical decision-making

assessment and diagnosis

evidence-based practice

pharmacology

models of practice.

These conceptual areas defined a body of knowledge that was common across all nurse practitioner models of practice. Whilst the data that informed this content area were derived from four specific models, they are transferable to curricula for nurse practitioner preparation across a range of practice contexts. The models in this study included practice in hospital-based, outreach, community and primary health settings, covered biophysical and mental health specialties, and included practice that extended beyond the traditional boundaries of nursing.

**Contribution to the nurse practitioner role**

The aim of this aspect of the overall project was to identify the content and processes necessary for the design of a nurse practitioner curriculum. Inherent in this endeavour was the need to differentiate the nurse practitioner level of educational preparation from that of the broader field of advanced practice nursing. This was an important aspect of the study. There is an extensive body of literature relating to the notion of advanced practice nursing and describing a range of nursing roles and definitions that conform to advanced practice. One of these roles is that of the nurse practitioner. However, the nurse practitioner stands out as different in that, in Australia and elsewhere, the role and practice of the nurse practitioner is subject to different privileges that are protected by legislation. Therefore, the essential element of a nurse practitioner is extended practice; this is defined by those elements of nursing activity that call upon additional legislation.

One of the important outcomes of this study is the recognition of advanced practice as an appropriate preparation, rather than the end product, for the extended practice that defines the nurse practitioner level. The candidates in the trial were all undertaking or had completed postgraduate education and had extensive experience in their specialties. They defined themselves as advanced practice nurses. Furthermore, before the study began and in its early days these, and other, nurses often claimed that they were already practising at the nurse practitioner level under mechanisms such as standing orders and delegated authority. However, as the candidates worked into the role, they became increasingly aware that it was different. The extended aspect of the nurse practitioner role differentiated it from advanced practice, in that it required formalized educational preparation to provide the knowledge, skills and, importantly, confidence to practise with autonomy. Hence, it became important to differentiate the advanced from the extended elements of nurse practitioner practice and, therefore, the learning requirements involved. Throughout this trial, when individual candidates presented their learning needs or issues in group work, there was a requirement to describe collaboratively how these contributed to their development as a nurse practitioner (see Table 1). This produced a body of data that described the nurse practitioner level of service and differentiated it from advanced practice. Primarily, the extended practice element related to specialist assessment, autonomy in clinical

decision-making, collaboration and clinical nursing leadership, and knowledge of science.

**Specialist assessment**
Specialist patient assessment was in-depth and specific to the area of specialist practice. Skills in patient assessment needed to be at a level of competency and confidence to support and inform:

accurate diagnosis of the health problem

appropriate referral to another health provider

accurate differential diagnosis

efficacious treatment.

**Autonomy in clinical decision-making**
The nurse practitioner candidates required a level and depth of knowledge that enabled them to practise autonomously with safety and confidence. Whilst definitions and descriptions of the nurse practitioner level of practice emphasize work in a multidisciplinary team, by definition they also work autonomously, in that they have legal and professional discretionary decision-making capabilities within a defined scope of practice. In addition, nurse practitioners in settings such as remote areas of Australia, Canada and New Zealand may have to work independently for extended periods. The functions relating to this requirement included:

initiating treatments and management protocols

knowing about new technologies and clinical applications

initiating medications

monitoring and titration of medication.

**Collaboration and clinical nursing leadership**
An essential part of the nurse practitioner role was to establish genuine collaboration with other health professionals whilst advocating a nursing model of practice. The nurse practitioner becomes an expert healthcare provider, offering a service that is different to that currently being provided by either nurses or physicians (MacLellan et al. 2002, O'Keefe & Gardner 2003). The field of practice is very narrow, but is structured within a nursing model of holistic care. Hence, the nurse practitioner brings an element to the healthcare team that is additional to conventional specialist health care. In order to establish genuine collaboration, the nurse practitioner must be functioning within a nursing model of practice that includes developing skills and

attitudes of leadership and collegiality. The functions that defined this requirement included:

establishing collegiality in multidisciplinary teams

being an agent for change

practising innovative nursing

providing holistic care at an advanced level.

**Knowledge of science**

The preceding points rely on a sound scientific basis. Knowledge of science is needed to build on and extend the knowledge base of specialist and advanced practice nursing. Therefore, if nurse practitioners are to practise with competence and confidence, there is a requirement for in-depth study in the areas of pathophysiology and pathogenesis, diagnostics and pharmacology.

**Learning activities**

In addition to determining the content of a nurse practitioner education programme, the trial also aimed to provide data to inform the process of learning at this level of nursing practice. As previously described, the methodology used for this aspect of the trial was an action learning approach, in which nurse practitioner candidates worked into the role, reflected on their experiences to enhance their learning, and engaged in a collaborative production of data to inform research outcomes. Part of this activity was to examine collaboratively each model-specific learning need and issue as it was presented, and to identify appropriate learning activities to meet this need. The suggested learning activities crossed generic and model-specific boundaries. Some activities were specific to the individual candidate and required specialist clinical education that was available through follow-up with the clinical support team; others included lectures or presentation from content experts.

The nurse practitioner candidates had a strong interest in learning as efficiently and effectively as they could. Their work in the field continued to challenge and place demands on their clinical skills and knowledge, and they were highly motivated to advance their education. Analysis of the data in this category revealed that the following types of learning processes were used:

clinical and empirical learning

independent literature searching and reading

attending resource lectures.

Given the opportunity to acquire formal learning from any source (under the conditions of the trial), the candidates invariably agreed on the clinical field as the first option, and independent literature research and reading as the second option, with lectures from appropriate experts when necessary. The student-directed approach, facilitated by the action learning model, produced important information about the approach needed to achieve optimum learning for extended practice in nursing.

**Conclusions: synthesis and recommendations**

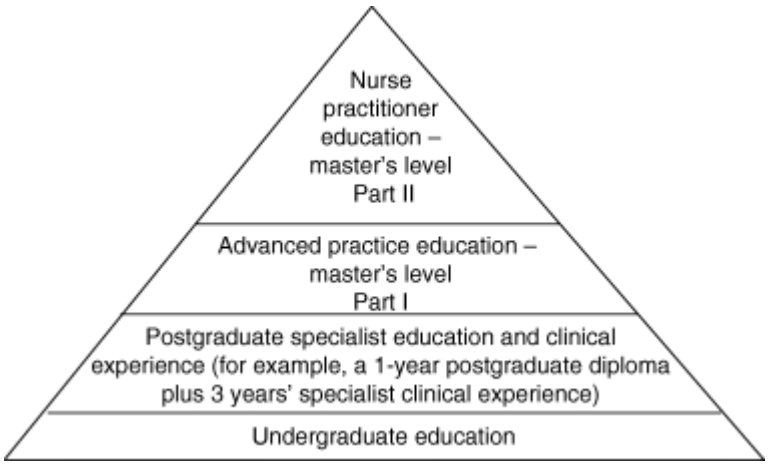
To date, there has been little published research to inform the content and process of curriculum design in nurse practitioner education. In addition, there is confusion and a lack of consistency in the nomenclature relating to advanced practice nursing roles and the inter-relationships of these roles (Dunn 1997, Woods 2000). In this paper we report the findings of an Australian study into nurse practitioner educational requirements. The methodology used for this study was both innovative and effective. The approach captured the complexity of content and process that was necessary for education of four nurse practitioners, and generated data relating to their learning requirements. There are, nevertheless, limitations in the methodology used in that the findings are not generalizable. However, the strength of the methodology is, firstly, in a practice and inquiry process that can be replicated across other health service settings and, secondly, in findings that provide an evidential base to inform nurse practitioner curriculum design.

## Curriculum framework

Analysis of the data on educational outcomes of trial of practice identified the following issues that may be important in a nurse practitioner curriculum:

- the place of nurse practitioner education in the postgraduate nursing educational framework;
- the content framework for model-specific learning requirements;
- the content of a generic learning component;
- optimum learning processes for nurse practitioner education.

An important outcome of this study is the identification of the place of nurse practitioner education in overall specialist nursing education. As previously argued, the nurse practitioner is differentiated from other advanced practitioner roles in that practice at this level in Australia is protected and supported by specific legislation. This necessitates a special and specific education that can support extension to practice in the areas of prescribing, referral and diagnostics, a finding supported by previous research on nurse prescribing (Luker et al. 1998). Thus, the curriculum must build on the postgraduate education and clinical experience needed by an advanced practice nurse. This is represented schematically in Figure 1.




Educational outcomes relating to curriculum content and process were categorized into three broad areas of study with relevant learning processes. Each area contains content modules for a variety of subject structures and sizes (see Table 3). This curriculum structure was derived from the data relating to the four models in the ACT nurse practitioner project (ACT Government 2002). All models related, in varying degrees, to biophysical and psychological illness. We recognize that nurse practitioner models will cover a wide range of healthcare services that are not necessarily concerned with illness in individuals, as opposed to health in families and communities. The curriculum structure that we propose can accommodate other models in that the concepts in the modules can be interpreted to apply to individuals, systems (social, community, health) and/or services. Table 3 Areas of study and content of modules

| **Areas of study** | **Modules** | **Module content** | **Learning and assessment processes** |
|---|---|---|---|
| Clinical practice | Assessment and diagnosis | Model specific; related to specialist field of practice; needs to be responsive to the clinical events confronting the nurse in an extended scope of practice | This area of study:<br>▪ is field based<br>▪ uses experiential learning<br>▪ is supported by a clinical team and an academic facilitator<br>▪ uses a learning contract to structure learning activities and outcomes across the three modules<br>Assessment will be related to clinical performance and clinical decision making. |
| | Pathophysiology/pathology | Model specific; dealing with the structural and functional changes in illnesses or disorders related to the clinical specialty area | |
| | Therapeutic options | Model specific; related to any aspects of therapeutic | |

| | | | |
|---|---|---|---|
| | | interventions (e.g. medication, procedures and referrals); responsive to clinical events in an extended scope of practice | |
| Clinical sciences | Clinical decision-making | Deals with decision-making in extended clinical practice, such as ordering tests, interpretation of laboratory tests and their place in deciding between treatment options | Learning process includes:<br>▪group work related to situated learning stimulus<br>▪resource lectures from content experts<br>▪individual literature research<br>Assessment will evaluate both knowledge and application of knowledge in challenging situations. |
| | Assessment and diagnosis | Generic learning related to principles of health assessment, with a specific focus on pattern recognition and diagnostics | |
| | Pharmacology | The study of drugs and their actions in therapeutic use; content is generic and supports specific model-based study in this field | |
| Nursing studies | Models of practice | Examines the nurse practitioner level of practice in terms of the profession and health services as a whole; model definition explored, scope of practice determined and clinical protocols developed | Learning process is:<br>▪active and student-directed<br>▪ productive in terms of developing clinical protocols, medication formularies and definitions of the scope of practice for a specific model<br>Assessment will be related to the production of a model- specific scope of practice, defined by protocols, formularies and a portfolio. |
| | Evidence-based practice | Includes the study of epidemiology, the production of evidence and use of evidence to support practice decisions | |

A further outcome of this trial was recognition of the importance of the clinical environment to nurse practitioner education, a finding that is supported by previous research into undergraduate (Papp et al. 2003) and specialist (Chaboyer et al. 2001) nurse education. Inherent in this clinical learning aspect is the role of a committed clinical mentor who can facilitate purposeful learning.

Our study contributes important new knowledge in an emerging area of the health services. The nurse practitioner uses a nursing model of care in a practice context that crosses the grey areas between nursing and medicine. In so doing, nurse practitioners can provide health care for individuals and populations that, because of geographical, social or lifestyle issues, would otherwise be under-serviced, marginalized in the healthcare environment, or excluded from access to health care. This calls for a new and specific approach to postgraduate nurse education. The findings presented in this paper inform the requirements for nurse practitioner education.

**Author contributions**
All authors contributed directly to this study and paper. All authors were responsible for the study conception and design. AG was responsible for the data collection and GG and AG contributed to the data analysis. All authors drafted the paper and carried out critical revisions.

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