AN INTEGRATIVE REVIEW OF EDUCATIONAL STRATEGIES THAT PROMOTE THE CLINICAL JUDGEMENT ABILITY OF STUDENTS IN HEALTH CARE

Nora Frances Olivier

July 2014

AN INTEGRATIVE REVIEW OF EDUCATIONAL STRATEGIES THAT PROMOTE THE CLINICAL JUDGEMENT ABILITY OF STUDENTS IN HEALTH CARE

By

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Supervisor: Prof. Y. Botma

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I certify that the dissertation hereby submitted by me for the **MSocSc (Nursing)** degree at the University of the Free State is my independent effort and had not previously been submitted for a degree at another university/faculty. I furthermore waive copyright of the dissertation in favour of the University of the Free State.

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Nora Frances Olivier

July 2014

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To Whom it May Concern

Hereby I declare that Mrs Nora Olivier may submit her dissertation titled "AN INTEGRATIVE REVIEW OF EDUCATIONAL STRATEGIES THAT PROMOTE THE CLINICAL JUDGMENT ABILITY OF STUDENTS IN HEALTHCARE". The dissertation had not previously been submitted to the assessors, either as a whole or partially.

Yours truly

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SUMMARY

The plethora of literature available on the practice-theory gap, learning transfer and the continuous search for better methods of educating healthcare students emphasises the fact that an educational problem exists. The best available evidence informs clinical practice, and educators in healthcare should base educational decisions on the best evidence supporting educational strategies.

The purpose of the study is to determine the educational strategies that promote clinical judgement of students in healthcare through an integrative literature review of studies published from January 2000 to October 2013.

Multiple databases and search methods were used to identify studies that met the inclusion criteria for an integrative literature review. The search strategies identified 897 records of which seven were identified for critical appraisal according to the inclusion criteria. Three researchers independently critically appraised the articles according to the standardised CASP and QaulSyst, appraisal tools. Four of the seven studies were used for analysis. Although an integrative review allows for qualitative studies, all four articles were randomised control studies.

This review was unable to provide conclusive evidence regarding appropriate educational techniques promoting clinical judgement. All four studies differed regarding sample size, duration, type of interventions and the outcome measurement tools. The four trials used high fidelity simulation, case-based learning and web-based learning as educational strategies. Shared educational design factors of the educational strategies were found, such as authenticity, active student engagement, cooperative learning, learner focussed and scaffolding, providing a shared base for educational strategies improving learning transfer and clinical judgement. Two of the studies indicated sequencing of the interventions improved clinical judgement.

Due to the paucity of evidence, no conclusion as to which educational strategies promote clinical judgment could be made. However, there is evidence suggesting that high fidelity simulation, case-based learning and web-based learning may promote transfer of learning.

Recommendations for further research include a standardised measurement of clinical judgement and that more educational strategies should be tested for their ability to promote transfer of learning.

Keywords

Clinical judgement

Educational strategies

Educational design factors

Healthcare

Learning transfer

Theory-practice gap

Integrative literature review

Simulation

Web-based learning

Case-based learning

OPSOMMING

Die oorvloed van beskikbare literatuur wat oor die teorie-praktyk gaping, die oordrag van leer en die deurlopende navorsing vir beter onderrigmetodes van gesondheidsorgstudente handel, beklemtoon die feit dat daar ‘n opvoedkundige probleem bestaan. Die beste beskikbare bewyse rig die kliniese praktyk en opvoedkundiges in gesondheidsorg moet hul besluite baseer op die bewyse wat hul opvoedkundige strategieë ondersteun.

Die doel van die studie is om die opvoedkundige strategieë te identifiseer wat studente se kliniese oordeel bevorder deur ‘n volledige literatuuroorsig te doen van studies wat vanaf Januarie 2000 tot Oktober 2003 gepubliseer was.

Veelvuldige databasisse en soekmetodes is gebruik om studies te identifiseer wat aan die insluitingskriteria van ‘n volledige literatuuroorsig voldoen. Die soekstrategieë het 897 rekords opgelewer waarvan sewe vir kritiese waardering geïdentifiseer is volgens die vereistes van die insluitingskriteria. Drie navorsers het onafhanklik van mekaar die artikels volgens die gestandaardiseerde *CASP* en *QaulSyst* instrumente waardeer. Vier van die sewe studies is vir analise gebruik. Alhoewel ‘n omvattende oorsig vir kwalitatiewe studies voorsiening maak, was al vier studies gerandomiseerde toevallige kontrole studies.

Hierdie oorsig was nie daartoe in staat om onweerlegbare bewys te lewer van toepaslike opvoedkundige tegnieke wat kliniese oordeel bevorder nie. Al vier studies het verskil met betrekking tot steekproefgrootte, duur van studie, tipe van tussentrede en die instrumente wat gebruik is om die uitkomste te meet. Die vier studies het simulasie , geval- en webgebaseerde leer as opvoedkundige strategieë gebruik. Die opvoedkundige strategieë het die volgende ontwerpfaktore soos outentisiteit, aktiewe studentbetrokkenheid, samewerkende leer, leerder gesentreerdheid en stellasies van kognitiewe denke bevat. Dit voorsien ‘n gedeelde basis vir opvoedkundige strategieë wat leeroordrag en kliniese oordeel bevorder. Twee van die studies het aangetoon dat die opeenvolging van tussentredes ook kliniese oordeel bevorder het.

Weens die gebrekkige bewyse kan geen gevolgtrekkings gemaak word oor watter opvoedkundige strategieë kliniese oordeel bevorder nie. Nietemin, daar is bewyse wat voorstel dat hoë getrouheid-simulasie, geval-gebaseerde leer en web-gebaseerde leer die oordrag van leer kan bevorder.

Aanbevelings vir verdere navorsing sluit gestandaardiseerde meting van kliniese oordeel in en dat meer opvoedkundige strategieë se vermoë om oordrag van leer te bevorder, getoets moet word.

Kliniese oordeel

Opvoedkundige strategieë

Opvoedkundige ontwerpfaktore

Gesondheidsorg

Oordrag van leer

Teorie-praktykgaping

Volledige literatuuroorsig

Simulasie

Web-gebaseerde leer

Geval-gebaseerde leer

ACRONYMS

ACS	Acute Coronary Syndrome
CASP	Critical Appraisal Skills Programme
CBL	Case-based learning
eDerm	Web-based learning
HPS	Human patient simulation
OSCE	Objective structured Clinical Examination
PASW	Statistical software version 17.0
PBL	Problem-based learning
RCT	Randomised control trial
SIM	Simulator based learning
SPSS	Statistical software version 14.0
QualSyst	Critical appraisal tool

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CHAPTER 1
OVERVIEW OF THE RESEARCH STUDY

1.1. INTRODUCTION

Bok (cited in Groccia & Buskist, 2011: 6) indicates that there is no hard evidence that students learn more that they did 50 years ago irrespective of extensive educational services, educational technology, development of new curricula and extensive resources in education. Yet, research has indicated that education has an influence on patient mortality. Aiken, Clarke, Cheung, Sloane and Silber (2003: 1620) have adequately demonstrated the relationship between a well-educated workforce and mortality in healthcare. In addition, healthcare workers are accountable to the society that they serve (Fleet, Kirby, Cutler, Dunikowski, Nasmith & Shaughnessy, 2008: 15-16) and social accountability makes a well-educated healthcare workforce an absolute necessity. Technological advances have created a society that is aware of accountability and the informed public is demanding improved healthcare (Rich & Nugent, 2010: 230). More than 100 000 patients in United States hospitals die each year due to medical mistakes and patients visiting a medical practitioner receive the correct treatment only half of the time (Agency for Healthcare Research and Quality, 2007, Online). Medical practitioners and professional nurses responsible for statistics such as these practises in a first world country and the reality may be worse in countries with additional disease burdens.

The picture may be more forbidding in South Africa considering the disease burden and small workforce. Despite having a nurse-based healthcare system, South Africa has only 231 036 (2010) registered nurses for a population of 50 586 757 (Statistics South Africa, 2011: 6). They have to cope with a quadruple disease burden of HIV (17% of the global burden), AIDS and tuberculosis; high maternal mortality (38% are avoidable deaths); neonatal and child mortality (from 57/1 000 in 1990 to 67/1 000 in 2008) due to nutritional problems and infectious diseases; non-communicable diseases; violence and injuries (DFID Human Development Resource Centre, 2011: 5). The implication is that in South Africa the relatively small number of nurses

should be well trained and competent to manage huge patient burdens with multiple comorbidities. In order to meet the healthcare needs of society, healthcare professionals should be well trained and able to integrate theory in practice in order to make sound clinical judgement.

The plethora of literature available on the practice-theory gap, learning transfer and the continuous search for better methods of educating healthcare students emphasises the fact that the problem still needs addressing. Research by McCartney and Morin (2005: 406-412) indicates that the National League for Nursing called for curricular designs, educational strategies and evaluation methods based on research. Central to education is how to teach and what needs to be taught. Rich and Nugent (2010: 228) note that the actions taken by academia are most likely to have either a positive or a negative influence on the future and significance of nurses in healthcare. Educators can no longer use old techniques, but have to base their educational techniques on the best evidence. The success of both educators and students depends on knowledge concerning the science of education. The level of evidence will increase if more studies are performed to measure student transfer of learning and skills related to patient care outcomes (McCartney & Morin, 2005: 407-408). Almost a decade ago, McCartney and Morin (2005: 406-412) indicated that there were fewer educational researchers compared to clinical researchers. The situation has not improved since then.

Next, the problem statement and the paradigmatic perspective are discussed, followed by a short discussion on the methodology of the study. The chapter concludes with a discussion on rigour and related ethical aspects.

1.2. PROBLEM STATEMENT

The best available evidence informs clinical practice, and educators in healthcare should base educational decisions on the best evidence supporting educational strategies. Basing education on the best available evidence has several designations in the literature, one of which is ‘evidence-based teaching’. Evidence-based teaching is defined as “the conscientious, explicit, and judicious use of current best evidence in making decisions about education” (Stevens & Cassidy, cited in Patterson & McAleer Klein, 2012: 240). Despite a clear definition, there is a

shortage of empirical research demonstrating sufficient evidence to inform educational practice. Tacit, experimental or practical knowledge instead of empirical evidence is what nursing education is using to determine educational strategies (Patterson, 2009: 327-328, 332). There is little evidence on the kinds of teaching and learning strategies that would enable students to integrate theory and practice.

There is a global search for means to integrate students' theoretical knowledge into effective nursing practice (Chan, Chan & Liu, 2011: 1039). Billings and Kowalski (2006: 248) highlight the reality of the theory-practice gap and the detrimental effect it has on patient care and effective healthcare practice. Benner, Sutphen, Leonard and Day (2010: 1, 4, 5, 12, 15) argued that changes in education were needed because a significant gap was found between practice and the education for that practice. A change has taken place from an education-practice gap to a practice-education gap, demonstrating the inability of education to keep up with the rapidly changing, technological and research-directed practice of today (Benner *et al*., 2010: 1, 4, 5, 12, 15). Integration of theory and practice is important for outcome-based and competency-based education. Outcome-based and competency-based education measures the success of healthcare education according to clinical competence (Chan *et al*., 2011: 1039). Although it is true that theoretical knowledge is not necessarily reflected in clinical practice, it is also true that practitioners depend on the academics to provide a competent and skilled workforce that is able to render safe and effective patient care (Chan *et al*., 2011: 1039, 1044).

Lisko and O'Dell (2010: 107) contend that by ignoring the need to change educational strategies, educators are not meeting the current requirements for the education of nurses. Nursing programmes need to change in order to implement new educational strategies to facilitate and develop critical thinking and clinical judgement (Lisko & O'Dell, 2010: 108). The education and re-education of nurses are expensive investments that should produce acceptable dividends in translating theory into practice and are not limited to undergraduate nurses.

In a paper by the National Literacy Secretariat in Canada (nd: 4) it is argued that an annual expenditure of more than a hundred billion dollars leads to no more than 10% learning transfer in the work environment and that education does not have a sufficient effect in work application. Research indicated that only 15% of learning

transfer of content was retained one year after the learning intervention had taken place (Donovan & Darcy, 2011: 122). Organisations and workplace educational programmes experience the same problems of expenditure and insufficient transfer of learning. A point in case is that global investments are being made in continuous professional development (CPD) programmes with increasing questions being raised regarding the effectiveness of these programmes (Draper & Clark, 2007: 515-516). The researcher is unaware of evidence that traditional methods such as lectures improve learning transfer, practice or patient care, although an increase in knowledge does indeed take place.

The systemic model of learning transfer described by Donovan and Darcy (2011: 124) and Grossman and Salas (2011: 9) illustrates that student characteristics, educational strategies and transfer climate are three factors that will influence the system on which learning transfer is dependent. For example, the student characteristics refer to motivation and personality and the educational design refers to the actions undertaken in the educational programme and work requirements as well as the relationship between the two. The description of the learning transfer climate is, for example, a perceived positive climate that refers to provoking the student to use newly learned material and social support by supervisors (Donovan & Darcy, 2011: 123).

Grossman and Salas (2011: 104-106) state that student characteristics, educational strategies and transfer climate have a direct or indirect influence on educational output that will lead to long-term maintenance and generalisation of modified behaviour, culminating in permanent changes. The three above-mentioned factors have a direct influence on motivation to learn and transfer and an indirect influence on the individual and/or organisational performance, which is influenced, in turn, by the work environment. The work environment focuses on the opportunities of the student to practise and use the learned material and in turn influences the motivation to learn and transfer that which was learnt (Donovan & Darcy, 2011: 125). The researcher takes note of the inter-related aspects of the systemic model, such as student characteristics and the transfer climate and acknowledges that the context of these factors is important to the success of learning transfer (Donovan & Darcy, 2011: 123-124, 131). The research reported in this dissertation focussed on the educational design aspect of educational programmes in the systemic model.

According to Grossman and Salas (2011: 103), learning alone does not accomplish successful education, as effective transfer has to take place to ensure permanent cognitive and behavioural changes. The design of an educational programme should include the specific factors that have shown the most consistent and compelling relationships to transfer. Holton III (1996: 14) states that one of the reasons for unsuccessful transfer is the inability of the educational design to enable the successful transfer of learning. Grossman and Salas (2011: 111) confirm that the design of the education, as well as the delivery, has profound effects on learning and transfer outcomes. The transfer of learning should be the aim of any programme for professional education. The programme design should be of such a nature as to expedite transfer from theory to practice (Lauder, Sharkey & Booth, 2004: 43). Velada, Caetano, Michel, Lyons and Kavanagh (2007: 284) call it the transfer design and subsequently list educational strategies, principles of learning as well as self-management, relapse-prevention strategies and goal setting as factors that influence educational design.

Educators should base their teaching[1] on the most appropriate methods for students and be well informed of the optimal teaching practices (Patterson, 2009: 327). Student preferences regarding teaching strategies include the use of visual material and handouts before the class, experimental learning, case studies and role models (Robert, Pomarico & Nolan, 2011: 16). Preferences concerning teaching effectiveness included flexibility, clear communication accessibility, clear learning objectives and direct, constructive feedback (Robert *et al*., 2011: 16). Furthermore, the availability of the learning outcomes to the students directs their attention and action. When combined with the relevance of the educational content, transfer should improve (Burke & Hutchins, 2007: 273). While research by Blume, Ford, Baldwin and Huang (2010: 1092) indicated that goal setting (outcomes) had little effect on transfer, Biggs (2003: 1) found that obtaining the desired learning outcomes through aligned teaching activities might have more effect.

In an effort to promote theory-practice integration, the School of Nursing at the University of the Free State (henceforth referred to as the School of Nursing) strives to use teaching and learning strategies known to promote transfer of learning. The

[1] The term ‘teaching’ is used interchangeably with ‘facilitation of learning’.

School of Nursing implements active and ongoing research, such as the current research, to determine how to promote learning transfer in the undergraduate programmes, postgraduate programmes and CPD programmes offered by the Academy for Continuing Nursing Education. These programmes accommodate students who strive to attain learning transfer. It is essential and in the best interest of the students to determine how to obtain learning transfer results in all the programmes. Attaining learning transfer enables the students to demonstrate clinical judgement. However, the question that appears to remain unanswered in the literature is 'What is the best available evidence regarding educational strategies that will promote the clinical judgement of healthcare students?'

In conducting the study, the researcher was of the opinion that an integrative literature review may provide answers with regard to best evidence and educational strategies, especially since there is not a integrative literature research available in healthcare answering the question. An integrative literature review is the appropriate method to use, as it would provide the opportunity to review, analyse and synthesise the representative academic, peer-reviewed literature on learning transfer in educational strategies that are utilised in healthcare. The current study is positioned within the theory of learning transfer, specifically the learning transfer model as developed by Kontoghiorghes (2004: 212) and discussed by later researchers (Donovan & Darcy, 2011: 124-125). The model provides a systemic view of the most significant learning transfer factors, including educational strategies.

1.3. RESEARCH PURPOSE

The purpose of the study was to determine the educational strategies that promote clinical judgement of students in healthcare through an integrative review of the relevant literature published from January 2000 to October 2013. The elements of PICOT are reflected in the research question. Refer to Table 1.1.

Table 1. 1 Elements of the research question

PICOT COMPONENTS	RESEARCH ELEMENTS
P – Population of interest (participants, principle person or thing)	Students in healthcare
I – Intervention (therapy, treatment educational technique, issues of	Educational strategies

interest)	
C – Comparison (standard of operation, care, technique, placebo or no comparison)	No comparison
O – Outcome (results or final point)	Improved clinical judgement
T - Time	2000 - 2013

1.4. PARADIGMATIC PERSPECTIVE

A sociological perspective is to be used in conducting healthcare research as such studies are concerned with humanity. Mouton and Marais (1996: 7) define social science research as "a collaborative activity in which social reality is studied objectively with the aim of gaining a valid understanding of it". The worldview or paradigmatic perspective of the researcher influences research. Bruce, Klopper and Mellish, (2005: 39) use the definition of a paradigm supplied by Kuhn: "the set of practices that define a scientific discipline at any particular period of time". They add, "it is the way we view and analyse the world around us". A paradigm describes the elemental aspects of what is studied; this includes defining what is studied, the questions asked, how these questions should be asked and the rules that will be followed to interpret the findings (Botma, Greeff, Mulaudzi & Wright, 2010: 40). A paradigm provides the context within which the research will be conducted and has a determining influence on the research approach to be used by the researcher. A pragmatic perspective is applied.

Pragmatism is an approach whereby the value of actions, situations and consequences determines the knowledge obtained from the research. In a pragmatic approach, the appropriateness of the methodological decisions determines how the research question is answered and multiple methods can be used to obtain the data (Welford, Murphy & Casey, 2010: 42). The data collection and analysis methods chosen in a pragmatic perspective are the most likely to provide an answer to the research question. The pragmatic paradigm does not have a philosophical loyalty to any alternative paradigm (Mackenzie & Knipe, 2006: 198). The integrative literature review uses an analysis of the outcomes of primary studies to obtain answers applying both inductive and deductive logic. There are multiple

methods of analysing the studies, depending on the research question. 'Pragmatic' implies being sensible and following the most sensible method to obtain the data, concurring with the use of an integrative literature review. The most appropriate technique is selected from the full range of available techniques in order to answer the research question. As the integrative literature review is neither qualitative nor quantitative research, the pragmatic orientation rejects distinct methodological identities. Researchers are considered simply as researchers and when the term 'qualitative' or 'quantitative' is used, it refers to methods that generated either numerical or narrative data that are useful for particular purposes (Hammersley, 2013: Online).

A paradigm in human research reacts to basic philosophical questions and is characterised in those terms (Polit & Beck, 2012: 11). Ontological, epistemological and methodological perspectives (Brink, Van der Walt & Van Rensburg, 2012: 24) answer these questions. The researcher's views will be discussed from the pragmatic perspective.

1.4.1. ONTOLOGICAL PERSPECTIVE

The ontological perspective of social science research is concerned with aspects of social reality. Research always has an object, either empirical or non-empirical (Mouton & Marais, 1996: 8). Ontology is concerned with how the researcher views the world and the nature of reality. The researcher accepts the external reality with a real world orientation (Mackenzie & Knipe, 2006: 199) by looking towards that which works. The research focused on determining which educational strategies work with regard to clinical judgement as outcome measure.

1.4.2. EPISTOMOLOGICAL PERSPECTIVE

The word 'epistemology' is derived from the Greek word *episteme*, meaning true knowledge. Epistemology is the study of the nature of human knowledge. The epistemological dimension means that understanding of the phenomena must be valid and reliable, not just understandable (Mouton & Marais, 1996: 4, 8). Epistemology deals with the nature of knowledge, more specifically with the structure of knowledge as demonstrated in methods, theories, concepts, rules and procedures. It determines the rules and principles whereby research is conducted, where the researcher is impartial and objective in researching an objective reality

(Botma *et al*., 2010: 40, 46; Scotland, 2012: 10). From a pragmatism perspective, the epistemological question relates to both an objective and a subjective point of view. The research reported in this dissertation was concerned with the relationship between educational strategies and effective learning transfer, where clinical judgement is the measure of effectiveness as well as with the subjective experiences of students in the effective transfer of learning with clinical judgement as measurement. The researcher is inherently a pragmatist. The pragmatic value system allows the researcher to study what is of value and utilise the results to bring about positive consequences.

1.4.3. METHODOLOGICAL PERSPECTIVE

Defining objectivity in social science research implies being critical, balanced, unbiased, systematic and controllable. The methodological dimension of research includes viewing research as systematic and methodical while being critical and balanced in the process (Mouton & Marais, 1996: 8). The methodology is concerned with how to conduct the study and includes the rules and procedures directing the researcher. The pragmatic perspective in this study was concerned with real problems researched by the most appropriate method to initiate change in educational practice. By doing an integrative literature review, the researcher systematically reviewed and analysed primary research in order to derive new data and synthesise new findings. The researcher conducted secondary research using the outcomes of qualitative and quantitative research to synthesise the new data.

1.5. CONCEPT CLARIFICATION

Conceptual definitions are concepts with connotative meaning, for example comprehensive, abstract or theoretical, determined by concept analysis, derivation or synthesis. An operational definition is a description of the measurement or manipulation of concepts in a study (Burns & Grove, 2009: 693, 712).

The conceptual clarification is presented according to the order in the title and the research purpose. The order is as used in the study and is not alphabetically structured.

1.5.1. THE INTEGRATIVE LITERATURE REVIEW

The integrative literature review is a research method allowing inclusion of experimental and non-experimental research as well as theoretical and empirical literature to provide the broadest kind of review method. The purpose of an integrative literature review is to define concepts, review theories or evidence and analyse methodological issues of a topic (Whittemore & Knafl, 2005: 547-548).

1.5.2. EDUCATIONAL STRATEGIES

Educational strategies are the various approaches and techniques used to teach the practice of healthcare and achieve the desired outcome (Jacobs, Gawe & Vakalisa, 2000: 210; Mellish *et al.*, 2005: 97-98) so that students are able to make sound clinical judgements. In this dissertation, the concept 'educational strategy' is used throughout.

1.5.3. CLINICAL JUDGEMENT

Clinical judgement means the conclusion about the needs of the patient or the healthcare problems, the decision either to take action or not, and using or changing standardised approaches or improvising new approaches as seen fit according to the responses of the patient. Clinical judgement is the product of critical thinking and clinical reasoning that involves four steps: noticing, interpreting, responding and reflecting. The different types of knowledge used during the process include that which is abstract, generalisable and applicable in different situations (Tanner, 2006: 204-205, 208).

1.5.4. STUDENTS

According to the Oxford Dictionary (2014: Online) a student is a person studying at a university or other place of higher education or a person studying in order to enter a particular profession or who takes an interest in a particular subject. The study was concerned with students studying in the field of healthcare.

1.5.5. HEALTHCARE

The term 'healthcare' refers to the social organisational response to disease, disability and health risks that include all the disciplines in healthcare such as medicine, nursing and allied health professions (Van Rensburg, 2012: 1-2).

1.6. RESEARCH DESIGN AND METHOD

The study used an integrative literature review as method, with a descriptive design to obtain the best evidence regarding educational strategies that promote the clinical judgement of healthcare students. Despite a thorough perusal of the literature, the researcher did not find an integrative literature review of educational strategies in healthcare. However, research comparing two or more educational strategies in healthcare was available. A complete view of research done to date is possible by combining diverse methodologies in the integrative literature review. The evidence-based results inform academics with regard to educational strategies (Whittemore & Knafl, 2005: 547).

The diverse methodology incorporated in the primary studies provides the possibility of including all educational techniques used in healthcare education. The inclusion of both empirical and non-empirical research leads to a fuller understanding of the subject being researched (Whittemore & Knafl, 2005: 547; Torraco, 2005: 360). A discussion of the systematic literature identification, analysis, synthesis and reporting of the results according to the stages involved in an integrative literature review follows below.

1.6.1. STAGES OF THE INTEGRATIVE LITERATURE REVIEW

The researcher used the five stages identified in Whittemore and Knafl (2005: 548-551) of performing an integrative literature review. Each stage is described briefly in this chapter with more comprehensive description and discussion in subsequent chapters.

PROBLEM IDENTIFICATION STAGE

The researcher applied criteria (Whittemore & Knafl, 2005: 548) for a clear problem statement including the variables, concepts, target population, the perceived problem in healthcare as well as the sampling framework. The purpose of the study was to identify primary studies published from 2000 to 2013 in order to determine educational strategies that promote clinical judgement in healthcare students. The identification of such strategies will provide direction to future education of students.

LITERATURE SEARCH STAGE

During the literature search stage, the researcher used different methods to obtain relevant results, including electronic searches, hand searches and ancestor searches. The ideal is to obtain all relevant literature. Search strings were developed in collaboration with the study supervisor and librarian in order to identify the maximum amount of appropriate literature. The search terms and inclusion and exclusion criteria direct the search in the databases used (Whittemore & Knafl, 2005: 548-549).

DATA EVALUATION STAGE

Quality evaluation of the literature is a difficult process as there is no gold standard to facilitate the process. The researcher, in consultation with the supervisor, chose Critical Appraisal Skills Programme (CASP) instruments to analyse the included literature critically. A different instrument for each of the different types of methodology was used (Whittemore & Knafl, 2005: 549). Quality scores obtained from the QualSyst instruments obtained from Kmet, Lee and Cook (2004: 4-5) were used to score the critical appraisal of the literature. Three researchers, namely, the supervisor, a senior researcher at the School of Nursing and the student as the primary researcher, used the critical appraisal forms and scoring system.

DATA ANALYSIS STAGE

During the data analysis stage, data are ordered, coded, categorised and summarised to obtain an integrated conclusion. The data reduction, data display, data comparison and the drawing of conclusions and verification are included in the data analysis stage (Whittemore & Knafl, 2005: 550-551).

PRESENTATION/ SYNTHESIS STAGE

The presentation phase of the literature review calls for a logical chain of evidence to support the conclusions. The results should capture the depth and breadth of the topic and contribute new insights (Whittemore & Knafl, 2005: 552).

1.7. METHODOLOGICAL RIGOUR

Rigour is defined as the endeavour to apply accuracy and consistency in a research design providing a measure of quality (Moule & Goodman, 2009: 393) and includes validity that refers to the influence of the design and interpretation of the conclusions

drawn from the study. Internal or external threats to validity exist. Internal threats involve the research design, content validity, data gathering and analysis. External validity refers to the generalisability of the results to other populations (Botma *et al*., 2010: 174-177). The use and writing of a protocol minimises bias as the researcher states the methods a priori without prior knowledge of the results (Tricco, Tetzlaff, Sampson, Fergussen, Cogo, Horsley & Moher, 2008: 422).

The methodological strategies proposed by Whittemore and Knafl (2005: 546-551) provide directions on the methodological rigour of the integrative literature review. The use of systematic and explicit methods reduces the possibility of error. Possible problems that can occur include an incomplete literature stage and incorrect or incomplete data extraction and interpretation. During synthesis, combining diverse methodologies may contribute to a lack of rigour (Whittemore & Knafl, 2005: 547). A more detailed discussion involving all five stages follows in subsequent chapters. Table 1.2 provides a summary by Whittemore (2005: 61) on stages where quality observation is needed. The researcher endevoured to adhere to the quality criteria proposed by Whittemore (2005: 61) as listed in Table 1.2.

Table 1. 2 Quality criteria in research reviews as adapted from Whittemore (2005: 61)

Quality criteria in research reviews
1. Well-defined problem and review purpose
2. Explicit identification of review method
3. Investigators with expertise in content and methodology
4. Clear specification of review process and protocol
5. Comprehensive and explicit literature search
6. Explicit, unbiased and reproducible data extraction for content and quality
7. Primary study quality considered in analysis
8. Data analysis is systematic and variability of findings addressed
9. Evidence included from primary studies

10. Conclusions based on evidence and capturing complexity of problem 11. Methodological limitations identified

1.8. ETHICAL CONCERNS

The three primary ethical principles of beneficence, respect for human dignity and justice are not directly applicable to an integrative literature review. The research presented in this dissertation formed part of a larger research project and approval for the research was obtained from the Ethics Committee of the University of the Free State (Botma *et al*., 2010: 4-16).

A well-planned and executed research design to provide relevant results is an ethical obligation. The goal of research is to add informational value to the discipline by using a rigorous methodology (Bless, Higson-Smith & Kagee, 2011: 145). Benefits from the study are that informational value is added to the educational discipline and risks entail obtaining biased results by not following rigorous and ethical guidelines (Bruce *et al*., 2011: 386). Collaboration with the supervisors and repeatedly accessing the literature provides the necessary guidelines.

Scrupulous documentation of the research process to ensure repeatability of the research translates to auditability, described as the meticulous development of a decision trail (Burns & Grove, 2009: 612). Repeatability becomes possible through scrupulous documentation in the thesis of the sampling procedures, analysis and synthesis, thereby creating a decision trail.

Researchers are responsible for the conduct, reporting and publication of the research and results, thereby taking responsibility for the integrity of the research protocols, results and publications (Burns & Grove, 2009: 213).

Research conducted with integrity and ethical responsibility requires honesty, accuracy and competence from the researcher (Brink *et al*., 2012: 43). The implication is that the research must be conducted with scientific integrity (Burns & Grove, 2009: 212). Fabrication and falsification of data constitute misconduct. The researcher must be committed to executing the study with scientific integrity, professionalism, ethical and moral conduct and truthfulness.

Plagiarism constitutes representation of the work of others as one's own work. The reference list and in-text references assign the credit to sources used in the study (Brink *et al*., 2012: 44). The researcher endeavours to respect the intellectual property of others through the correct use of references and to avoid plagiarism (Botma *et al.*, 2010: 277).

1.9. CHAPTER LAYOUT

A chapter layout is provided in Table 1.3 to serve as a guide to the following chapters.

Table 1. 3 Chapter layout

Chapters	Brief description	Addendums
CHAPTER1 **Overview of the research study**	The chapter provides the formulation of the research question according to the PICOT format followed by a background and problem statement. The paradigmatic perspective is followed by the methodological rigour and the chapter concludes with the ethical issues.	None
CHAPTER 2 **Conceptual framework**	The framework contains information on evidence-based practice, the theory-practice gap, learning transfer and the transfer manifestations.	None
CHAPTER 3 **Methodology**	The actualisation of the research is recorded. The stages of the integrative literature review include: - Research question and PICOT - Literature search stage - Data evaluation stage	Addendum A: CASP critical appraisal tools Addendum B: QualSyst appraisal tools Addendum C: Manual for quality scoring of the studies Addendum D: Critical appraisal

		of quantitative studies
CHAPTER 4 **Analysis and synthesis**	Analysis stage Synthesis stage	Addendum E: Complete matrix of samples
CHAPTER 5 **Conclusion**	Limitations, recommendations and conclusions	None

1.10. SUMMARY

This opening chapter introduced the reader to the study. The introduction and problem statement explained the aim of the study and the paradigmatic perspective elucidated the view of the researcher. A brief explanation on the methodology followed by a discussion on rigour and ethics concluded the chapter. The following chapter provides a discussion on the conceptual framework of the research.

CHAPTER 2.
CONCEPTUAL FRAMEWORK

2.1. INTRODUCTION

This chapter provides a short overview of the theoretical aspects that are important to the literature review. The discussion includes the learning transfer model, the theory-practice gap and educational strategies and it concludes with the learning transfer manifestations. The concepts discussed in the transfer manifestations are used interchangeably in the literature and delineating the terms in the current chapter guided the selection of studies described in Chapter 3.

2.2. CONCEPTUAL FRAMEWORK

A conceptual framework is a broad understanding of the phenomena under study. It represents the assumptions and philosophical views of the researcher. According to Botma *et al*. (2010: 271), "Conceptual frameworks are less formal attempts for organising phenomena than theories." Although this chapter is a conceptual framework, the researcher did not attempt to represent personal assumptions and philosophical views, even though it is impossible to exclude all subjectivity completely. The researcher has tried to represent the literature as faithfully as possible. A discussion on relevant aspects provides a better understanding of the scope of the study.

2.3. LEARNING TRANSFER

As stated earlier, the effectiveness of the process of learning is measured by the utilisation and application of the knowledge and skills acquired by the student. Knowledge therefore transfers from the cognitive domain to an application in a specific setting. Blume *et al*. (2010: 1067) define transfer as consisting of two major dimensions: the first is generalisation, which means the extent to which the knowledge and skill acquired in the learning environment are applied to different settings, people, and/or situations. The second is maintenance, which is the extent to which changes that result from a learning experience persist over time.

Therefore, it was, deemed essential to investigate the theoretical aspects of learning transfer and the constructs associated with it. The transfer of learning that has taken place measures the effectiveness of learning, teaching methods and motivational aspects, in this case the application learning as demonstrated through clinical judgement.

2.3.1. SYSTEMIC LEARNING TRANSFER MODEL

Originally, development of the learning transfer model was for use in human resource development (Donovan & Darcy, 2011: 122). The same model can be adapted and utilised in higher education institutions. The ultimate objective of any education is the transfer of learning to improve an individual or organisation's performance; if performance is not improved, education has little or no value (Donovan & Darcy, 2011: 123; Kontoghiorghes, 2004: 213). Transfer is the maintenance and generalisation of knowledge and skills to new situations (Subedi, 2004: 591). The learning transfer systems model is based on the research conducted into the elements that can influence transfer of learning to the work environment. The initial evaluation model by Kirkpatrick in 1976, although still used widely, was criticised for focusing on outcomes and did not account for variables that could influence the outcomes (Holton III, 1996: 6-7). Later research introduced context with regard to climate and system and a systemic model of learning transfer was subsequently developed. The systemic model improved on the traditional model of learning transfer by viewing education as a systemic factor instead of a non-systemic one. Variables that influence the student and organisational performance were incorporated into the system (Baldwin & Ford, 1988: 65; Kontoghiorghes, 2004: 211-214). The systemic model of learning transfer is depicted in Figure 2.1.

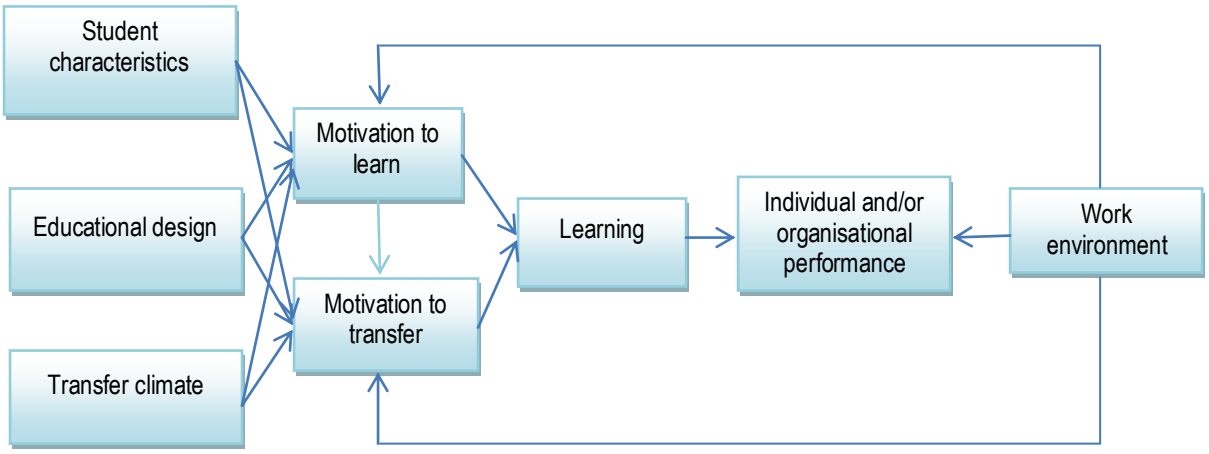

Figure 2. 1 The adapted systemic model of learning transfer (Donovan & Darcy, 2011: 125)

As can be seen in Figure 2.1, the systemic model of learning transfer consists of the students' characteristics, the educational design and the learning transfer climate. The students' characteristics include ability, personality and motivation. The educational design includes principles of learning, sequencing and educational content. The transfer climate includes support by supervisors and co-workers, task cues, job and career utilities, educational accountability, opportunity to use what has been learnt, as well as intrinsic and extrinsic rewards for the use of new knowledge. Holton III, Bates and Ruona (2000: 335) describe the transfer climate as a "mediating variable in the relationship between organisational context and an individual's job attitudes and work behaviour". Although the focus of the research was not the students' characteristics or the transfer climate, these factors are noteworthy as they influence learning transfer. All three of these have a direct influence on motivation to learn and motivation to transfer and both of these have a direct influence on learning transfer. The individual and/or organisational performances are the evidence or indicators of learning transfer. The students' characteristics, the educational design and the learning transfer climate therefore have a direct influence on the transfer of learning (Baldwin & Ford, 1988: 65-66). The work environment has a direct influence on individual and organisational performance and an indirect influence on motivation to learn and transfer of learning (Kontoghiorghes, 2004: 211-214). The model validates the systemic nature of learning transfer, confirming the findings and indicating the importance of the work

environment as an incentive to the transfer of learning. Kontoghiorghes (2004: 218-219) concludes his findings by indicating that transfer cannot be studied in isolation.

To summarise, learning transfer occurs within a specific system where each factor in the system influences the transfer of learning. Optimal transfer of learning improves the performance of both the individual and the organisation (Donovan & Darcy, 2011: 122; Kontoghiorghes, 2004: 213; Yamnill & McLean, 2001: 196) through the application, maintenance and generalisation of newly acquired knowledge and skills (Cheng & Hampson, 2008: 328; Grossman & Salas, 2011: 104; Holton III *et al*., 2000: 334; Holton III, Bates, Bookter & Yamkovenko, 2007: 389). According to Grossman and Salas (2011: 104), the difference between learning outcomes and demonstrated behavioural change in the workplace is an indication of the gap between learning and organisational outcomes and correlates with the description in the nursing literature of the theory-practice gap.

2.4. THEORY-PRACTICE GAP

Carson and Carnwell (2007: 221, 225) state that narrowing the theory-practice gap of students has become a universal concern. One of their findings indicated an imbalance between the idealism of theory and the reality of practice as a reason for sustaining the gap. Similarly, Scully (2011: 93-94) speaks of the mismatch between textbook descriptions of clinical situations and the reality of clinical practice. Scholarly literature attributes the gap to distancing theoretical knowledge from the clinical situation. Different methods are discussed in the literature concerning reducing the theory-practice gap, such as the use of learning synergy and community of practice to enhance closer collaboration between lecturers and clinical specialists (Chan *et al*., 2011: 1039). Some researchers advocate reflection as a method to bridge theory and practice (Hatlevik, 2012: 870, 876), the lecturer practitioner's role in working with students, and mentors to guide students in bridging the gap (Carson & Carnwell, 2007: 228). Evans, Guile, Harris and Allen (2010: 246) strive to reconceptualise knowledge by "successfully moving knowledge from disciplines and workplaces into a curriculum, from a curriculum into successful pedagogic strategies and learner/employee engagement in educational institutions and workplaces". Benner *et al*. (2010: 30-31, 39, 65, 69-70), indicate that the divide between classroom and clinical practice must be reduced and integrated. In

addition, there is a call for new educational strategies that will enable students to use their knowledge by using theoretical content that articulates within the clinical practice. Benner *et al*. (2010: 64-65) are of the opinion that pedagogical strategies that integrate clinical experiences in the classroom will increase critical thinking. Conversely, standardised lectures, presenting knowledge as organised and categorised information do not support critical thinking and clinical reasoning (Benner *et al*., 2010: 64-65).

Different perspectives on and solutions to the theory-practice gap exist. The current study turns to educational strategies for effective transfer of theory into practice through individual performance as demonstrated by clinical judgement. In referring to the theory-practice issue, Chan *et al*. (2011: 1039) explain it as how students "acquire their learning in class, based on the pedagogies adopted by academics and practitioners, and their use of the theoretical knowledge in practice".

2.5. EDUCATIONAL STRATEGIES

Educators know numerous educational strategies. It is not within the scope of the study to discuss all the strategies, but it was necessary to determine which of those strategies are associated with transfer of learning in the context of healthcare. Educational strategies are the various approaches and techniques that educators use to teach the science and art of healthcare. The educator chooses the most appropriate strategy to attain the learning outcomes, thereby reducing the theory-practice gap (Jacobs *et al*., 2000: 210; Mellish *et al*., 2005: 97-98). Velada *et al*. (2007: 283) view an effective teaching and learning design as an enabling factor for the transfer of learning and they concur with Holton III *et al*. (2000: 345) that the transfer design refers to the degree to which education has been designed and delivered (Velada *et al*., 2007: 284). Education should be designed in such a manner that it provides students with the ability to transfer learning to the job. Transfer designs also provide educational instructions to match job requirements.

There is a continuous call for change in teaching interventions or strategies, as continued dissatisfaction exists because students do not attain the set outcomes and fail to transfer learning or apply their knowledge. At the same time, organisations' demand for critical thinkers is increasing (Hung, 2013: 27). Additional research is

necessary to determine what particular forms of teaching are most effective with specific students in specific situations with specific subject matter (Fink, Ambrose & Wheeler, 2005: 192). In view of the lack of empirical evidence, the question arises whether the current educational strategies in healthcare, especially nursing, employ transfer-linked practices (Patterson, 2009: 332).

2.6. TRANSFER MANIFESTATIONS

Holton III (1996: 9) describes three outcome measures of learning transfer, namely learning, individual performance and organisational results, where learning results in a change in the individual's performance that is reflected in organisational results. The expectation of education is that the changed behaviour of the student reflects the knowledge gained. In healthcare, the expectations are in the demonstration of critical thinking and clinical reasoning culminating in clinical judgement. Without the specific type of demonstrated change in behaviour, optimal patient care will not be possible (Victor-Chmil, 2013: 34).

Although the terms 'critical thinking', 'clinical reasoning' and 'clinical judgement' are used interchangeably in the literature, differences exist between these interrelated aspects (Rural Connection Inc, 2007: 73; Victor-Chmil, 2013: 34). Furthermore, the three processes are necessary for competent healthcare practice. In the following subsections each of the concepts, the knowledge levels required for each of the concepts and the imbedded knowledge levels necessary to ensure the optimal outcomes in healthcare are discussed and also demonstrated in Table 2.1 and Figure 2.2. Careful consideration had to be given to the literature on critical thinking, clinical reasoning and clinical judgement due to the interchangeable use of the concepts and their interrelatedness. Consequently, available concept analyses are discussed in more detail. The researcher concluded that the interrelated process of the three concepts might explain the interchangeable use of the concepts, especially with regard to advanced students.

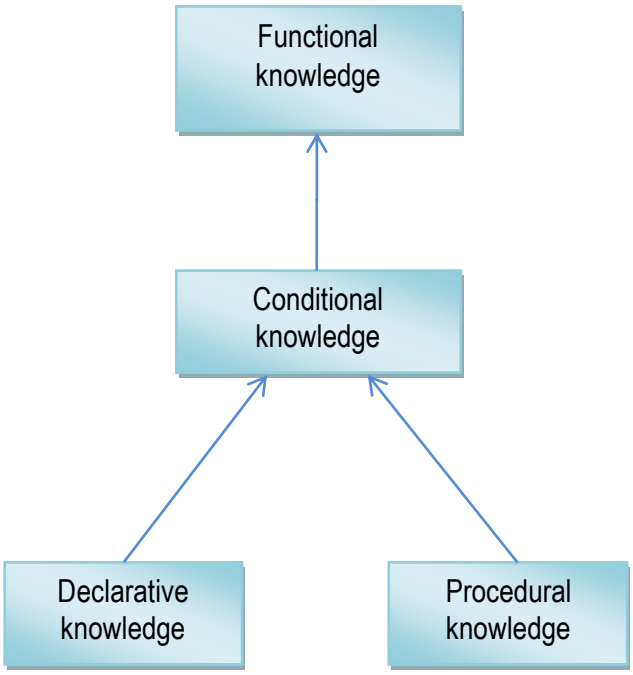

Figure 2. 2 The relationships between the different kinds of knowledge (Pascoe & Singh, 2008: 94)

Table 2. 1 The relationship between the different types of knowledge, critical thinking, clinical reasoning and clinical judgement

KINDS OF KNOWLEDGE	APPLICATION	CONCEPTS
Declarative and procedural knowledge	Link theoretical knowledge from different disciplines It is a cognitive theoretical exercise linking theory	Critical thinking
Conditional knowledge	Context-specific – taking context specifics into consideration (making a diagnosis)	Clinical reasoning
Functional knowledge	Plan and implement best possible management of the patient	Clinical judgement
Metacognition	Evaluate thinking and reasoning processes through reflection	Metacognition

2.6.1. CRITICAL THINKING

The American Association of Colleges of Nurses describes critical thinking as underlying independent and interdependent decision-making that includes "questioning, analysis, synthesis, interpretation, inference, inductive and deductive reasoning, intuition, application, and creativity" (Benner, Hughes & Sutphen, 2008: 1/87). A concept analysis provides a better understanding of critical thinking.

In concept analysis, antecedents imply situations that occur before the occurrence of the concept and consequences are the result of the occurrence of the concept, while attributes provide characteristics of the concept. In critical thinking, the only antecedent appearing in the sources used in the concept analysis is knowledge-based (Turner, 2005: 276). Consequences for critical thinking include safe, competent, skilful practitioners, competent practice and successful practice, implementing changing and challenging care, philosophies, improved decision-making, clinical judgement, problem solving and ethical moral issues. The attributes of critical thinking showed little replication in the literature and included reasoning, interpretation, knowledge, open-mindedness and inference (the result of drawing a conclusion). Turner (2005: 277) concludes the concept analysis of critical thinking by indicating that no clear boundaries exist for terms such as 'critical thinking', 'problem solving', 'clinical decision-making', 'diagnostic reasoning', 'clinical judgement' or 'nursing process' and suggests a comparative analysis of critical thinking, diagnostic reasoning (surrogate term for clinical reasoning) and clinical judgement. When taking the antecedents and consequences into consideration, it is obvious that a well-founded knowledge base is required for critical thinking. The consequences of critical thinking as a concept indicate critical thinking as a precursor to clinical reasoning and clinical judgement.

Victor-Chmil (2013: 34) describes critical thinking as the cognitive processes used to analyse knowledge. It is knowledge-based and not dependent on the situation. Critical thinking is based on the knowledge about the subject situated in evidence and science rather than assumptions and conjectures. Fink *et al*. (2005: 187), Pascoe and Singh (2008: 94) and Weinstein, Acee and Jung (2011: 49) explain declarative knowledge as knowing what or knowing about and the basic definition of

a strategy regarding the content of knowledge. Procedural knowledge can be explained as knowing how to use the knowledge. Walsh (2007: 81) considers declarative and procedural knowledge as the relevant knowledge base (foundational knowledge). Pascoe and Singh (2008: 94) indicate that in the relationship between the different types of knowledge, both declarative and procedural knowledge are required to reach the next level of conditional knowledge (Refer to Figure 2.2 and Table 2.1).

Critical thinking is central to the healthcare curriculum and the way it is defined will determine how it is taught (Benner *et al*., 2008: 1/88). Knowledge integration, skills and attitude (affective tendency) form the basis of critical thinking. Regarded as a cognitive process, critical thinking is the ability to analyse and evaluate a problem and to generate solutions. Discipline-specific knowledge underpins critical thinking as a transferable skill (Banning, 2006: 461). Critical thinking is not an independent, self-taught process. Healthcare education should provide safe learning environments for students to learn and apply critical thinking (Dickieson, Carter & Walsh, 2008: 1). Benner *et al*. (2008: 1/88) emphasise that students should be able to discern between critical thinking and clinical reasoning.

2.6.2. CLINICAL REASONING

Tanner (2006: 204-205) explains clinical reasoning as follows:

> [It] refers to the processes by which nurses and other clinicians make their judgements, and includes both the deliberate process of generating alternatives, weighing them against the evidence, and choosing the most appropriate, and those patterns that might be characterised as engaged, practical reasoning (e.g. recognition of a pattern, an intuitive clinical grasp, a response without evident forethought).

In the concept analysis of clinical reasoning the antecedents that were found are cognitive perception, tacit or explicit knowledge, cues, perceived need for action, discipline-specific knowledge, experience, long- and short-term memory and formal/informal education. The consequences are choice, cognitive awareness of additional cues, evaluation of alternatives, decision, implied action, judgement and inference. The attributes of clinical reasoning include analysis, deliberation, heuristics, inference, metacognition, logic, cognition, information procession and

intuition (Simmons, 2010: 1155). If the antecedents and consequences are taken into consideration, it is obvious that a well-founded knowledge base involving discipline-specific information and education (critical thinking) is needed. The consequences of the concept involve choice, cognitive awareness of additional cues, evaluation of alternatives, decision-making, implied action and judgement, thus moving the process towards clinical judgement. Simmons (2010: 1156) concludes the concept analysis of clinical reasoning by indicating that the term is not clearly defined in the literature consulted since it is used synonymously with terms such as decision-making and clinical judgement. Through the concept analysis, a distinction can be made between clinical reasoning and clinical judgement. In discussing the relationship between critical thinking and clinical reasoning, Simmons (2010: 1154) states that clinical reasoning is a broader concept relating to particular dispositions, skills and mental habits.

Critical thinking and clinical reasoning form part of a cognitive process to further knowledge where critical thinking underpins sound clinical reasoning (Alfaro-LeFevre, 2013: 70; Benner *et al*., 2008: 1/89; Facione & Facione, 2008: 1; Rhodes & Curran, 2005: 257). Cognitive and metacognitive processes are used in clinical reasoning with regard to a clinical situation or patient (Victor-Chmil, 2013: 34). Defining patient problems and determining the best interventions to reach positive patient outcomes trigger cognitive processes known as clinical reasoning (Chang, Chang, Kuo, Yang & Chou, 2011: 3225). To summarise the above, it can be said that clinical reasoning is context-dependent and domain-specific (Simmons, 2010: 1154-1155; Kopp, Stark, Kühne-Eversmann and Fischer, 2009: 1211). From a nursing perspective, it incorporates knowledge unique to nursing within a specific practice setting with accurate diagnosis of disease as the goal of clinical reasoning (Simmons, 2010: 1153). Conditional knowledge is defined as knowing the conditions under which to use knowledge (Beyer, 2008: 224; Pascoe & Singh, 2008: 94; Weinstein *et al*., 2011: 49) as applicable during the use of clinical reasoning. Kopp *et al*. (2009: 1211) describe conditional knowledge as knowledge about the conditions of application of conceptual and strategic knowledge, which implies the knowledge behind diagnostic decisions and procedures. The Performance Based Development System demonstrated that although nurses had content knowledge and procedural skills, adequate response to clinical situations did not realise due to a

lack of clinical reasoning (Levett-Jones, Hoffman, Bourgeois, Kenny, Dempsey, Hickey, Hunter, Jeong, Norton, Roche, Arthur, Lapkin, & Jeffrey, 2009: 3-4).

Clinical reasoning requires a determined, active engagement in deliberate practice and reflection to improve clinical performance (Levett-Jones *et al.*, 2009: 4). According to Rhodes and Curran (2005: 257), critical thinking and clinical reasoning are used for sound clinical judgement in order to reach valid conclusions and to act appropriately on the conclusions.

2.6.3. CLINICAL JUDGEMENT

Clinical judgement is defined as "an interpretation or conclusion about a patient's needs, concerns, or health problems, and/ or the decision to take action (or not), use or modify standard approaches, or improvise new ones as deemed appropriate by the patient's response" (Tanner, 2006: 204). Clinical judgement is necessary in clinical situations that are underdetermined, indistinct or that can have conflicts of values with competing interests (Tanner, 2006: 204).

In the concept analysis of clinical judgement, the following antecedents were found: a sound knowledge base, analytical reasoning skills, creativity and inquisitiveness, persistence, awareness of patient and self, and sound judgement skills. The consequences are outcomes. The attributes are an appropriate response with regard to a holistic view of the patient, process orientation, reasoning, interpretation and reflection (Collin Higher Education Center, 2014: Online). The consequences stated as outcomes include effective patient outcomes, evidence-based nursing and an effective nurse-patient relationship. By examining the antecedents and consequences, the sound knowledge base refers to critical thinking and the analytical reasoning skills refer to clinical reasoning. Rhodes and Curran (2005: 257) confirm this by stating that clinical judgement is the outcome of clinical reasoning. Clinical judgement is the result of critical thinking and clinical reasoning (Alfaro-LeFevre, 2013: 70). Clinical judgement involves decision-making with regard to significant information and knowledge, and application thereof to complete healthcare activities. Critical thinking and clinical reasoning therefore culminate in clinical judgement.

In the definition of clinical judgement, taking action or not and using standard approaches or improvising according to the patient's response are indicative of the

requirement of the healthcare professional to act. The healthcare professional has to act with regard to a holistic view of the patient in context, taking into consideration the pathophysiology, diagnostic and disease aspects, including the social, emotional, physical and family contexts (Tanner, 2006: 205). The healthcare professional should use critical thinking to notice the relevant factors in each specific context and clinical reasoning to come to a decision through clinical judgement and should furthermore act in an appropriate manner. Being able to perform a procedure or a skill does not indicate that the healthcare professional understands the need, applicability or implication for the procedure. Clinical judgement is essential to all healthcare professions (Phaneuf, 2008: 3) and development of this essential competence starts at student level.

Novices are capable of making clinical judgements, although difficulty is experienced and the judgement is analytical by nature. Clinical judgement is a critical skill and essential to education (Phaneuf, 2008: 3-4, 6). All students in healthcare should be able to demonstrate clinical judgement that will become increasingly easier as the student develops. It is a continuous process where outcomes from judgements made will inform further critical thinking and reasoning. Critical thinking or clinical reasoning by itself is not enough; a continuous evolvement of thinking processes, actions and evaluations on outcomes within a specific context is necessary to develop a competent professional. The alternative, a deficit in ability to analyse a problem, evaluate results or behave without reflecting and care delivery without evaluating the effect, is not a desirable standard of practice (Facione & Facione, 2008: 1). Healthcare professionals who are able to make sound clinical judgements are deemed competent.

The Nursing Education Stakeholders (NES) Group (2012: 50) defines competency within the context of theory and practice integration as follows:

> [It is] the ability to integrate knowledge from all disciplines in order to identify the problem, understand the theory related to the problem, as well as the appropriate response, treatment and care of the patient. All the integrated knowledge should then be applied in a practical event or situation in a real-life or simulation.

The safety and care of patients are closely associated with competency and researchers are divided as to how it is understood: theory-based versus practice-based (Axley, 2008: 214). The term 'competency' as used in education describes the educational standards of outcomes. It is more than just being skilled, as other difficult to measure attributes are involved, such as attitudes, interpretive ability and motives. Antecedents that help to define competence include that the required educational knowledge is acquired, that the behavioural or standards of action relate to the educational theory and that accountability and responsibility for knowledge and actions must be evident (Axley, 2008: 220). Consequences are described as the events or incidents resulting from the occurrence of a concept; therein lies the importance of competency, because incompetence results in medical errors and unacceptable patient outcomes (Axley, 2008: 217-220).

In order to develop critical thinking, clinical reasoning and clinical judgement to fit the complex role of healthcare professionals, it is necessary to look to appropriate educational strategies (Lisko & O'Dell, 2010: 108; Pascoe & Singh, 2008: 94).

2.7. SUMMARY

In this chapter, the conceptual framework provided a relatively linear line of thought from learning to the manifestations of learning transfer. The model of learning transfer and the relationship to the theory-practice gap provided the basis of the discussion on educational techniques. The chapter concluded with the transfer manifestations, namely critical thinking, clinical reasoning and clinical judgement.

The following chapter delineates the process followed in the methodology according to the steps of an integrative literature review.

CHAPTER 3
METHODOLOGY

3.1. INTRODUCTION

This chapter outlines the methodical stages and provides an overview of the realisation of the integrative literature review as conducted according to the stages of such a study. Stage 1 incorporates the research question identification; Stage 2 deals with the literature search and Stage 3 is the data evaluation phase. The rigour of all the stages of the integrative review is addressed in detail at the end of the chapter. The data analysis and conclusions are discussed in subsequent chapters.

3.2. INTEGRATIVE LITERATURE REVIEW METHOD

An integrative literature review is a research method that reviews, integrates, analyses and synthetises mature or new topics of representative literature. A number of researchers consider it the "most comprehensive methodological approach of reviews" (De Sousa, Da Silva & De Carvalho, 2010: 103; Torraco, 2005: 356). An integrative literature review as a research design provides a condensed view on previous empirical and/or theoretical research (De Sousa *et al*., 2010: 103; Whittemore, 2005: 57; Whittemore & Knafl, 2005: 546), which allows the researcher to obtain a comprehensive understanding of a specific problem. The purpose of an integrative literature review is to define concepts, to review theories, to find evidence and to analyse methodological problems (De Sousa *et al*., 2010: 103; Whittemore & Knafl, 2005: 547-548). The purpose of the study was to find evidence as to which educational strategies promote transfer of learning as evidenced by sound clinical judgement. An integrative literature review as method was decided on to provide as comprehensive a review as possible in order to use the outcomes as guidelines for the implementation of learning programs.

Furthermore, an integrative literature review incorporates research studies based on combinations of methodologies, such as experimental and non-experimental research designs. Combining different types of methodologies in the research can increase the depth and scope of conclusions reached (Whittemore, 2005: 57;

Whittemore & Knafl, 2005: 547). These authors state that if the integrative literature review includes an explicit theoretical or philosophical perspective providing focus within a broad and diverse sampling frame, the review will not be a purely descriptive study.

The method used in analysing peer-reviewed literature allowed a new understanding of previously conducted primary research in educational strategies and, as a mature topic, the role played in learning transfer. The direct and indirect influences of educational strategies on clinical practice prompted the use of the integrative review method in search of new understanding regarding the educational strategies used in healthcare. An integrative review as methodology allows the examination of different types of educational techniques and prevents possible erroneous focus on a single technique.

De Sousa *et al*. (2010: 102) conducted an integrative review to discuss the phases and methodology of integrative reviews as research methodology. In the review, with only five articles identified, De Sousa *et al*. (2010: 102) remarked on the scarcity of articles on integrative reviews. The articles included in the review were used as guidelines in this chapter. Exclusion of one article took place based on language and a second due to inability to obtain the article. The remaining articles, specifically those of Whittemore and Knafl (2005: 546-553), formed the basis of the methodology used. The publication dates of all three fall outside the directives for use of literature in a research study, but as the integrative review by De Sousa *et al*. (2010: 103) indicates, there is a scarcity of such articles. Adherence to standardised methods reinforces integrative reviews because it enhances rigour and quality (Emeis, 2012: 275).

3.3. STAGES OF AN INTEGRATIVE LITERATURE REVIEW

Common descriptors of a secondary literature search include sampling criteria, the inclusion and exclusion criteria, search terms, the databases used and search strategies (Russell, 2005: 11; De Sousa *et al*., 2010: 104; Whittemore & Knafl, 2005: 548; Whittemore, 2005: 59). Each of these descriptors will be discussed in detail in the sections that follow. The researcher adhered to the stages of the integrative review methodology as delineated by Whittemore and Knafl (2005: 548-551).

3.3.1. PROBLEM IDENTIFICATION STAGE

According to Whittemore and Knafl (2005: 548), the wide range of data, infinite number of variables, as well as issues or populations contained in a literature review makes the clarity of the research purpose important.

The review question was conceptualised and approved with the assistance of the supervisor. Implementation of the PICOT format ensured a focused question. PICOT reflects the elements of the research question and is a proven pedagogical model (Academy of Nutrition and Dietetics, 2012: Online; Welty, Hofstetter, & Schulte, 2012: 476-477). Refer to Table 1.1 for the elements of PICOT as applied to the research question.

The researcher formulated the review question in the following way: What is the best evidence available from 2000 to 2013 regarding educational strategies that will promote clinical judgement of healthcare students?

3.3.2. LITERATURE SEARCH STAGE

Although there are definite methodological differences between systematic reviews, meta-analysis and integrative reviews, no discernible differences were found in the limited descriptions of the data search stage (Cronin, Ryan & Coughlan, 2008: 39-40; Russell, 2005: 10-11; De Sousa *et al*., 2010: 103-104; Torraco, 2005: 360-361; Whittemore, 2005: 58-59; Whittemore & Knafl, 2005: 548-549). The researcher conducted electronic and ancestor searches, and accessed the personal databases of the Faculty of Health Sciences. Each search strategy is discussed in detail below.

3.3.2.1. ELECTRONIC SEARCH

Yoshii, Plaut, McGraw, Anderson and Wellik (2009: 21-25) conducted a systematic review on analysing the electronic search strategies of Cochrane systematic reviews. They identified the following seven criteria in the Cochrane eBook version 4.2.5 on explicit documentation of the electronic database search strategy:

- Databases searched
- Name of host
- Date searched
- Years covered by search
- Complete search strategy

- One or two sentence summaries of the search strategy
- Language restrictions

Russell (2005: 11) and Whittemore and Knafl (2005: 549) confirm the above-mentioned criteria. Therefore, the researcher applied the seven criteria during the electronic search and documentation of the search.

The following discussion deals with the inclusion and exclusion criteria, the search strings and databases used in the electronic search.

INCLUSION AND EXCLUSION CRITERIA

In order to ensure quality and find representative data, the researcher included only published, peer-reviewed academic literature, systematic reviews, master's dissertations and doctoral theses. The representativeness of the data is an indication of the veracity and reliability of the results (De Sousa *et al*., 2010: 104).

The search did not exclude any language specifications to prevent language bias from being an external threat to validity. EBSCOhost automatically includes all languages. Peer-reviewed academic literature in 11 languages other than English was found. This included eight Portuguese, three Italian, one French, eight Chinese, three Turkish, one Chilean, one Russian, one Finnish, one Spanish, one Japanese and two Persian articles.

The search was limited to education in healthcare and included reviews, qualitative, quantitative and mixed method research studies, as an integrative literature review lends itself to research of multiple methodologies. Epidemiological bias may be a factor if the search filters only include, for example, randomised controlled trials (Sampson McGowan, Cogo, Grimshaw, Moher, & Lefebvre, 2009: 950).

Contrary to Cronin *et al*.'s (2008: 40) recommendation that the period should span 5 to 10 years maximum, the researcher restricted data from 2000 to 2013 in order to capture as many diverse teaching strategies as possible and to prevent including only the most recently discussed in the literature.

The critical inclusion criteria of the literature was that the study had to measure clinical judgement as an outcome, as it validates successful learning transfer. More than one researcher used the selection criteria to select included studies. The study

was performed with a team that consisted of the researcher, supervisor and senior researcher in the School of Nursing.

Inclusion criteria:

- Published literature
- Peer-reviewed academic literature, systematic reviews, master's dissertations and doctoral theses
- Publications in Afrikaans and English, and conditionally other languages, for example Dutch and Flemish (Translations were considered if the abstract could be obtained in English.)
- Limited to educational strategies in healthcare
- Diverse methodologies, experimental and non-experimental research studies
- Literature demonstrating clinical outcomes reached and clinical judgement demonstrated
- Literature from January 2000 to December 2013
- Peer-reviewed academic literature with sound rigour

Exclusion criteria:

- Literature that demonstrated learning transfer by patients
- Abstracts that were unobtainable in English
- Publications before the year 2000 and after October 2013
- Literature focusing on competence of a cognitive or psychomotor skills

SEARCH WORDS

The researcher developed search strings by using PICOT in order to include all the concepts that were relevant to the research. The components of PICOT for the study were (P) students in healthcare, (I) educational strategies, (C) no comparisons will be made, (O) improved clinical judgement, clinical outcomes and (T) 2000-2013, as discussed by Welty *et al*. (2012: 476). The Cochrane eBook (Green, Higgins, Clarke, CD. & Oxman, 2011: Online) warns that the terms may not be represented in the title or the abstract of a study, therefore the search included the category ALL and TITLE.

The search strings were developed in consultation with the supervisor and the librarian to determine concepts and synonyms that are combined, separated or

excluded by the Boolean terms of AND, OR and NOT as described by Rew (2011: 66). Key words in articles discussing educational strategies helped to formulate the search strings. The search string and a list of intended databases were sent to the librarian in advance so that she could familiarise herself with the search engines if necessary.

SEARCH STRINGS

The researcher followed the Boolean guidelines to formulate the first search string. Box 3.1 shows the composition of the first search string. The Boolean terms ALL and TITLE indicate the categories included in the search. TITLE indicates that the terms are to be included in the titles of the abstracts; ALL that the search terms can be included in any part of the studies while AND indicates a combination of the search terms and/or usually synonyms of the terms.

ALL (transfer* OR integrat*)
(outcome* OR evaluation* OR value*)

AND

("program* design*" OR "course design*" OR approach*)

AND

(technique* OR strategy OR strategies OR method* OR approach* OR system*)

AND

(educat* OR learning* OR "theory-practice gap*" OR integration* OR skill* OR teach* OR train* OR "Clinical Competen*" OR instruction* OR knowledge* OR "clinical judg*")

AND

(nurs* OR health* OR medic*)

AND

(academic* OR Baccalaur* OR undergrad* OR postgrad* OR post-grad* OR "post grad*" OR graduat* OR post-basic* OR "post basic*" OR universit* OR college* OR student*)

AND

TITEL (nurs* OR health* OR medic*)

AND

(educat* OR learn* OR "theory-practice gap*" OR integration* OR skill* OR teach* OR train* OR judgement* OR competen* OR instruction* OR knowledge* OR clinical*)

AND

("program* design*" OR "course design*" OR approach*)

AND

(academic* OR Baccalaur* OR undergrad* OR postgrad* OR post-grad* OR "post grad*" OR graduat* OR post-basic* OR "post basic*" OR universit* OR college* OR student*)

Box 3. 1 First search string

On 19 April 2013, the search string in Box 3.1 was tested during a trial run in EBSCOhost and rendered 120 abstracts that were perused by the researcher and supervisor. The abstracts contained inapplicable studies and focused on inter-professional education, work disability, treatment, problems of transfer, applied principles, case studies, perceptions, opportunities and barriers. The librarian assisted in compiling the second search string depicted in Box 3.2. An adaptation was to include search terms in the title.

ALL ((“transfer of learning*” OR “transfer of training*” OR “theory-practice gap*” OR integration* OR application* OR “clinical judgement*” OR “clinical reasoning*” OR outcomes* OR competence*) and ("course design*" OR "programme design*" OR "teaching techniques*" OR "teaching methods*" OR "teaching strategies*" OR "teaching practices*" OR "training delivery methods*" OR "training design*" OR "learning strategy*" OR technology* OR "clinical teaching*" OR teach* OR instruction* OR train*))

AND

TITLE (knowledge* OR learning* OR skill* OR education* OR training* OR teaching* OR instruction* OR knowledge* OR scholarship*)

AND

TITLE (student* OR university* OR college* OR “higher education*” OR pre-registration* OR undergraduate* OR “post basic*” OR “post graduate*” OR post-graduate*)

AND

TITLE (“healthcare*” OR “health services*” OR nurse* OR nursing OR health* OR medic* OR midwifery*)

Box 3. 2 Second search string

The search with the second search string took place on 30 May 2013 in EBSCOhost and the Cochrane Library. EBSCOhost provided 1 251 abstracts and the Cochrane Library provided 13 reviews, 34 methods and 642 trials. The supervisor and primary researcher perused the results and concluded that the abstracts did not only contain applicable studies, but that they also focussed on non-relevant subjects, such as communication.

A closer examination of the second search results revealed some abstracts that included research on curriculums, student satisfaction, the learning process, perception, confidence, attitude, characteristics, caring, proceedings, practical guides, guidelines or patient education. Thus subjects to exclude could be identified as these abstracts fell outside the scope of the research and the search string was adapted to include the Boolean NOT. The third and final search string is captured in Box 3.3.

ALL ((“transfer of learning*” OR “transfer of training*” OR “theory-practice gap*” OR integration* OR application* OR “clinical judgement*” OR “clinical reasoning*” OR outcomes* OR competence*) AND ("course design*" OR "programme design*" OR "teaching techniques*" OR "teaching methods*" OR "teaching strategies*" OR "teaching practices*" OR "training delivery methods*" OR "training design*" OR "learning strategy*" OR technology* OR "clinical teaching*" OR teach* OR instruction* OR train*))

NOT

(Communication OR “student* satisfaction” OR “Learning process*” OR Perception* OR Confidence* OR Attitude* OR Characteristic* OR Caring OR Proceedings OR “Practical guide*” OR Curriculum* OR Guideline* OR “Patient education*”)

AND

TITLE (knowledge* OR learning* OR skill* OR education* OR training* OR teaching* OR instruction* OR knowledge* OR scholarship*)

AND

TITLE (student* OR university* OR college* OR “higher education*” OR pre-registration* OR undergraduate* OR “post basic*” OR “post graduate*” or post-graduate*)

AND

TITLE (“healthcare*” OR “health services*” OR nurse* OR nursing OR health* OR medic* OR midwifery*)

Box 3. 3 Third and final search string

The librarian, in collaboration with the researcher, adapted the searches on each database according to how the search engine performed. In the Cochrane Library, the first part of the search string was entered (#1) and the second part (#2) built on the results obtained. The results were refined by adding #1NOT#2. The parts of the search strings were all added in this manner until the whole search string was used. PubMed required a similar application of the search string as the Cochrane Library. Contrary to PubMed and Cochrane, the RHL search engine required the whole search string.

The search strings were adapted for each search, as separate entry of terms in the title was not possible in all the search engines. The librarian provided help with the application of the search strings in each search engine. Yoshii *et al*. (2009: 21-22) warn that the specific structure of each database should be taken into consideration. Adaptation of the search strings for each database may reduce inconsistencies that can develop due to problems with indexing in the databases (Pentland, Forsyth, Maciver, Walsh, Murray, Irvine & Sikora, 2011: 1409-1410; Whittemore & Knafl, 2005: 548).

The search conducted on 31 May 2013 was limited to EBSCOhost, due to time constraints affecting both the researcher and the librarian. Searching the rest of the databases took place on 5 June 2013. Refer to Table 3.2 for the search engines, databases and number of abstracts obtained from the final search string.

DATABASES

Suggestions from colleagues as well as input from the librarian and the supervisor determined the databases used. The researcher and the librarian conducted the electronic searches on numerous search engines and databases.

On EBSCOhost the following databases were searched, Academic Search Complete, Africa-Wide Information, CINAHL with full text, ERIC, Healthsource-Consumer Edition, Health Source: Nursing/ academic Edition, Medical Literature Analysis and Retrieval System on-line with full text (MEDLINE), AHFS Consumer Medication Information, PsycARTICLES and PsycINFO.

The World Health Organization Reproductive Health Library (RHL) is an electronic review journal published by the Department of Reproductive Health and Research at WHO Headquarters in Geneva, Switzerland. RHL allows access to full text Cochrane systematic reviews as well as full text published journal articles on reproductive health (The WHO Reproductive Health Library (RHL), 2013: Online).

PubMed includes literature from MEDLINE, life science journals and online books (PubMed Help, 2013: Online). The researcher is uncertain whether PubMed is a search engine or a database; the librarian could not shed any light on this question and the decision was made to list PubMed as a search engine.

Searches on PubMed and the Cochrane Library rendered inconsistent results. PubMed delivered only three possible abstracts while the Cochrane Library delivered multiple abstracts via PubMed. On 21 June 2013, the researcher and the librarian repeated the PubMed search in an effort to solve any problems that might have occurred during the previous search. The results were the same. The librarian explained that the manner in which search engines function might be the reason for the inconsistency. As PubMed can also be accessed via the Cochrane Library, it was decided, after consultation with the supervisor and librarian, to accept the results.

The Cochrane Library consists of six databases and results were obtained from three, namely the Cochrane Central Register of Controlled Trials, The Health Technology Assessment database and the Cochrane Database of Systematic Reviews. The three excluded databases from the Cochrane Library were accessed during the search but did not deliver any studies. The Cochrane Central Register of Controlled Trials, called CENTRAL, contains articles from the bibliographic databases MEDLINE and EMBASE. Three-fifths of CENTRAL records come from MEDLINE. The database also contains articles from PubMed, although not discussed under the information provided by Cochrane Library. Specialised Registers are maintained by collection of controlled trials of relevant interest to each group, although each Cochrane Review Group may select articles that are not relevant to their area of interest and these are called Hand Search Results (The Cochrane Library, 2013).

Midwivesonline.com was searched, but the articles were unsuitable as they did not constitute qualitative, quantitative and mixed method research studies and therefore did not conform to the inclusion criteria. Midwivesonline.com was searched twice to rule out mistakes.

The Centre for Reviews and Dissemination (CRD) includes the National Institute for Health for Research (NHS). The CRD allowed access to the Cochrane Library, Health Systems Evidence, SUMSearch, Trip database, Virtual Health Library and the Knowledge Network of NHS Scotland (Centre for Reviews and Dissemination, 2013: Online). Repeated searches with different combinations of the search string did not deliver relevant studies.

Due to fiscal restraints, the researcher was unable to subscribe to the following databases:

- MIDIRS at http://www.midirs.org/ Midwives Information & Resources Service
- BMJ group at www.clinicalevidence.com
- Virginia Henderson Library
- Bandolier www.medicine.ox.ac.uk/bandolier/www.ebandolier.com
- Joanne Briggs

DOCUMENTING THE SEARCH

The description of the search should include the search strategies, search engines and the databases accessed, indicating the number of abstracts obtained from each for clarification (Yoshii *et al*., 2009: 21-25). Table 3.1 reflects the search engines used, the databases accessed as well as the number of abstracts obtained. The search strategies have been discussed (3.3.2.1: Electronic search).

Table 3. 1 Search engines, databases and number of abstracts obtained from first' second and third electronic search

SEARCH ENGINE	DATABASES	NUMBER OF ABSTRACTS		
		ORIGINAL SEARCH	2nd SEARCH (Update)	3rd SEARCH (Update)
EBSCOhost	Academic Search Complete	165	10	2
	Africa-Wide Information	11	0	1
	CINAHL	164	6	5
	ERIC	10	0	0
	Health Source: Nursing	27	0	0
	Locally held title	1	0	0
	MEDLINE	15	0	0
	PsycARTICLES	2	0	0
	PsycINFO	31	0	2
	SocINDEX	3	0	0
	Sportdiscus	1	0	0
	TOTAL	**430**	**16**	**10**
COCHRANE LIBRARY	COCHRANE TRIALS (CENTRAL)			
	PubMed	216	3	0
	EMBASE	5	0	0
	Epub ahead of print	1	0	0
	Hand-searched	29	0	0
	TOTAL:	**251**	**3**	**0**
	COCHRANE	16	0	0

SEARCH ENGINE	DATABASES	NUMBER OF ABSTRACTS		
		ORIGINAL SEARCH	2nd SEARCH (Update)	3rd SEARCH (Update)
	METHODS STUDIES			
	TOTAL	**16**	**0**	**0**
	COCHRANE DATABASE OF SYSTEMATIC REVIEWS	1	0	0
	TOTAL	**1**	**0**	**0**
	COCHRANE HEALTH TECHNOLOGY ASSESSMENTS	0	0	0
	Health Technology Assessment Database	2	0	0
	TOTAL	**2**	**0**	**0**
	TOTAL	**270**	**0**	**0**
RHL (The World Health Organization Reproductive Health Library)		2	0	3
	TOTAL	**2**	**0**	**3**
PubMed	PubMed - indexed for MEDLINE	68	3	2
	PubMed	12	4	2
	TOTAL	**80**	**7**	**4**
ABSTRACTS	**TOTAL n=825**	**782**	**26**	**17**
ARTICLES OBTAINED	**TOTAL n=49**	**47**	**2**	**0**
ABSTRACTS REJECTED	**TOTAL n=776**	**735**	**24**	**17**

3.3.2.2. RESULTS FROM THE ELECTRONIC SEARCH

The search delivered 430 abstracts from EBSCOhost, 270 from the Cochrane Library, 2 from RHL and 80 from PUBMED. The total number of abstracts obtained from the search was 782, as shown in Table 3.1. The electronic search was updated twice.

The Centre for Dissemination and Research: Systematic Reviews (2009: Online) suggests the updating of literature searches depending on the scope and time scale of the review. The search was updated on 30 September 2013 with the same search strings in the same search engines and databases. The second update generated delivered 26 new abstracts. EBSCOhost delivered 16 abstracts, the Cochrane Library 3 and PUBMED 7.

On 12 November 2013, the third and last update was done with the same search strings on the same search engines and databases. EBSCOhost delivered 10 abstracts, RHL 3 and PUBMED 4, thus providing 17 new abstracts. Table 3.1 reflects the summary of the complete electronic search strategy with a total of 825 abstracts for the complete electronic search. The researcher and supervisor consulted on each step of the review and independently performed selection of the abstracts and studies. The team reviewed the 47 possible articles and conducted the critical appraisals independently. The primary researcher consulted with the supervisor during the analysis of the results.

PROCESS OF SELECTION

According to Notar and Cole (2010: 3), a review should include only the most relevant articles, as quality is considered more important than quantity. The methodological selection process followed in the research, as portrayed in Figures 3.1 and 3.2, aimed to accomplish the directive of finding relevant articles of quality.

Seventy-eight duplicates were identified in the electronic searches and removed. The electronic searches returned 782 abstracts before removal of the 78 duplicates and the four abstracts that were excluded due to language. The researcher excluded four articles in other languages due to financial restraints. The supervisor and the researcher performed the process of selection independently. Discussion resolved any disagreements. Over-inclusion of abstracts occurred, as advocated, in order to prevent excluding an abstract or article where the title or abstract was inconclusive (Academy of Nutrition and Dietetics, 2012: 22; Centre for Dissemination and Research: Systematic Reviews, 2009: 29-30; Cronin *et al*., 2008: 40; Torraco, 2005: 361). Scanning of the abstracts took place according to relevance with regard to the inclusion and exclusion criteria. The literature was included regardless of whether the outcomes of the primary research yielded positive or negative results. Inclusion was dictated by the parameters of the research and methodological quality of the study described in the article. The researcher obtained the full articles of the 47 selected abstracts for perusal by three reviewers. Of the 47 scanned articles, six were selected for critical appraisal as directed by the inclusion and exclusion criteria. Three researchers, namely the supervisor, a senior researcher and the primary researcher, performed the critical appraisal. The same process was followed

regarding the abstracts of the two updated electronic searches. Two articles in full text were obtained from the first electronic update and none was selected for critical appraisal. Forty-nine abstracts in total were obtained in full text for perusal (refer to Figures 3.1 and 3.2).

The hand-search strategy is discussed below. The hand-search was conducted in consultation with the supervisor.

FACULTY OF HEALTH SCIENCES

Cooper and Hedges (2009: 12) state that there is no better source for obtaining unpublished or recent works than accessing one's close colleagues and other researchers in spite of the obvious biases. The researcher argued that accessing the databases available to colleagues in search of peer-reviewed published literature should also be valid. The Centre for Dissemination and Research: Systematic Reviews (2009: Online) suggests contacting experts.

An email via MEDMAIL was delivered once a month to 680 members of the Health Science Faculty at the University of the Free State over a period of three months. The email stated the title of the research, the methodology and the inclusion and exclusion criteria. The faculty members were asked to forward relevant peer-reviewed published literature to which they had access. The email elicited 28 responses. Two of the responses, entailing a book and an article outside the inclusion date, were inapplicable. Removal of two duplicates left 24 studies. The same researchers followed the same procedure for selection. None of the articles was selected as none met the inclusion criteria. The bibliographic references of the studies selected during the electronic search were used for ancestor searching.

ANCESTOR SEARCHING

Randolph (2009: 7) considers ancestor searching as the most effective and describes the process as repetitive until saturation is reached. The method of hand searching is also discussed in the Cochrane handbook version 5.1.0 (Green *et al*., 2011: Online) and by the Centre for Dissemination and Research: Systematic Reviews (2009: Online).

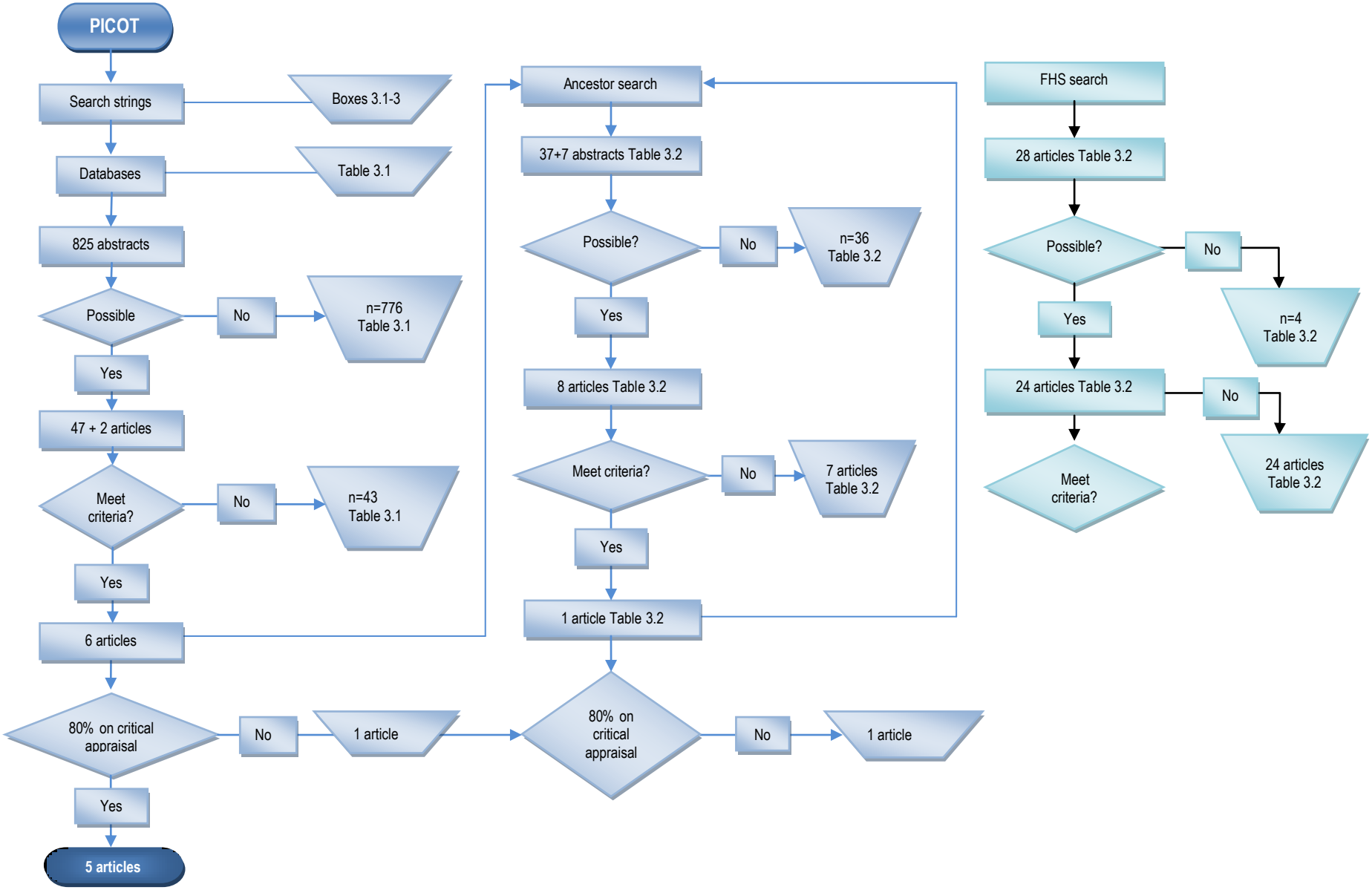

Figure 3. 1 The Document Search

Ancestor searching of the bibliographic reference lists from the six studies selected during the electronic search furthered the search. Titles and abstracts that were possibly relevant were identified. Any titles that appeared to be germane but about which there was uncertainty were also included. An additional 37 abstracts were identified for review from the six articles obtained by the electronic search. The researcher removed one double. Full text scanning of eight studies by the two researchers took place in the same manner as previously described. One article was selected for critical appraisal. Both researchers scanned the references of the selected article and obtained seven additional abstracts. Both researchers also scanned the abstracts but no further articles were reviewed. The process reached saturation. Refer to Figure 3.1.

The researcher could not identify other sources through ancestor searching. Table 3.2 indicates the reasons for exclusion of the abstracts and articles.

3.3.2.3. REASONS FOR EXCLUSION OF ABSTRACTS AND STUDIES

Exclusion of abstracts and studies falls into two categories. The first includes studies that are clearly irrelevant to the topic and do not need a reason for exclusion. The second category includes studies excluded due to specific unmet criteria with reasons provided for exclusion (Centre for Dissemination and Research: Systematic Reviews, 2009: 29; Russell, 2005: 11).

The reviewers adhered to explicit, objective and well-delineated criteria during the decision-making process of excluding abstracts and studies. Abstracts and studies not adhering to the inclusion and exclusion criteria were excluded.Refer to Chapter 2 for the delineation of the transfer manifestations. Table 3.2 provides the reasons for exclusion.

A large number of abstracts and articles discussed the merits, assessment or reporting of a programme, course or module. The search terms ‘course design*’ OR ‘programme design*’ OR ‘teaching practices*’ OR ‘training delivery methods*’ OR ‘training design*’ explain the inclusion. Difficulty in underpinning the different denominations in the literature for educational strategies led to the inclusion of these terms.

The different definitions attributed to critical thinking and clinical reasoning made reviewing studies regarding these two concepts mandatory. Studies investigating critical thinking and clinical reasoning were excluded when application or management did not take place as defined by clinical judgement. For example, students reaching a diagnosis demonstrate clinical reasoning, but if management on diagnosing took place, the study could be included as clinical judgement. When research indicated evaluation of a skill without application in management, exclusion took place because it portrayed the level of critical thinking (procedural knowledge).

Excluded studies discussed health promotion strategies in the community, learning opportunities for students in the community and health promotion strategies for students. Irrelevant results covered subjects that discussed school health and patient education in spite of exclusion in search strings. Studies were repeatedly scrutinised to determine the exact outcome measure; for example, a study indicated management, but used instruments measuring the diagnostic (clinical reasoning) ability of the students.

Table 3.2 indicates the reasons for exclusion of the abstracts and articles. The electronic, FHS and ancestor searches yielded seven studies (articles) for critical appraisal.

3.3.3 DATA EVALUATION STAGE

Critical appraisal is the systematic review of evidence assessing validity, results and relevance to provide an informed decision about primary research (Ontario Public Health Libraries Association, 2014: 3). According to Whittemore and Knafl (2005: 550), quality evaluation in an integrative review includes authenticity, methodological quality, informational value and the representativeness of the primary research. Russell (2005: 12) indicates two methods of deciding on the inclusion or exclusion of studies, a priori before the data collection, or a posteriori, where all the articles are included but weighed according to scientific rigour. In the study, the decision was a priori to include or exclude articles according to the findings of critical appraisal. The use of three reviewers prevented evaluation of the studies according to the beliefs of the reviewer and inclusion or exclusion based on the direction of the strengths of the study findings. Different study designs are prone to varying sources of systematic

bias; Young and Solomon (2009: 84) suggest the use of design-specific critical-appraisal checklists to determine the quality of studies. The Critical Appraisal

Table 3. 2 Reasons for exclusion of abstracts and articles

REASONS FOR EXCLUSION	SEARCH ENGINES												HAND SEARCH					TOTAL
	EBSCOhost			COCHRANE LIBRARY			RHL			PUBMED			ANCESTOR SEARCH			FHS		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	R	A	
Critical thinking/ Clinical reasoning	17	1	1	14	1	0	0	0	0	5	0	0	3	2	0	10	0	**54**
Commentary on previous research/course	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**22**
Knowledge/learning assessment	58	6	1	71	1	0	0	0	0	4	0	0	1	0	0	2	0	**144**
Skills	74	2	3	88	1	0	0	0	0	1	0	0	8	1	0	0	0	**178**
Course/programme module/evaluation/ development/ Assessment/report	165	4	2	45	0	0	0	0	0	42	4	0	14	3	0	7	0	**286**
Health promotion strategies community/students	40	1	1	6	0	0	0	0	0	13	3	0	6	1	0	0	0	**71**
Irrelevant	0	2	2	12	0	0	2	0	3	15	0	4	3	0	0	7	0	**50**
Language	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	**4**
Duplicates	50	0	0	28	0	0	0	0	0	0	0	0	1	0	0	2	0	**81**
Critical appraisal	3	0	0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	**7**
TOTAL 700	**430**	**16**	**10**	**270**	**3**	**0**	**2**	**0**	**3**	**80**	**7**	**4**	**37**	**7**	**0**	**28**	**0**	**N=897**

1ST electronic search and updating as 2nd and 3rd are indicated at EBSCOhost, COCHRANE Library, RHL, and PUBMED.

FHS = Faculty of Health Sciences. R = received studies. A = Ancestor search.

Skills Programme (CASP) was considered as such a tool as it has separate checklists for each study design. Refer to Addendum A. The development of CASP tools resulted from guidelines produced by the Evidence Based Medicine Working Group. The CASP was relevant in developing an evidence-based approach in health and social care in collaboration with local, national and international groups. The tools assess internal validity, the results and relevance to practice (National Collaborating Centre for Methods and Tools, 2013: 1).

A consultation with the supervisor led to the decision to use a scoring system for final evaluation in the critical appraisal stage. As the CASP tools lack a scoring system for all the tools, the data evaluation stage incorporated the QualSyst appraisal instruments. Refer to Addendum B. The QualSyst appraisal instruments consist of qualitative and quantitative appraisal instruments and were developed from existing published critical appraisal instruments. The tools development incorporated inter-rater agreement for both qualitative and quantitative studies by item and overall scores as well as inter-rater agreement for inclusion and exclusion of studies. The instruments provided a systemic, reproducible and quantitative assessment of quality of research across a wide range of study designs while providing exploration of variation in the studies and directing synthesis and interpretation (Kmet *et al*., 2004: 6-12). The inclusion of a manual facilitated the use of the appraisal tools. Refer to Addendum C. Limitations of the QualSyst tools that have been discussed include the introduction of bias using summary scores and subjectivity of the tools through reflection of the writer's perception of the key components of study quality (Kmet *et al*., 2004: 9). The lack of a gold standard against which to measure the QualSyst tools provided the basis for the possible limitations, but it is true for all appraisal tools. During the selection process, only qualitative and quantitative studies fulfilled the set criteria, although the inclusion criteria stated qualitative, quantitative mixed method and review research studies.

The following instruments were used in the critical appraisal process:

- Critical appraisal instrument for randomised controlled trials (CASP) (Critical Appraisal Skills Programme, 2011: Online)
- Critical appraisal instrument for qualitative studies (CASP) (Critical Appraisal Skills Programme, 2011: Online)

- Critical appraisal instrument for quantitative studies (QualSyst), (Kmet *et al*., 2004: 5)
- Critical appraisal instrument for qualitative studies (QualSyst) (Kmet *et al*., 2004: 5)

The peer-reviewed articles must be of sound rigour as directed by research appraisal tools. The detailed information obtained from the CASP tools in combination with the QualSyst tools provided the conclusive evidence used to select the appropriate articles. Appraisal of each article took place twice, first with the CASP instruments and then with the QualSyst instruments.

Three researchers, namely the supervisor as senior researcher, a second senior researcher at the School of Nursing and the student as primary researcher, critically appraised seven studies independently. The three reviewers discussed the merits of each study and selected four studies based on the scores. Although the sample size was small, the reviewers rejected two studies because their scores were below 80%. A third study was rejected based on lack of information. The studies were unmasked because the general opinion is that unmasked assessment by two independent researchers is acceptable (Centre for Dissemination and Research: Systematic Reviews, 2009: Online). The Centre for Dissemination and Research: Systematic Reviews (2009: Online) found several studies that indicated that blinding had limited value. Refer to Addendum D for the critical appraisal of the studies.

3.3.3.1. INTER-RATER RELIABILITY

A biostatistician calculated the reliability of the results obtained from the three reviewers. The possibility of a 'not applicable' (N/A) score exerted the greatest influence on the final scores of the studies. It complicated the evaluation as it influenced the totals for each study. The QualSyst critical appraisal tool has 14 criteria. Refer to Addendums B and D to view the criteria. The differences between how the reviewers scored the critical appraisal of each criterion collectively in the studies are indicated.

- The score of not applicable (N/A) in the quantitative studies indicated no differences between the reviewers in the first to fourth criteria of the tool.

- In the fifth and sixth criteria, one reviewer did not concur with the other two reviewers. The fifth criterion indicated the possibility and description of interventional and random allocation. The sixth criterion indicated blinding of the subjects during intervention and whether it was reported.
- The reviewers differed from each other five times regarding the seventh criterion in providing a N/A rating. The seventh criterion indicated the interventional and blinding of subjects and whether it was reported.
- The criteria from numbers eight to fourteen showed no differences between the reviewers.

The range of the scores between the reviewers varied between 3.57% and 18.33%. The range of the scores indicates the difference between the highest and the lowest score. The lowest average percentage for an article was 19.94% and the highest 96.66%. The average scores indicate the sum of the scores by the reviewers divided by three. Refer to Table 3.3. The five articles above 80% were considered as the final sample as all five scored above 80%. The average of 19.94% for the study by Guhde (2010: 387-389) and 74.63% by Sobhani, Ahmadi, Jalili, Hatmi, Olang, Eslami and Gatmiri (2012: 478-481) excluded the studies. The study by Sobhani *et al*. (2012: 478-481) provided additional reasons for exclusion in spite of a relatively high score. The reasons are discussed below.

The study by Malesela (2009: 1-6) required clarification, which the researcher requested repeatedly via email. However, since the author did not respond, the study was excluded. The qualitative study by Malesela (2009: 1-6) explored student experiences regarding the use of the case study. Three themes were identified in the study; one of which was critical thinking. The discussion on critical thinking described clinical judgement. In the literature, discrepancies in the definition of critical thinking, clinical reasoning and clinical judgement allowed the possible inclusion of the study. The researcher indicated by email that clarification was needed on whether the theme of critical thinking identified by the students was not actually clinical judgement. Discrepancies in defining the two concepts may have allowed inclusion of the study.

The disagreements between reviewers of the study by Sobhani *et al*. (2012: 478-481) about the appropriateness of the study design, blinding of the intervention

group, control for confounding aspects and reporting of variance in the results, led to the exclusion of the study.

Table 3. 3 Percentage score by each reviewer

Nr	Author	Study score			Range	Average
		Reviewer 1	Reviewer 2	Reviewer 3		
1	Dolev *et al*	88.89	94.44	100.00	11.11	94.44
2	Guhde	25.00	6.25	28.57	3.57	19.94
3	Lindsey and Jenkins	83.33	83.33	75.00	8.33	80.55
4	Malesela*	100.00	100.00	90.00	10	96.66
5	Schwartz *et a*l	94.44	100.00	90.00	5.56	94.81
6	Sobhani *et al*	72.22	66.67	85.00	18.33	74.63
7	Steadman *et al*	88.89	88.89	85.00	3.89	87.59

*Clarification requested and excluded based on non-reply by author

Inter-rater reliability, also called equivalence, provides a comparison of the measure of the same event by more than one observer (Botma *et al*., 2010: 177). According to Foster and Shurtz (2013: 194), the inter-rater reliability demonstrates the quality of a tool. The Spearman Correlation Coefficient was used to determine the inter-rater reliability. A Rho value of <0.05 is significant, as it was in all three cases, with the strongest correlation between reviewer 1 and 2 and the weakest between reviewer 1 and 3. The inter-rater reliability between reviewer 1 and 2 was significant at the 1% level (p<.0001). The inter-rater reliability between reviewer 1 and 3 and reviewer 2 and 3 were significant at the 5% level (p<.0221 and p<.0467). Refer to Table 3.4.

Table 3. 4 The inter-rater reliability between reviewers

Spearman Correlation Coefficients, N=7 Prob > [r] under H0: Rho = 0			
	Reviewer 1	Reviewer 2	Reviewer 3
Reviewer 1	1.00000	0.98182	0.76150
		<.0001	0.0467
Reviewer 2	0.98182	1.00000	0.82572

	<.0001		0.0221
Reviewer 3	0.76150	0.82572	1.00000
	0.0467	0.0221	

FLOW DIAGRAM

The researcher took note of the standard form of the flow diagram as delineated by Green *et al*. (2011: Online) in the Cochrane handbook. Preference was given to an adapted form of the flow diagram as it made more sense and provided an overview of the whole process while including all the levels of the search strategy. Figure 3.2 provides the overview of the literature search stage.

3.4. METHODOLOGICAL RIGOUR

Whittemore and Knafl (2005: 546-553) delineate the enhancement of rigour throughout the research phases to reduce bias in integrative reviews. The same standards of rigour that apply to any primary research apply to an integrative review. Rigour refers to the accuracy and consistency of a research design providing a measure of the quality (Moule & Goodman, 2009: 393). Explicit and systematic methods reduce bias and error that are possible at any stage during the integrative review (Whittemore & Knafl, 2005: 547).

Vaughan (2008: Online) indicated initial bias, where the existing knowledge and experience of the researcher may have an influence on the conceptual framework of a study. In the same way, ongoing bias may have an influence once the conceptual framework has been developed by providing grounds for ongoing bias in the rest of the study (Vaughan, 2008: Online). The theoretical framework that was developed concurs with the directive by Whittemore and Knafl (2005: 548) that integrative reviews should be conducted from an explicit theoretical perspective to prevent reviews from being solely descriptive. The conceptual framework provided the opportunity to differentiate clearly between similar and confusing concepts, thereby reducing bias.

A discussion on the rigour practised during the stages of the research follows below.

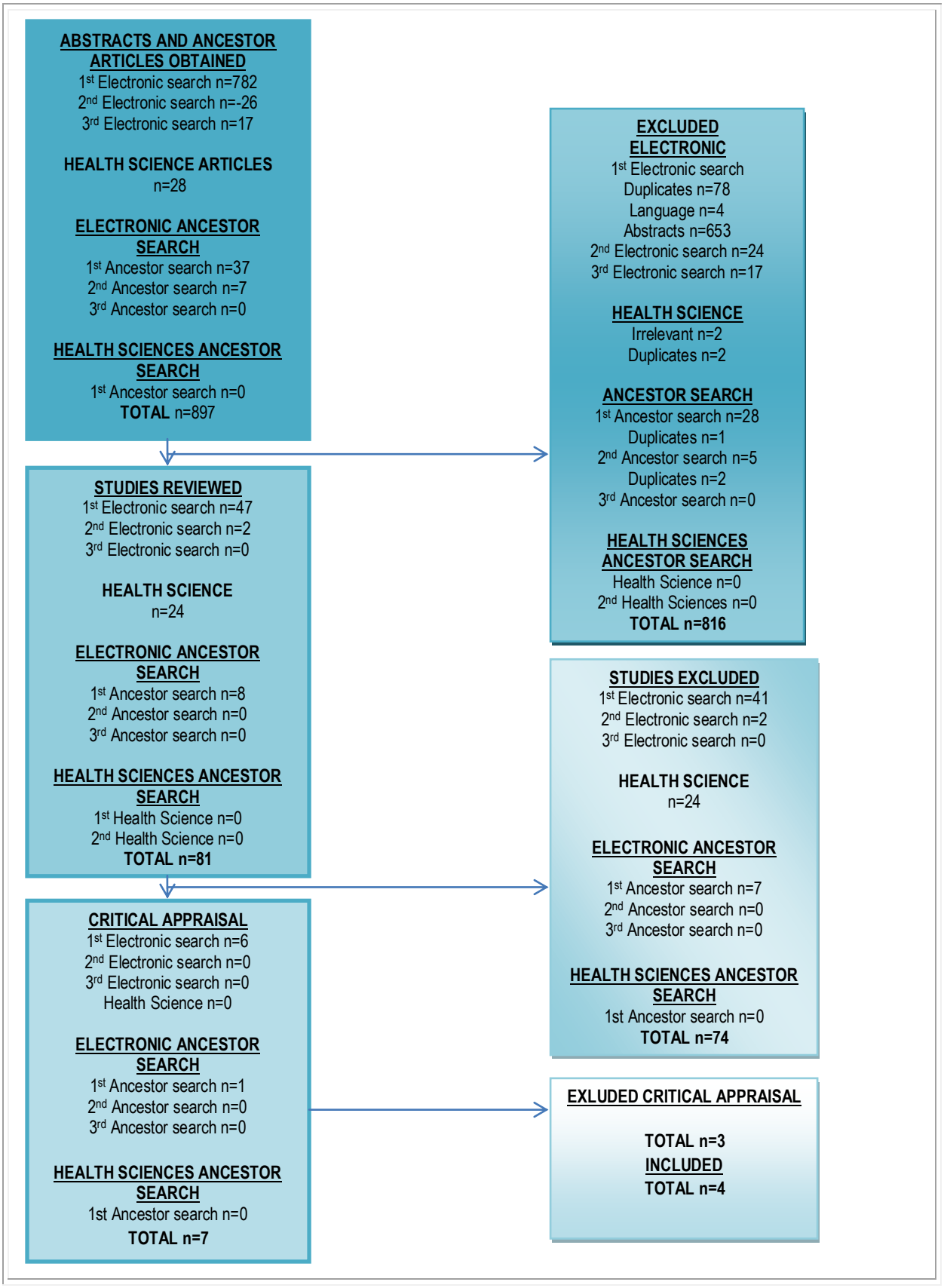

Figure 3. 2 Overview of literature search stage

3.4.1. PROBLEM STATEMENT

Since an infinite number of variables are possible with an integrative review, a clearly defined statement of the problem and purpose, which includes all the variables, facilitates the extraction of the appropriate data (Russell, 2005: 9; Whittemore & Knafl, 2005: 548).

The researcher tried to adhere to these guidelines by phrasing the research question in the PICOT format and closely followed the directives from Whittemore and Knafl (2005: 547-551) to increase rigour and validity. Refer to Table 1.1.

3.4.2. SEARCH STRATEGIES

Major threats to rigour and validity exist during the search processes. Validity refers to the justification of the study according to the design and interpretation (Botma *et al.*, 2010 :174). Internal threats can be biases that might occur at any stage of the research regarding the sample selection, data collection, analysis or interpretation of the results. Confirmation of external validity refers to generalisation of the results to a wider population enabling the researcher to provide recommendations to a wider practice based on the findings of the research (Moule & Goodman, 2009: 196). A number of strategies were used to minimise threats and are discussed below.

Well-defined search strategies reduce bias and incomplete search results and enhance the rigour of the review. Adhering to the criteria described by Yosshii *et al*. (2009: 21-25), in the Electronic Search 3.3.2.1, enhances internal validity. Inadequate sampling is a major threat to internal validity (Russell, 2005: 11) and a well-defined literature search enhances rigour (Whittemore & Knafl, 2005: 548). Incomplete and biased search strategies lead to an inadequate database and therefore inaccurate results. Electronic databases, although efficient, are limited. The search strategies should be as broad and diverse as possible using sampling criteria that will ensure the representativeness of the sample. These are indicators of reliability and veracity in the results (De Sousa *et al*., 2010: 104).

The detailed account of the search strategies increases internal validity. In order to conduct a comprehensive and unbiased search, more than one search strategy was used. The three search strategies used were (1) an electronic search in multiple databases without language limitations, thereby reducing language bias, (2) ancestor

searching, and (3) requests directed towards the vast personal databases of all personnel employed by the Faculty of Health Sciences on the campus of the University of the Free State. The electronic search was conducted in 20 databases. Explicit reporting on the search regarding search strategies, search engines, databases accessed and the number of abstracts obtained enhances credibility and repeatability of the search. Refer to Table 3.1.

The second search strategy, ancestor searching, may lead to citation bias. Citation bias occurs when the fact that a study was used as a reference is associated with its results (Tricco *et al.*, 2008: 434). Both the supervisor and the primary researcher vetted the references obtained during the ancestor search. Inclusion was based only on the potential of the title of each reference to adhere to the inclusion criteria.

Another internal threat to validity during a search is language bias. During the search no limitations were set on language. The articles that were originally published in other languages were obtained in English. The four articles in Korean were unobtainable in English, and were excluded, providing grounds for language bias. This exclusion is considered a limitation of the study.

3.4.3. DATA COLLECTION

The use of research studies with diverse methodologies is considered a limitation of the integrative literature review method as a lack of rigour and accuracy occurs with resultant bias (De Sousa *et al*., 2010: 105; Whittemore & Knafl, 2005: 547). To address these issues, Whittemore and Knafl (2005: 547, 549) recommend improved methods of data collection and data extraction.

Although the results provided primary studies of similar methodology, clear documentation of the study justifies sampling decisions regarding databases used, all search strategies applied and the inclusion and exclusion criteria of selection.

A threat to validity during selection refers to a discrepancy between the included studies and the target population of the literature review. Russell (2005: 11) describes how threats to validity can be reduced in this stage of the review process by determining why exclusion takes place as well as how the sample abstracts and studies differ from the set criteria. The study had well-defined inclusion criteria to

which the reviewers adhered during the selection of articles for critical appraisal. Table 3.2 provides the reasons for exclusion of all abstracts and articles.

The reliability increases and the risk of selection bias and ongoing bias decreases in the decision making process when more than one researcher assesses the abstracts and articles independently (Centre for Dissemination and Research: Systematic Reviews, 2009: 30; Emeis, 2012: 275; Randolph, 2009: 7; Vaughan, 2008: Online). Selector bias is relevant when the researcher chooses freely which studies to include due to a lack of clear demarcation by the inclusion criteria (Tricco *et al.*, 2008: 434). Selection bias was limited because the researcher and the supervisor selected the abstracts independently. Discussion resolved any disagreements. The selectors adhered closely to the inclusion criteria and noted why the abstracts were excluded in order to adhere to the guidelines as described by Russell (2005: 110) and Tricco *et al*. (2008: 434). The strategy also limited inclusion criteria bias that could occur when the inclusion criteria of a review purposefully exclude known studies that may be important (Tricco *et al*., 2008: 434).

The relevancy of the selected studies is also important. According to Notar and Cole (2010: 3), it is vital to include only the most relevant studies in an integrative review, as quality is more important than quantity. Hence, the team discussed the relevance of each possible study and reached consensus on the studies for critical review.

3.4.4. CRITICAL APPRAISAL

According to Whittemore and Knafl (2005: 550), the discussion of authenticity, methodological quality, informational value and representativeness of the available primary resources will enhance the rigour of the integrative literature review. The primary studies identified were representative of the research question according to the PICOT format.

A threat to validity during critical appraisal is the evaluation of studies according to the beliefs of the reviewer (Russell, 2005: 12). The influence of personal beliefs on decisions about the quality of the literature, or at any other stage of the review, reduces the validity of the study. The use of critical appraisal evaluations increases objectivity (Cronin *et al.*, 2008: 38; Russell, 2005: 12). The three independent reviewers used two independent critical appraisal tools, CASP and QualSyst.

Methodological appropriate appraisal tools were used and quality scores were calculated.

Tricco *et al*. (2008: 434) warn about country of conduct bias where researchers actively engage in associating the strength or direction of research finding with the country of publication. The researchers involved with selection of the primary studies did not note the countries of publication and it was not a criterion on the critical appraisal tool used.

Publication bias relates to inclusion of studies on the strength or direction of the findings (Tricco *et al.*, 2008: 434) and reduces the internal validity. The use of three independent reviewers reduced publication bias as an external threat to validity.

Reliability is the consistency of the measure achieved; meaning that if different people use the same instrument, the same results should be produced. Inter-rater reliability is the comparison of the measures by different people (Botma, *et al.,* 2010: 177). The inter-rater reliability of the critical appraisal tools used in the three researchers' statistical analysis was determined. The inter-rater reliability was measured using the Spearman Correlation Coefficient and was significant at the 1% level ($p<.0001$) between reviewer 1 and 3 and at the 5% level ($p<0.221$ and $p<.0467$) between reviewers 2 and 3. Refer to Table 3.4.

Bias in scoring quality involves scoring of studies by peers or in high-impact journals as more rigorous. None of the primary studies reviewed involved peers known to the researchers and the type of journals were not considered. The use of more than one researcher also reduced the possibility of bias in scoring study quality.

3.5 SUMMARY

This chapter provided the first three steps of the integrative literature review as directed by Whittemore and Knafl (2005: 548-549). The stages are the research question according to the PICOT format, the literature search that included the electronic search of several databases, and supplemental search methods, such as ancestor searching. The data evaluation stage delivered four studies for inclusion in the literature review. In the following chapter the data analysis stage is described and discussed.

CHAPTER 4.
DATA ANALYSIS

4.1. INTRODUCTION

This chapter entails data extraction and analysis, as well as synthesis of the data in the final sample. A summary of the findings and statements in line with the steps of an integrative literature review is attempted. The integrative literature review, with the exception of the meta-analysis, uses a narrative or qualitative analysis (Whittemore, 2005: 60). The a priori decision of including diverse methodological studies, rendered meta-analysis not applicable (Whittemore & Knafl, 2005: 545). After consultation with a biostatistician at the University of the Free State, the researcher continued with the planned narrative analysis, although the sample studies included are of similar methodology. The biostatistician indicated that meta-analysis of the included studies was not viable and would be meaningless in view of the few studies obtained for analysis and the different assessment methods and instruments used in the four studies. The supervisor concurred after discussion. Findings of the included studies are objectively stated in the data analysis chapter.

4.2. EVALUATION OF THE DATA

A search conducted according to the methods of integrative literature reviews delivered 897 studies. The use of keywords in the search strategy defined the search. The different search strategies used, employed the inclusion and exclusion criteria. Studies adhering to the research question to obtain evidence of learning transfer are suited to the current study (Academy of Nutrition and Dietetics, 2012: 28). No exclusion took place based on methodology used, although all the studies answering the inclusion criteria proved experimental studies, namely randomised control trials (RCTs). Critical appraisal of seven studies delivered four final studies.

The included studies were analysed according to the methodology of integrative literature reviews, as recommended by Whittemore and Knafl (2005: 550-551). The suggestions by Crawford, Morita, Febre, Valdez and Rondinelli (2010: Online) are

used together with the methods delineated by Whittemore and Knafl (2005: 550-551).

4.3. DATA ANALYSIS STAGE

According to Whittemore and Knafl (2005: 550), the goals of the analysis stage are the coding, categorisation and summarisation of the data from the primary studies, and an in-depth, unbiased interpretation of the primary sources, culminating in a unified and integrated conclusion regarding the research problem. Furthermore, the use of constant comparison converts data into systematic categories that will facilitate determination of patterns, variations and relationships in the studies. Initial comparison of data item by item allows categorisation of similar data (Whittemore & Knafl, 2005: 549).

Data analysis includes iterative comparison of categories related to educational strategies as well as the variables that might influence the outcomes. Constant comparison of extracted data with the primary sources reduces mistakes (Whittemore & Knafl, 2005: 549). Crawford *et al*. (2010: Online) suggest an iterative process in action as follows: a table of the evidence-based on gathered evidence and worksheets; a topic summary that is based on the table of evidence; followed by the key summary of the evidence-based on the results from the topic summary. Based on the key evidence and recommendations a synthesis summary statement is compiled. A discussion of the data according to the steps in Whittemore and Knafl (2005: 550-552) includes data reduction, data display, data comparison and drawing conclusions and verification. The steps indicated by Whittemore and Knafl, (2005: 550-552) will be combined with the suggestions by Crawford.

4.3.1. DATA REDUCTION

Whittemore and Knafl (2005: 550) suggest an overall classification system to manage all the data. The classification system comprises logical subgroupings based on the types of evidence that provides a manageable framework to simplify, focus and organise the data. Grouping the evidence according to type facilitates analysis, for example, all experimental studies together (Whittemore & Knafl, 2005: 549). In the current study, all four studies are randomised trials.

A complete delineation of the sampled studies is available in Addendum E. The data reduction includes the methodological and relevant characteristics of each study. The data were organised based on the research purpose, research design, study site, protocol description and sampling. Also included are the study populations and attrition rates, characteristics of participants, intervention, blinding, data collection methods, statistical analysis used, outcomes, conclusions, value of the study limitations and funding sources (Academy of Nutrition and Dietetics, 2012: 60-61; Cronin *et al*., 2008: 41; Notar & Cole, 2010: 9; Whittemore & Knafl, 2005: 550; Whittemore, 2005: 60). The iterative process suggested by Crawford *et al*. (2010: Online) was followed.

The organisation of the data in the studies into tables expedited the recognition of themes. The first step as advised by Crawford *et al*. (2010: Online), by using a table of evidence was followed. The initial table provides a summary of the contextual information of the studies. Additional thematic tables were extracted from both the comprehensive table in Addendum E and the table of evidence to explore information relevant to the research question. The information is displayed in Addendum E and Table 4.1.

Table 4. 1 Summary of the contextual information of the studies

Reference	(Dolev *et al*., 2010)	(Lindsey & Jenkins, 2013)	(Schwartz *et al*., 2007)	(Steadman *et al*., 2006)
Studies	Dolev, J.C., O'Sullivan, P. and Berger, T. (2010) The eDerm* online curriculum: A randomised study of effective skin cancer teaching to medical Students, Journal of the American Academy of Dermatology, 65(6), e165-e171.	Lindsey, P.L. and Jenkins, S. (2013) 'Nursing Students' Clinical Judgement Regarding Rapid Response: The Influence of a Clinical Simulation Education Intervention', Nursing Forum, vol. 48, no. 1, January-March, 61-70.	Schwartz, L.R., Fernandez, R., Kouyoumjian, S.R., Jones, K.A. and Compton, S. (2007) 'A Randomised Comparison Trial of Case-Based Learning versus Human Patient Simulation in Medical Student Education', Academic Emergency Medicine, vol. 14, no. 2, February, 130-137.	Steadman, R.H., Coates, W.C., Huang, Y.M., Matevosian, R., Larmon, B.R., McCullough, L. and Ariel, D. (2006) 'Simulation-based training is superior to problem-based learning for the acquisition of critical assessment and management skills', Critical Care Medicine, vol. 34, no. 1, 151-157.
Design	Randomised crossover design.	Pre-test–post-test two-group randomised experimental design.	Randomised comparison design.	Randomised comparative group design.
Purpose	eDerm and clinical clerkship on ability to diagnose and manage clinical cases when eDerm is received before and after clinical clerkship (p e166).	Clinical simulation to improve clinical judgement (p 61, 63).	Simulation compared with case-based learning measuring behavioural actions (p 131).	High fidelity simulation compared with problem-based learning in teaching acute care assessment and management (p 152).
Study population	Eligibility to participate by enrolment in an introductory dermatology elective of third (n=55) and fourth (n=219) year medical students (n=274) (p e166).	Eligibility depended on participation in a clinical simulation day as part of the programme by final year nursing students (n=79) (p 64).	Eligible to participate by enrolment in 2005 in a mandatory month-long emergency clerkship of fourth year medical students (n=105) (p 133).	Eligibility to participate by enrolment of fourth year medical students during a week-long acute care course (n=34) (p 152).
Sample	Sampling occurred from 2005 to 2007. Block randomisation was used as method. The first 38 students were blindly included	Randomisation was done by the investigators into an intervention group (n=40) and a control group (n=39). The	Students were randomly assigned to two groups. Randomisation took place monthly as the students	A computer randomisation program randomised the students into two groups, SIM (simulator-based learning)

Reference	(Dolev *et al*., 2010)	(Lindsey & Jenkins, 2013)	(Schwartz *et al*., 2007)	(Steadman *et al*., 2006)
	from each group for balanced design. Attrition of 22 students took place, four due to technical difficulties and the remainder due to no identifiable cause. The final sampling completing the trial (n=252) consisted of third and fourth year students. No mention was made regarding age, gender or race in randomisation. The group included for analysis n=228. Arm 1 and 2 each n=114 (p e166-168).	randomisation method was not discussed further. The students were all in the age group of 20-22 year old Caucasian females from northern Illinois (p 63, 65).	presented for the month-long course. The exact method of randomisation was not discussed further. Fourth year students with a mean age of 26.7 years, range 22-44 years and male 52.0% were included with no mention of race. Students that attended the initial lecture were considered eligible; three students were excluded from the trail due to failure attending the lecture component of intervention (n=102), CBL=52 and HPS=50. The sample size formula by Lauter for MANOVA study designs was used and indicated 46 participants in each group would be needed to achieve a strong power (0.80) when the significance level is set at 0.05 (p 130-133).	(n=15) and PBL (problem-based learning) (n=16). Female 60% in SIM, female 69% in PBL, no mention was made to age or race in randomisation. Absence from any portion of the week resulted in exclusion from the study. Three students were absent from one or more sessions (n=31) (p 152-154).
Ethics	Institutional board approval was obtained. No mention was made of informed consent, but tutorials formed part of curriculum (e165-e168).	Institutional Review Board approval was obtained. Written consent was obtained and the study was conducted anonymously. Those who did not wish to participate wrote 'refused' on the forms. Investigators were blinded to	Approval was obtained from the Wayne State University Human Investigation committee. Consent was obtained and students who did not agree to participation were included in randomisation as the clerkship was mandatory. A	Human Subjects Protection Committee approval was obtained. Written consent was obtained (p 152).

Reference	(Dolev *et al*., 2010)	(Lindsey & Jenkins, 2013)	(Schwartz *et al*., 2007)	(Steadman *et al*., 2006)
		consent to participate. The students who refused did not complete the pre- and post-test surveys (p 63-64).	confidentiality contract was signed and failure to abide by the contract was considered a violation of the code of honour (p 130-133).	
Comparability of groups	Fourth and third year students, no mention was made of gender, age or race (p e166).	Final semester students. The sample was 20-22 year old female Caucasian students (p 63, 65).	Fourth year students. Mean age of 26.7 years, range 22-44 years male 52.0%, no mention was made of race (p 130).	Fourth year students. Female 60% in SIM, female 69% in PBL, no mention was made of race or age. The gender distribution between the two groups was determined using a chi-square test to verify the randomisation process (p 152-154).
Location	The trial took place at the School of Medicine at the University of California San Francisco (USA) (p e166).	The trial took place in a clinical simulation laboratory at a Midwestern public university in Illinois (USA) (p 61, 64).	The trial took place at the School of Medicine, Wayne State University in Detroit (USA). CBL was conducted as a classroom instruction and HPS took place in a simulation laboratory located within the Eugene Applebaum College of Pharmacy and Health Sciences (p 131).	The trail took place at a simulation centre in the Acute Care College at the University of California, Los Angeles (USA) (p 151-152).
Attrition rate	Eighteen students elected to withdraw from the study and 4 participants declared inability to finish. Students who did not complete (n=22) (p e168).	No attrition (p 65)	Students who did not attend the initial lecture were excluded (n=3) (p 131).	Students who did not attend any portion of the weeklong course were excluded (n=3) (p 152, 154).
Blinding	Students logged in with a designated user identification	All consent forms were placed in an envelope and the lab faculty	Trained evaluator and physicians (to verify inter-rater	The two raters were blinded to group assignment of the

Reference	(Dolev *et al*., 2010)	(Lindsey & Jenkins, 2013)	(Schwartz *et al*., 2007)	(Steadman *et al*., 2006)
	blinded to the investigators. Random rotation of the pre-test, post-test 1 and post-test 2 by user identification (p e168).	and investigators did not know which students had consented to participate in the study, although all students participated in the exercise (p 64).	reliability) who scored the results were blinded to the training protocol of the students (p 132).	students assessed final assessment performance (p 153).
Intervention	The intervention consisted of receiving an eDerm (web-based) programme consisting of 17 tutorials at the beginning or the end of clinical dermatology clerkship that consisted of 2 weeks of 14 half-day outpatients' clinics (p e166-e167).	The rapid response education intervention consisted of a 10-minute lecture followed by a guided rapid response simulation (p 64).	An initial lecture on acute coronary syndrome (ACS) and core objectives provided. CBL session (1h) received a vignette of a patient with classic ACS and reviewed the advanced cardiac life support protocols. HPS session (1h) received a 15-minute mannequin orientation explaining all features, followed by an individual simulation session (p 131-132).	All students received two intervention sessions, one on PBL and one on simulation. The PBL group received a PBL session on dyspnoea and a simulation session on abdominal pain. The SIM group received a PBL session on abdominal pain and a simulation session on dyspnoea (p 151-152).
Exposure time to intervention	Clerkship=2 weeks and tutorials 1 day according to description, but 17 tutorials seems a lot for one day (p e166).	Exposure consisted of participation in simulation day (p 66).	One-month clerkship in emergency medicine (p 131).	Five days (p 152).
Data collection methods	Internet assessment using a 15-item test provided 2 scores ranging from 1-15 for assessment and management. The previously used instrument was considered a proven instrument and correct diagnosis was based on biopsy proven	An 11-item multiple-choice survey used in pre- and post-tests. Questions allocated according to purpose, function and anticipated outcomes. Questions 1, 5, 6, 8 and 9 assessed knowledge about purpose, function and	An ACS OSCE evaluated all the students. Instrument contained 43 behavioural observations, with three subscales, history (n=22), AMI observations and management (n=13) and cardiac arrest management (n=8). Physicians evaluated the	The same cases and checklists were used in both groups. Unique standardised checklists were used for each scenario. Both groups were assessed on the simulator for management of dyspnoea with the standardised checklists. Scenario was

Reference	(Dolev *et al*., 2010)	(Lindsey & Jenkins, 2013)	(Schwartz *et al*., 2007)	(Steadman *et al*., 2006)
	diagnosis of the lesion. Parallel versions of the tests (A, B, C) provided each group the same number and difficulty of diagnosis (p e168-e169).	anticipated outcomes of rapid response systems. Questions 2, 3, 4, 7 and 10 assessed clinical judgement in activating and participating in rapid response calls. Question 11 assessed prior knowledge of rapid response calls.Content validity determined by consultation of nursing faculty with expertise in critical care and education (p 63-64).	recorded sessions for inter-rater agreement (p 132).	managed in pairs in 15 minutes to obtain a primary and secondary assessment and initial critical management. The METI high fidelity simulator was used in all 3 assessments. The checklist was proven by previous use. Final assessments were videotaped for debriefing purposes (p 152-153, 156).
Statistical analysis	Statistical software used (SPSS, Version 15.0, SPSS Incorporate, Chicago, IL) for two-way repeated measures' analysis of covariance for diagnosis and management. Interaction of the 3 test time-periods and arm assignments were evaluated. The Pearson correlation coefficient was determined for correlation between diagnosis and management (p e168).	Scantron forms were used for pre- and post-tests. Scantron machines provided individual scores and item analysis. PASW 17.0 statistical software was used for individual percentage scores that were used to analyse the data further (p 65).	Descriptive analysis was used regarding the demographics. Multivariate analysis of variance (MANOVA) was used to control for type 1 error inflation. The SPSS version 14.0 (SPSS Inc., Chicago, IL) was used for statistical analysis. A standard deviation of 0.75 was recorded. Adequate sample size was determined using the Lauter formula for MANOVA study designs. A group size of 46 participants was needed to achieve strong power (0.80) with a level of significance set at 0.05. Cronbach's $\propto$ was implemented for internal	The overall score of each subject was determined (fraction of checklist items performed) for both initial and final assessments. The change in score was determined (percentage correct in final minus the percentage correct in initial). Comparison between groups, the means and standard deviation and the change in both initial and final assessments were done using the student's t-test. A *p* value of <.05 was considered significant. Verification of randomisation was done using a chi-square test for gender distribution. The

Reference	(Dolev *et al*., 2010)	(Lindsey & Jenkins, 2013)	(Schwartz *et al*., 2007)	(Steadman *et al*., 2006)
			consistency for each scale (p 132).	Shapiro-Wilkes test evaluated assessment scores for normality (Gaussian distribution). No other specific statistical software mentioned. Analysis of initial and final scores did not indicate any basis to reject the normal distribution (p 153-154).
Main findings	Improvement after both eDerm and clerkship Highest level of improvement with eDerm after clerkship Higher scores in management than diagnosis Improved diagnosis of malignant lesions (p e168).	Improvement in knowledge and clinical judgement in the rapid response education intervention versus the traditional code blue groups (p 65).	No significant difference in outcome between the CBL and HPS groups regarding clinical judgement (p 133).	Improved performance by SIM group versus PBL group in assessment and management (p 154).
Additional findings	eDerm knowledge additive to clerkship. eDerm consolidates knowledge and acts as advanced organiser of vocabulary and scaffolding. It was determined that it is easier to teach management than diagnosis. eDerm alone provides significant improvement in diagnostic and management skills (p e168-e170).	None.	The researcher with the help of a biostatistician, did further interpretation of the outcomes which indicated that both groups demonstrated clinical judgement. The subscales of acute coronary syndrome evaluation and management and the cardiac management items were respectively n=13 items and n=8 items. AMI evaluation and management indicated mean percentage scores of all the items as	Simulation preceded by PBL leads to improved results (p 154).

Reference	(Dolev *et al*., 2010)	(Lindsey & Jenkins, 2013)	(Schwartz *et al*., 2007)	(Steadman *et al*., 2006)
			CBL=69.2% and HPS=66.9% and the cardiac management scores indicated CBL=81% and HPS=87.5%. The scores indicate how both groups performed with regard to clinical judgement regardless if one could not be proven superior to the other. (p 134-135)	
Limitations of studies	No delayed testing of subjects took place. Small number of melanoma lesions in eDerm curriculum (p e170).	Convenience sampling was used. Test sensitisation that threatened internal validity. Interaction between pre-test and intervention may have threatened external validity. Multiple educational interventions (p 66).	Sample size affecting primary outcome. The differences in academic potential of students may have an influence. Concurrent learning (p 133, 136-137).	Constrained study design within curriculum. The prior knowledge of the students may provide an influence. Simulator practice bias may provide an advantage to the simulation group. Variability in PBL measurement due to oral feedback (p 155-156).
Funding source	Funded by the Sulzberger Educational Grant from the American Academy of Dermatology. Declared no conflicts of interest (p e165).	No funding sources indicated.	No funding sources indicated.	Funded by the David Geffen School of Medicine at UCLA Los Angeles (p 151).

CBL=Case-based learning. HPS=Human patient simulation. SIM=Simulator learning. PBL=Problem-based learning. ACS=Acute Coronary Syndrome. eDerm=Web-based learning. OSCE=Objective Structured Clinical Examination.

4.3.2. DATA DISPLAY AND COMPARISSON

Matrices, graphs, charts, tables or networks used to display data from the primary studies enhance visualisation of patterns and relationships across and within the primary sources (Whittemore & Knafl, 2005: 550). All relevant information to facilitate comparison of characteristics, variables and findings of the studies are included in the display tables. More than obvious data were included in the subgroupings in order to facilitate identification of limitations, gaps, patterns, relationships and any other aspects relevant to the educational techniques.

De Sousa *et al*. (2010: 104) recommend the use of a display table to minimise transcription error and to serve as a record. All the tables provide detail of the primary studies as supportive evidence for the conclusions drawn by the researcher (Whittemore, 2005: 61).

Data comparison provides the means of establishing patterns and themes, seeing plausibility, clustering, counting, making contrasts and comparisons, noticing patterns and building a logical chain of evidence (Whittemore & Knafl, 2005: 551). Data comparison provides the basis for summary, descriptive information and synthesis (Whittemore, 2005: 60). The following discussion demonstrates these directives as indicated by the findings based on themes.

4.3.2.1. RESEARCH FINDINGS BASED ON THEMES

Tabular summary of the contextual information of the studies, such as design, objectives and study populations help determine thematic similarities or dissimilarities (Academy of Nutrition and Dietetics, 2012: 61-62). The identified themes and tables include research purposes, research design, location site of the studies, study populations, sample size, allocation, attrition, characteristics of participants, intervention, data collection methods, outcomes and conclusions, exposure time to intervention and funding. The data display provides an initial subgroup classification and serves as a starting point (Whittemore & Knafl, 2005: 551). The researcher used the display table as point of departure to analyse the sample studies and a discussion of the associated themes accompany each table. Refer to Addendum E for complete delineation of included studies

RESEARCH PURPOSES AND EDUCATIONAL STRATEGIES

Three of the studies employed simulation to evaluate assessment and management (Lindsey & Jenkins, 2013: 61, 63; Schwartz, Fernandez, Kouyoumjian, Jones & Compton, 2007: 131; Steadman, Coates, Huang, Matevosian, Larmon, McCullough & Ariel, 2006: 152) and compared it with case-based learning (Schwartz *et al*., 2007: 131) and problem-based learning (Steadman *et al*., 2006: 152). Lindsey and Jenkins (2006: 64) do not identify the type of simulation but the description of the scenario with subtle changes in the human patient simulator as well as assigned roles of the other students, indicates that high fidelity simulation was used. Schwartz *et al*. (2007: 130) and Steadman *et al*. (2006: 151) indicate the use of high fidelity human patient simulators in their studies. Schwartz *et al*. (2007: 130) speak of high fidelity mannequin-based human patient simulation (HPS) and Steadman *et al*. (2006: 151) speak of full-scale, high fidelity patient simulation (SIM). Paige and Morin (2013: e481-482) indicated that there is a lack of clarity in the use of the terms simulation, fidelity and cueing. Simulation activity consists of the modality (the type of simulated model used), the scenario and cueing (the reality or conceptual cues as delivered by the equipment, patient or role characters). The fidelity matrix supplied by Paige and Morin (2013: e485) supply adequate directions to accept that high fidelity simulation was used in the studies. Dolev *et al*. (2010: e166) compared eDerm with clinical clerkship. eDerm is an online interactive curriculum consisting of 17 tutorials where the students have to diagnose and manage 85 clinical dermatology cases (Dolev *et al*., 2010: e166). eDerm is web-based learning. Refer to Addendum E for more detail.

RESEARCH DESIGN

All of the included studies were randomised controlled trials. Dolev *et al*. (2010: e166) used a crossover design and Lindsey and Jenkins (2013: 63) a pre-test–post-test two-group randomised experimental design. Both Schwartz *et al*. (2007: 130) and Steadman *et al*. (2006: 152) used a randomised comparison design. Refer to Addendum E for complete description of study designs.

LOCATION AND SITE

In the study of Dolev *et al*. (2010: e166) the web-based learning was completed on the internet on the students' own time and the standard clerkship consisted of 2 weeks clinical exposure in dermatology rotation. The School of Medicine at the

University of California San Francisco (USA) offered the introductory dermatology elective. Lindsey and Jenkins (2013: 61, 64-65) used the clinical simulation laboratory at a Midwestern public University in Illinois. Schwartz *et al*. (2007: 131) conducted their study at the School of Medicine, Wayne State University in Detroit. The CBL was supplied with classroom instruction and the HPS in a simulation laboratory within the Eugene Applebaum College of Pharmacy and Health Sciences. Steadman *et al*. (2006: 151-152) used the simulation centre in the Acute Care College at the University of California, Los Angeles and the PBL was conducted in a lecture room. All of the included studies were conducted in the United States, although in different states. Refer to Table 4.1 and Addendum E.

STUDY POPULATIONS, SAMPLE SIZE, ALLOCATION, ATTRITION AND COMPARABILITY

Three of the studies used medical students as study population and one used nursing students (Lindsey & Jenkins, 2013: 63). The medical students were fourth year students in three of the studies (Dolev *et al*., 2010: e166; Schwartz *et al*., 2007: 133; Steadman *et al*., 2006: 154). Dolev *et al*. (2010: e166) also included third year students. The nursing students were final semester nursing students (Lindsey & Jenkins, 2013: 64). Eligibility was decided by enrolment in the different programmes in three of the studies and one stated that the students needed to participate in a simulation day as part of the programme (Lindsey & Jenkins, 2013: 63). The study population included 274 eligible students in Dolev *et al*. (2010: e166), 79 in Lindsey and Jenkins (2013: 64), with 105 and 34 respectively in Schwartz *et al*. (2007: 133) and Steadman *et al*. (2006: 152).

The sample sizes ranged from 31 to 228 eligible students. Randomisations were conducted as follows; block randomisation in one study (Dolev *et al*., 2010: e168) and in the study by Lindsey and Jenkins (2013: 63) randomisation was performed by the investigators. Schwartz *et al*. (2007: 131) only mentions that randomisation took place on monthly bases as the students presented for the course. Computer randomisation was used by Steadman *et al*. (2006: 152) who also verified the gender distribution between groups using the chi-test as verification of the randomisation. One study used an all-female sample (Lindsey & Jenkins, 2013: 65). Both of the other two studies indicating gender show well-balanced gender distribution (Schwartz *et al*., 2007: 130; Steadman *et al*., 2006: 154). Only Lindsey and Jenkins

(2013: 63) and Schwartz *et al*. (2007: 131) indicate the age of the sampled students but the samples all consist of senior students. Schwartz *et al*. (2007: 132) determined the sample size power by using the formula by Lauter for MANOVA study designs. Achieving a strong power of 0.80 with a significance level set at 0.05 would require 46 participants in each group that was reached in the groups used. None of the other studies indicated sample size power.

Three of the studies indicated attrition rates whereas all the students participating in the study by Lindsey and Jenkins (2013: 63, 64), completed the study. Both Steadman *et al*. (2006: 154) and Schwartz *et al*. (2007: 132) had to exclude three students each due to failure of attending the lectures. In the study by Dolev *et al*. (2010: e168) 22 students did not finish the intervention or assessment due to technical problems for four of the students and no discernable reason for the remainder.

The pre-test scores in three of the studies were similar but no pre-test was performed in Schwartz *et al*. (2007: 130-133). There were no significant differences between the groups regarding speciality interest, cardiac arrest experience and self-rated learning style. Self-rated learning styles were determined by the Barsch Learning Styles Inventory and were similar overall (p=0.558). Steadman *et al*. (2006: 152) indicated the speciality interest was in anaesthesiology, emergency medicine and critical care.

Prior exposure was indicated in three of the studies (Dolev *et al*., 2010: e168; Lindsey & Jenkins, 2013: 65; Schwartz *et al*., 2007: 133).

The initial, final and group distributions for sample sizes as well as the attrition rates are provided in Table 4.2.

Table 4.2 Study populations, sample size, allocation, attrition and comparability

Study populations, sample size, allocation and attrition				
Reference	(Dolev *et al*., 2010: e166)	(Lindsey & Jenkins, 2013: 64)	(Schwartz *et al*., 2007: 131)	(Steadman *et al*., 2006: 152)
Population	Eligibility of 274 students was determined by enrolment in an introductory dermatology elective. Enrolled 3rd (n=55) and 4th (n=219) year medical students were eligible for the trial (n=274) (p e166). (e166-168).	Eligibility of 70 students was determined by participation in a clinical simulation day as part of the programme. Enrolled final year nursing students (n=79) were eligible for the study (p 64).	Eligibility of 105 students was determined by enrolment in 2005 in a mandatory month-long emergency clerkship. Enrolled fourth year medical students (n=105) were eligible for the study (p 133).	Eligibility of 34 students was determined by enrolment in a week-long acute care course. Enrolled fourth year medical students were eligible for the study (n=34) (p152).
Randomisation technique	Block randomisation of students from 2005 to 2007 into two equal groups namely arm 1 and arm 2 (n=114). Blind inclusion of the first 38 students allowed for balanced design with no mention of age, gender and race in randomisation process. The three tests, pre-test, post-test 1 and post-test 2 were randomly rotated by user identification with	Randomisation was done by the investigators into a control (n=39) and intervention group (n=40). The students consisted of 20-22 year old Caucasian females (p 63, 65).	Randomisation took place monthly during 2005 as the students presented for the month-long course. Students were randomised into a CBL (n=52) and HPS (n=50) group. The students had a mean age of 26.7 years and ranged from 22-44 years of age with 52.0% males and no mention of race. The exact method of randomisation was not discussed further (p 130,	A computer randomisation programme randomised the students into two groups, SIM (n=15) and PBL (n=16). The gender distribution between the two groups was determined using a chi-square test to verify the randomisation process with 69% female in PBL group and 60% in SIM group (p 152-153).

Study populations, sample size, allocation and attrition				
Reference	(Dolev *et al*., 2010: e166)	(Lindsey & Jenkins, 2013: 64)	(Schwartz *et al*., 2007: 131)	(Steadman *et al*., 2006: 152)
	balanced exposure across the three tests (p e168).		131).	
Power	None mentioned.	None mentioned.	The sample size formula by Lauter for MANOVA study designs was used and indicated 46 participants in each group would be needed to achieve a strong power (0.80) when the significance level is set at 0.05 (p 130-133).	None mentioned.
Attrition rate	18 participants stopped during study and 4 participants declared inability to finish. n=22 students did not complete (p e168).	No attrition (p 65).	Students who did not attend the initial lecture were excluded n=3 (p 131).	Students who did not attend any portion of the week-long course were excluded n=3 (p 152, 154).
Number of sample allocated to intervention/ comparison group	Arm 1: n=114 (p e167).	Intervention group n=40 (p 64).	HPS n=50 (p 133).	SIM n=15 (p 152).

Study populations, sample size, allocation and attrition				
Reference	(Dolev *et al*., 2010: e166)	(Lindsey & Jenkins, 2013: 64)	(Schwartz *et al*., 2007: 131)	(Steadman *et al*., 2006: 152)
Number of sample allocated to control/ comparison group	Arm 2: n=114 (p e167).	Control group n=39 (p 64).	CBL n=52 (p 133).	PBL n=16 (p 152).
Total sample size	Final n=228 (p e166).	Final n=79 (p63).	Final n=102 (p 133).	Final n=31 (p 152).
Comparability of groups				
Age	Fourth and third year students, no specific age mentioned (p e166).	Final semester students of 20-22 years old (p 63, 65).	Fourth year students (p 131). Mean age of 26.7 years, range 22-44 years (p130).	Fourth year students no specific age mentioned (p 152).
Gender	None mentioned.	Sample =female (p 65).	Male 52.0% (p 130).	Female 60% in SIM, female 69% in PBL (p 154).
Race	None mentioned.	Caucasian (p 65).	None mentioned.	None mentioned.
Prior exposure	Dermatology experience in totalled 142, Arm 1 n=70 and in Arm 2 n=72 with the Fisher exact test *P*=.89 (p e168).	Students that have heard of rapid response n=27 (34%), witnessed rapid response n=31 (39%), participated in rapid response n=9 (11%) and students unfamiliar with rapid response n=4 (5%) (p 65).	There was no difference between the groups regarding speciality interest (*p*=0.844), cardiac arrest experience (0.116). Six students in the HPS group had not witnessed resuscitation (*p*=0.558) (p	No prior exposure mentioned but the speciality interest was in anaesthesiology, emergency medicine and critical care (p 152).

Study populations, sample size, allocation and attrition				
Reference	(Dolev *et al*., 2010: e166)	(Lindsey & Jenkins, 2013: 64)	(Schwartz *et al*., 2007: 131)	(Steadman *et al*., 2006: 152)
			131-133).	
Learning styles	None mentioned.	None mentioned.	Self-rated learning styles were determined by the Barsch Learning Styles Inventory and were similar overall (p=0.558) (p 130, 133).	None mentioned.
Pre-test scores	Similar in both groups. Diagnosis 3.8.1% versus 38.3%, p=.94 and management 54.7% versus 55.1% P=.87 (p e168).	Similar in both groups. Pre-test scores in control group M=57.05, SD=16.47 and intervention group M=61.07, SD=17.19 (p 65).	No base-line pre-test was done (p 131).	The mean initial scores between the groups were similar p=.64 (p 154).

CBL=Case-based learning. HPS=Human patient simulation. SIM=Simulator learning. PBL=Problem-based learning.

INTERVENTION

A short description of the interventions follows, demonstrating the variety employed in the studies. The description takes place according to the authors.

i. Dolev *et al*. (2010: e166-e168)

An eDerm computer-based programme introduced at the beginning and end of a two-week clinical clerkship in a crossover design consisted of 17 tutorials. The eDerm consisted of a lecture providing information on pigmented and non-pigmented skin lesions with information on clinical features and differential diagnosis of melanoma, non-melanoma, skin cancers, nevi and benign dermatoses on 85 clinical cases. The tutorials consisted of short, intensive discussions and provided imaging of visual features needed to evaluate skin lesions. The students used a designated user identification to log in blinded to the investigators.

Clerkship, as standard practice, consisted of 2 weeks of 14 half-day outpatients' clinics, including dermatology, dermatology surgery, paediatric dermatology and other specialities averaging 10-14 patient/day.

ii. Lindsey and Jenkins (2013: 64-65)

The traditional Code Blue scenario included a 10-minute lecture provided by the clinical laboratory faculty. The lecture dealt with Code Blue situations and 2 minutes were devoted to rapid response calls.

The rapid response intervention included a 10-minute lecture instead of only 2 minutes. The students received a hand-out with the lecture content. The students then participated in a guided rapid response simulation followed by debriefing.

All participants received the rapid response education. Debriefing of the control group focussed on Code Blue and debriefing of the intervention group focussed on events for rapid response, namely emphasising key information, deepening understanding of clinical instability and promotion of clinical judgement.

iii. Schwartz *et al*. (2007: 131-132)

The students received an initial lecture at the beginning of a month-long mandatory clerkship in emergency medicine. The lecture contained information on emergency

management of acute chest pain and the students were provided with reading material on acute coronary syndrome (ACS) and the core objectives.

The intervention included the case-based learning (CBL) session (1h) and received a vignette of a patient with classic ACS. Participants in the CBL group had to determine the proper history, work-up, management and disposition of the patient. After discussion, the group received the advanced cardiac life support protocols for ventricular tachycardia and fibrillation. The human patient simulation (HPS) session (1h) included a 15-minute mannequin orientation explaining all features. Division of the group into smaller groups of 4-6 students took place and each group had to determine the proper assessment, management and disposition of a patient with ACS, ventricular fibrillation and tachycardia. Debriefing included correct management of the case and was similar to the discussion of the CBL group. The vignette and the simulated case were identical. Both groups used identical equipment. At the end of clinical rotation, all participants took part in an ACS OSCE.

iv. Steadman *et al*. (2006: 152-153)

All students received reference material at the beginning of the course for lectures on altered vital signs, abdominal pain and dyspnoea. The lecture presented information on vital signs before the initial assessment and on abdominal pain and dyspnoea before the intervention (p 153). Both groups, simulation group (SIM) and problem-based group (PBL), received orientation and an initial assessment SIM session on altered vital signs. After randomisation, the students were equivalently orientated to the simulator. All students received a PBL and SIM intervention in abdominal pain and dyspnoea. PBL received dyspnoea in PBL and abdominal pain in simulation and vice versa for the SIM. Management of the scenario took place in pairs over 15 minutes. The students received an hour-long debriefing aimed at consolidating and reinforcing their experiences. Both groups attended three simulation sessions, the initial assessment, the intervention session and a final assessment. Simulator assessment on the fifth day with a dyspnoea scenario completed the study. The main difference between simulation and PBL is the lack of simulation-based equipment. Refer to Table 4.1 and Addendum E.

DATA COLLECTION METHODS

One study used the internet to conduct all the evaluations employing user identification. Specific menus for diagnosing and management provided two scores ranging from 0-15 for each participant. Diagnosis validation took place by using biopsy proven diagnosis of the lesions. The investigators were blinded by user identifications. Previous evaluation proved the eDerm curriculum successful (Dolev *et al*., 2010: e166-e168).

Lindsey and Jenkins (2013: 63-64) used a multiple-choice survey with eleven questions allocated for different purposes. Five questions in the survey assessed knowledge about the purpose, function and anticipated outcomes. Another five assessed clinical judgement and one question assessed prior exposure. Experts in critical care and education determined the content validity of the instrument (Lindsey & Jenkins, 2013: 63-64).

Schwartz *et al*. (2007: 132) used a questionnaire determining general information about the participants. The same study used direct observation with a checklist containing 43 points evaluating performance on assessment, work-up and treatment as evaluation in an OSCE. The checklist provided three subscales, namely history (n=22), evaluation and management (n=13) and cardiac arrest management (n=8). Use of inter-rater reliability provided verification of the instrument (Schwartz *et al*., 2007: 132).

Steadman *et al*. (2006: 153) used simulation sessions for the initial assessment and two intervention sessions; one simulated and one PBL followed the initial assessment. The final assessment of both SIM and PBL groups took place on the simulator and evaluation took place by means of standardised checklists. The checklists, unique to each case scenario, consisted of assessment, diagnostic evaluation and management. Faculty members, experts in emergency medicine and anaesthesiology, assigned the point values to the checklists (Steadman *et al*., 2006: 153).

None of the studies used a statistically validated assessment tool and it is therefore a severe limitation of the studies. Refer to Table 4.1 and Addendum E.

OUTCOMES AND CONCLUSIONS

Two of the studies incorporated prior experience of the intervention in the study. Dermatology experience was similar in both groups according to Fischer exact test *p*=.89. Dermatology experiences in the groups in Arm 1 were 70 and 72 in Arm 2 (Dolev *et al*., 2010: 89). Participants in the Lindsey and Jenkins (2013: 65) research indicated prior knowledge of intervention. Question 11 in the multiple-choice survey measured prior knowledge. Results indicated that prior knowledge had little effect on pre-test scores as gaps in knowledge were reduced as demonstrated by post-test scores (Lindsey & Jenkins, 2013: 65). Refer to Addendum E.

Three studies used pre-test as a baseline in the research with similar results for the groups in each study (Dolev *et al*., 2010: e166; Lindsey & Jenkins, 2013: 65; Steadman *et al*., 2006: 154). The same three studies indicated statistical significant post-test scores based on comparison with pre-test scores (Dolev *et al*., 2010: e168; Lindsey & Jenkins, 2013: 65; Steadman *et al*., 2006: 154). Dolev *et al*. (2010: e168) found that the eDerm curriculum alone provides significant improvement in diagnostic and management skills while Lindsey and Jenkins (2013: 65) found improvement in both knowledge and clinical judgement. Assessment and management improved as demonstrated by the SIM group versus the PBL group. The two raters who assessed the final performance were blinded to the group assignment of the students (Steadman *et al*., 2006: 153-154). The same three studies demonstrated improvement in clinical judgement according to the inclusion criteria for the current study. Refer to Table 4.1 and Addendum E.

One study indicated no significant difference in outcome between the use of CBL or HPS (Schwartz *et al*., 2007: 133). There was no difference in the subscale measurement of history taking, acute coronary syndrome evaluation and management and cardiac arrest management. The trained evaluator and physicians scoring the results were blinded to the training protocol of the students (Schwartz *et al*., 2007: 132). Closer interpretation by the researcher of the outcomes indicated that when the outcomes are viewed according to the subscales both groups demonstrated clinical judgement reached as follows: the subscales of acute coronary syndrome evaluation and management and the cardiac management items were respectively n=13 items and n=8 items. Comparison of the percentages was indicated for each group. The AMI evaluation and management indicated mean

percentage scores of all the items as CBL=69.2% and HPS=66.9% and the cardiac management scores indicated CBL=81% and HPS=87.5%. The scores indicate how both groups performed with regard to clinical judgement regardless if one could not be proven superior to the other. Refer to Addendum E.

One study demonstrated the importance of the order of the intervention, where the application of the eDerm after the clerkship had the most effect (Dolev *et al*., 2010: e168) and another demonstrated the effectiveness of sequential application of two educational strategies (Steadman *et al*., 2006: 154). Results also indicated an increase in knowledge in one study (Lindsey & Jenkins, 2013: 65) and measurement of assessment and diagnosis by the other three studies (Dolev *et al*., 2010: e168; Steadman *et al*., 2006: 154; Schwartz *et al*., 2007: 132). Refer to chapter 2 regarding critical thinking and clinical reasoning. All four studies measured both diagnostic ability and management skills (Dolev *et al*., 2010: e168; Lindsey & Jenkins, 2013: 64; Schwartz *et al*., 2007: 132; Steadman *et al*., 2006: 154), although in one of the studies diagnosis of impending cardiac failure was inferred through the assessment (Lindsey & Jenkins, 2013: 64). Refer to Table 4.1.

Dolev *et al*. (2010: e170) reached the following additional conclusions. The use of the eDerm curriculum alone is enough to improve diagnosis and management and could be used as an alternative for the clinical elective. The crossover design provided proof that the knowledge obtained from the eDerm curriculum is additive to the clerkship as the arm assignment and time interaction provided the highest improvement. The eDerm provided consolidation of the knowledge learned in the clinical situation, acting as an advanced organiser of vocabulary and scaffolding for learning. During the clinical clerkship, the student has contact with real patients, providing a bigger picture and the eDerm provides focus on individual lesions. Another outcome is the suggestion that it is easier to teach management than diagnosing as the results indicated higher management scores than diagnostic scores. Steadman *et al*. (2006: 154) provided an additional statement to the results, namely that the study found that preceding simulation with PBL provide improved learning. The findings of the studies are displayed in Table 4.3. Refer to Table 4.1.

Table 4. 3 Finding of studies

Findings/outcomes of studies					
Prior experience of intervention	Statistical significant post-test scores	Order of intervention	Increase in knowledge as stated* by authors	Increase in diagnostic skills as stated*	Increase in management skills as stated*
(Dolev *et al*., 2010: e168) (Lindsey & Jenkins, 2013: 65)	(Dolev *et al*., 2010: e168) (Lindsey & Jenkins, 2013: 65) (Steadman *et al*., 2006: 154)	(Dolev *et al*., 2010: e168)	(Lindsey & Jenkins, 2013: 65)	(Dolev *et al*., 2010: e168) (Steadman *et al.,* 2006: 154)	(Dolev *et al*., 2010: e168) (Lindsey & Jenkins, 2013: 64) (Steadman *et al.,* 2006: 154)
Percentage in outcome indicated clinical judgement reached	Sequential application of two educational strategies	Increase in knowledge inferred** through assessment and diagnosis	Diagnostic skill inferred** by taking action after assessment		
(Schwartz *et al.,* 2007: 133)	(Steadman *et al*., 2006: 154)	(Dolev *et al*., 2010: e168) (Steadman *et al*., 2006: 154)	(Lindsey & Jenkins, 2013: 64)		

*As stated=stated as findings in the studies. **Inferred=improving clinical judgement indicates automatic increase in knowledge and diagnostic skill (refer to Chapter 2).

LIMITATIONS OF THE STUDIES

Dolev *et al*. (2010: e170) considered the lack of delayed testing as limitation as well as the small number of melanoma lesions in the eDerm curriculum. In spite of having used randomisation Lindsey and Jenkins (2013: 66) consider the use of a convenience sample of selected senior nursing students from one nursing college as a limitation. Test sensitisation may have resulted from the pre- and post-test creating an internal threat to validity while external validity may be threatened by interaction between the pre-test and education intervention (Lindsey & Jenkins 2013: 66). In addition, a possible limitation was the close succession of multiple educational interventions (Lindsey & Jenkins, 2013: 66). Schwartz *et al*. (2007: 133) indicate that the sample size limitations could provide an impact on the primary outcome. Furthermore, despite randomisation, the baseline academic achievement differences in the groups could influence internal validity as previous experience and training was not statistically controlled. Concurrent learning between intervention and outcome may also influence validity (Schwartz *et al*., 2007: 136-137). The design of the study by Steadman *et al*. (2006: 155-156) have been constrained by the need to meet curricular objectives and the prior knowledge and skills of the students are demonstrated by the equivalent management in the initial assessment cases. Although addressed by providing both groups with equal simulator practice, the SIM group may have obtained an advantage due to simulator practice bias. In contrast to simulation, the PBL group had to rely on instructor feedback that may vary (Steadman *et al*., 2006: 155-156).

Both Lindsey and Jenkins (2013: 66) and Steadman *et al*. (2006: 155) recognise the sensitisation to the pre- and post-tests in simulation and Schwartz *et al*. (2007: 134) acknowledge the possibility of sensitisation to a simulation intervention. Limitations of the studies are displayed in Table 4.4.

Table 4. 4 Limitations as stated in studies

Limitations as stated in the studies			
(Dolev *et al*., 2010)	(Lindsey & Jenkins, 2013)	(Schwartz *et al*., 2007)	(Steadman *et al*., 2006)
No delayed testing of subjects. Small number of melanoma lesions in eDerm curriculum (p e170).	Convenience sampling. Test sensitisation that threatened internal validity. External validity threat of interaction between pre-test and intervention. Multiple educational interventions (p 66).	Sample size affecting primary outcome. Differences in academic potential of students. Concurrent learning (p 133, 136-137).	Constrained study design within curriculum. Prior knowledge of students. Simulator practice bias. Variability in PBL measurement due to oral feedback (p 155-156).

EXPOSURE TIME

Intervention times ranged from one to 30 days. None of the studies performed delayed testing to determine long-term learning retention. The diverse times of exposure do not facilitate a relevant conclusion. Refer to Table 4.1 and Addendum E.

FUNDING

According to Tricco *et al*. (2008: 424, 434) funding may lead to association with positive outcomes and defined funding bias as biases in design, outcome and reporting of sponsored research. Lindsey and Jenkins (2013) and Swartz *et al*. (2007) declared no funding sources. Dolev *et al*. (2010: e165) declared no conflicts of interests from their funding source and Steadman *et al*. (2006: 151) indicated funding from the David Geffen School of Medicine. All the studies indicated positive outcomes with the exception of Swartz *et al*. (2007: 131). It is reasonable to expect that funding bias is absent. Refer to Table 4.1 and Addendum E.

CHARACTERISTICS OF THE EDUCATIONAL STRATEGIES

The following educational design factors were identified from the four studies, namely authenticity, active student engagement, interactive learning, cooperative learning, learner-focussed education and scaffolding. In a couple of instances a literature search confirmed the same design factors in the educational strategies used by the four studies but the independent sources are specifically indicated. Learning transfer focuses on performance. Performance is the measurement in

competence based learning and both Kolbe's and Merrils theories include these educational design factors. A short explanation will be provided on each.

Hardré (2013: 30-40) describes authenticity as the degree to which the learning experience represents the actual task or content in real life. All four of the primary studies indicated authenticity as a design factor of each of the relevant educational strategies (Dolev *et al*., 2010: e166; Schwartz *et al*., 2007: 131, 134; Lindsey & Jenkins 2013: 64; Steadman *et al*., 2006: 152).

Active student engagement is described by Trowler (2010: 7) as student participation in educationally effective practices where active and collaborative learning takes place; the students participate in challenging academic activities, are involved in enriching educational experiences and engage in formative communication with academic staff. Dolev *et al*. (2010: e168) describe the tutorials as actively engaging the students. Active student engagement is discussed by Schwartz *et al*. (2007: 131, 132) with regard to CBL and verbalisation by Steadman *et al*. (2006: 153) regarding PBL. The students actively took part during the high fidelity simulations (Lindsey & Jenkins, 2013: 64-65; Schwartz *et al*., 2007: 132; Steadman *et al*., 2006: 152-153). Hughes and Quinn (2013: 176, 183) indicate active student engagement as an educational design factor of web-based learning and Biggs and Tang (2011: 181) indicate active student engagement with regard to PBL.

Interactive learning is described as when the student is emotionally and intellectually engaged with the learning material and occurs when students are able to actively control and manipulate the learning material (McLaughlin & Oliver, nd: Online). Both, Dolev *et al*. (2010: e166) and Steadman *et al*. (2006: 151, 154) indicated interactive learning as necessary for effective learning with regard to web-based learning, simulation and PBL. The students interacted actively with the learning material, each other and the scenario during simulation (Lindsey & Jenkins, 2013: 152; Schwartz *et al*., 2007: 131; Steadman *et al*., 2006: 151). Howard (2007: 4) describes the case study as an interactive technique and the students used interactive learning during solving of the case presented during case-based learning (Schwartz *et al*., 2007: 131).

Cooperative learning is a form of active learning where students work together on teams on an assignment or project where certain conditions prevail. The conditions

are: face-to-face interaction needs to take place, individual accountability, interpersonal and small group skills are needed and group review to improve effectiveness (Foundation Coalition, 2006: Online). Steadman *et al*. (2006: 153) consider both simulation and PBL as cooperative learning techniques while Biggs and Tang (2011: 163, 165) consider case-based learning as employing cooperative learning. Working in groups involves cooperative learning such as in CBL, PBL and high fidelity simulation (Lindsey & Jenkins, 2013: 64-65; Schwartz *et al*., 2007: 131-132; Steadman *et al*., 2006: 153).

Learner-focussed instruction is a global shift from teacher-centred instruction towards a focus on learning outcomes. The focus is on what the student is expected to learn by creating student-centred educational environments (Commitee on Academic Programs and Teaching, 2005-2006: Online). Dolev *et al*. (2010: e170) and Steadman *et al*. (2006: 151) indicated web-based and simulation learning as learner-focussed. Schwartz (nd: 1) considers case-based learning as learner-focussed and Allen, Donham and Bernhardt (2011: 26) indicated PBL as learner-focussed. As the students in all the studies had to solve the problems presented by themselves, all the educational strategies can be considered learner-focussed (Dolev *et al*., 2010: e170; Lindsey & Jenkins, 2013: 64-65; Schwartz *et al*., 2007: 131-132; Steadman *et al*., 2006: 151).

Scaffolding of a learning experience is a combination of ensuring that the learning environment, instructional plan, supporting resources and instructional delivery are structured in such a way that best supports learning (Foley & Kaiser, 2013: 9). Dolev *et al*. (2010: e170) see eDerm as a form of scaffolding. None of the other studies indicates scaffolding as a characteristic of the educational techniques used and the research is unable to provide an objective view. The educational design factors (characteristics) are displayed in Table 4.5.

Table 4. 5 Characteristics of the educational strategies

Educational design characteristics				
Educational characteristics	eDerm	Case-based learning	Simulation	Problem-based learning
Authenticity	(Dolev *et al*., 2010: e166)	(Schwartz *et al*., 2007: 131)	(Schwartz *et al*., 2007: 134) (Steadman *et al*., 2006: 152) (Lindsey & Jenkins, 2013: 64)	(Steadman *et al*., 2006: 152)
Active student engagement	(Dolev *et al*., 2010: e168) (Hughes & Quinn, 2013: 176, 183)	(Schwartz *et al.,* 2007: 131)	(Lindsey & Jenkins, 2013: 64-65) (Schwartz *et al*., 2007: 132) (Steadman *et al*., 2006: 152-153)	(Steadman *et al*., 2006: 153) (Biggs & Tang, 2011: 181)
Interactive learning	(Dolev *et al*., 2010: e166)	(Schwartz *et al*., 2007: 131) (Howard, 2007: 6)	(Lindsey & Jenkins, 2013: 152) (Schwartz *et al*., 2007: 131) (Steadman *et al*., 2006: 151)	(Steadman *et al*., 2006: 151, 154)
Cooperative learning	None	(Schwartz *et al.,* 2007, 131) (Biggs & Tang, 2011: 163, 165)	(Lindsey & Jenkins, 2013: 64-65) (Schwartz *et al*., 2007: 131-132) (Steadman *et al*., 2006: 153)	(Steadman *et al*., 2006: 153)
Learner-focussed education	(Dolev *et al*., 2010: e170)	(Schwartz *et al*., 2007: 131-132) (Schwartz, nd: 1)	(Lindsey & Jenkins, 2013: 64-65) (Schwartz *et al*., 2007: 131-132) (Steadman *et al*., 2006:	(Steadman *et al*., 2006: 151) (Allen *et al*., 2011: 26)

Educational design characteristics				
Educational characteristics	eDerm	Case-based learning	Simulation	Problem-based learning
			151)	
Scaffolding	(Dolev *et al*., 2010: e170)	None	None	None

4.3.3. CONCLUSION DRAWING AND VERIFICATION

The interpretation and synthesis of the data used in the analysis are compared to the theoretical references. It includes stressing the inclusions and inferences, and provides an explanation of biases (De Sousa *et al*., 2010: 104-105). Whittemore and Knafl (2005: 551) confirm this by stressing verification with the primary sources as was done in the preceding tables. The final step in the data analysis is the drawing of conclusions from sub-groupings to provide an integrated summation of findings (Whittemore & Knafl, 2005: 551). The current study is constrained in drawing conclusions due to the limited number of primary studies. The researcher finds the iterative process suggested by Crawford *et al*. (2010: Online) suitable under the limiting circumstances in order to suggest possible interpretations of the available studies.

The topic summary, key summary and discussion on each follow. The summaries conclude the iterative process of the integrative literature review and relates only to the findings of the four studies.

4.3.3.1. TOPIC SUMMARY

Data extracted from the thematic tables provide a topic summary (Crawford *et al*., 2010: Online). Crawford *et al*. (2010: Online) warn against ignoring other interesting topics and avoiding exclusion of pertinent evidence. The topic summary supplies identified topics related to the research question.

- Randomised control trials used for evidence
- The research of the four studies focussed on clinical judgement.
- Healthcare students in medicine and nursing were used in the studies.
- The interventions used included web-based learning, case-based learning, problem-based learning and simulation.
- Web-based learning, with well-defined educational design factors, is an effective educational strategy on its own, but was found to be most effective after clinical exposure; in other words, a time-based intervention where importance is attached to when the intervention is applied.
- High fidelity simulation was found superior to problem-based learning.
- Problem-based learning followed by high fidelity simulation, improved clinical judgement.

- Case-based and simulation-based educational strategies were found to be equally effective.
- Both high fidelity simulation and case study learning improved clinical judgement.
- Increase in knowledge, diagnostic skills and management skills were found in all of the studies.
- Common characteristics exist between the educational design factors inherent to the educational strategies.

According to Crawford *et al*. (2010: Online) a key summary of evidence should follow on a topic summary.

4.3.3.2. KEY SUMMARY OF THE EVIDENCE BASED ON THE TOPIC SUMMARY RESULTS

Data extracted from the topic summary provides key summaries of the results (Crawford *et al*., 2010: Online). The key summary of evidence provides brief overarching and synthesised concepts extracted from the topic summary. The key summary should answer the research question, but do not provide grounds for generalisation of the statements made.

- Learning transfer as demonstrated by clinical judgement is supported by web-based, simulation-based and case-based learning when these strategies adhere to the design.
- Educational design factors inherent to the educational strategies promote learning transfer, such as authenticity, active student engagement, interactive learning, cooperative learning and learner-focussed education, also scaffolding with web-based learning.
- Educational strategies such as web-based, case-based and high fidelity simulation that meet the educational design requirements of authenticity, improve clinical judgement without alliance with another educational strategy.
- Sequential incorporation of learning activities incorporating cognitive, psychomotor and psychological domains, promotes the development and application of clinical judgement and is viewed as a way of scaffolding.

- Application of web-based learning preceded by clinical practice promotes the development and application of clinical judgement when the web-based learning is supported by adequate educational design factors.

The key summaries are refined and used to develop key statements. The summaries and statements are not to be considered part of the fundamental conclusion as there exists a shortage of evidence.

FIRST KEY STATEMENT

First statement
Learning transfer as demonstrated by clinical judgement is supported by web-based, simulation-based and case-based educational strategies when these strategies adhere to the design principles.

The major aim of any educational programme or strategy is to promote learning and transfer of learning. As seen in Chapter 2, transfer of learning occurs when the students' performance reflects application of knowledge and skills in different settings or situations (Blume *et al*., 2010: 1067). Helsdingen Van Gog and Van Merrienboer (2011: 383) stated that test tasks after education that are similar to the educational tasks as well as transfer to new tasks might be better indicators of changes in behaviour and maintenance of learning. The interventions used in the four studies demonstrated this by using similar test tasks and new tasks.

Dolev *et al*. (2010: e166) provided web-based tutorials that were similar, but also different (new tasks) to those encountered in the clinical practice. Lindsey and Jenkins (2013: 64) provided the students with a lecture and reading material about the rapid response intervention and the students thereafter were confronted with similar material in a new task in the form of a simulation.

Schwartz *et al*. (2007: 131-132) provided the case-based group with a vignette and the simulation group with the same task as the CBL group in simulation format; both groups were then confronted with a similar task in the form of a simulation. In spite of the difference, both groups performed equally. Steadman *et al*. (2006: 152-153) did not repeat the intervention scenarios during the final assessment and provided unique final assessment scenarios.

Three of the studies demonstrated improved clinical judgement according to the inclusion criteria of the current study and although Schwartz *et al*. (2007: 133) demonstrated no significant difference between case-based and simulation-based training, clinical judgement was demonstrated using both strategies. Three studies used high fidelity simulation (Lindsey & Jenkins, 2013: 64; Schwartz *et al*., 2007: 131-132; Steadman *et al*., 2006: 151-152). Web-based learning and case-based learning were used by single studies (Dolev *et al*., 2010: e166-e167; Schwartz *et al*., 2007: 131-132), providing single instances of attaining clinical judgement regarding educational strategies.

Clinical judgement is conclusions or interpretations about the condition of a patient, whether or not action should be taken according to standard, improvised or new approaches as seems appropriate according to the patient's response (Tanner, 2006: 204). Furthermore, Alfaro-LeFevre (2013: 70) stated that clinical judgement is the result of critical thinking and clinical reasoning; therefore, it involves decision making with information and knowledge leading to the application thereof to complete healthcare activities. The students in the studies used critical thinking and clinical reasoning to apply clinical judgement.

A critical element of learning transfer is that behavioural changes from a learning experience should persist over time (Blume *et al*., 2010: 067; Subedi, 2004: 591). None of the studies performed delayed testing. The permanence and learning transfer of the changes from the learning experiences are therefore in question.

The preceding discussion focussed on transfer of learning. Although educational strategies are mentioned in the statement, the mentioned strategies will be discussed under the third key statement as the focus is on the different strategies.

SECOND KEY STATEMENT

Second statement
Educational design factors such as authenticity, active student engagement, interactive learning, cooperative learning, learner-focussed education and scaffolding promote transfer of learning.

The characteristics of educational design strategies, such as authenticity, active student engagement, interactive learning, cooperative learning, learner-focussed

education and scaffolding are highly acclaimed in the literature. Scaffolding as design criteria is not discussed because key statement four addresses sequencing as component of scaffolding.

Learning content is authentic when task, concept or experience reflects the practical situation. Dolev *et al*. (2010: e166) used real-life clinical cases in the tutorials and three of the studies used high fidelity simulation (Lindsey & Jenkins, 2013: 64-65; Schwartz *et al*., 2007: 131-132; Steadman *et al*., 2006: 152-153). Schwartz *et al*., (2007: 131) and (Steadman *et al*., 2006: 152) used an authentic case scenario in the case-based learning and problem-based learning. As stated in Chapter 2, there exists a mismatch between textbook descriptions of clinical practice and the reality of clinical practice (authenticity), and pedagogical strategies that integrate clinical practice will reduce the theory-practice gap. Authenticity in learning provides learners with a view of practice, demonstrating the task, experience or context. Increased learning takes place when the context of the learning task closely relates to the context of the practice, (authenticity). Simulation mimics clinical practice in a safe environment; therefore it promotes learning transfer (Norman, Dore & Grierson, 2012: 637). Authentic learning experiences indicate the 'when' and 'how' of a task to the learner and the relevance of learning information to the actual performance of the task (Hardré, 2013: 39). Grossman and Salas (2011: 112) suggest that relevancy in educational content provides experience to target behaviours in the work environment. Confirmation by Norman *et al*. (2012: 637) state that the closer the context of learning is to the context of practice the better learning will take place. Holton III *et al*. (2007: 391) indicated that educational tasks and tasks applied in the work environment should be similar.

Four basic principles underlie research of content validity in the educational design, namely, identical elements theory, general principles theory, stimulus variability and the conditions of practice. The identical elements theory refers to elements that must be identical in stimulus and response in the setting. Identical elements increase retention of motor and verbal behaviours (Burke & Hutchins, 2007: 274; Lawler, Curry, Donnenwirth, Mangrich and Times, 2012: 403). General principles theory includes the teaching of general rules and theoretical principles and not just skills applicable to the work environment. Supplying a variety of educational

examples increase transfer in stimulus variability and the principle of conditions of practice include feedback, massed or distributed training and overlearning (Bhatti & Kaur, 2010: 659; Holton III *et al*., 2007: 390-391; Lee, 2009: 137; Saks & Belcourt, 2006: 632). Holton III *et al*. (2007: 391) condense this description, educational tasks and tasks applied in the work environment should be similar. Lee (2009: 135, 138) indicated that near transfer, as described in transfer theory development, happens with triggering of semi-automatic responses when the novel material has similar context as the previous knowledge and involve basic skills. Near transfer is associated with the identical elements theory (Lee, 2009: 138; Hung, 2013: 27-28). Far transfer involves deliberate abstraction from one context of learning to another context in a search for connections. The principles theory, stimulus variability and various conditions of practice involves far transfer (Lee, 2009: 135-136, 138). The use of different settings or situations supplied in the studies during interventions or final assessments provide opportunity of applying learning in different contexts and making the connections for learning transfer.

Authenticity in high fidelity simulation reflects the context of the practice. Paige and Morin (2013: e485) describe the fidelity matrix as containing dimensions namely the physical (equipment and environment) psychological (task and functional) and the conceptual. The level of fidelity is determined by the design, learner engagement and the conceptual content of the simulation. The levels include high, medium or low fidelity. The knowledge, skills and attitude (foundational knowledge) combined with the specific context (conditional knowledge) allows learning transfer from the cognitive domain to performance in specific settings, demonstrating functional knowledge/clinical judgement.

Eison (2010: 1-2) describes active learning strategies as involving students in thinking and doing in the activities, being involved with the activities. Dolev *et al*. (2010: e168) indicated that the students had to actively engage in choices provided upon two drop-down menus in the tutorials. The students actively participated in the high fidelity simulations during the studies where high fidelity simulation was used (Lindsey & Jenkins, 2013: 64-65; Schwartz *et al*., 2007: 131-132; Steadman *et al*., 2006: 152-153). Schwartz *et al*. (2007: 131) indicated that active student participation was sought during the case-based learning and the students were

actively engaged in determining the findings, diagnosis and treatment during the problem-based learning (Steadman *et al*., 2006: 153). It is the engagement of students in thinking creatively, expressing ideas, exploring their personal attitudes and values, receiving feedback and reflecting on the learning process. Educational research has indicated that academic achievement is positively influenced by the extent of active participation in the learning process (Trowler, 2010: 22). Active learning relates to foundational learning when the students are engaged in doing and observing with opportunities for reflection (Cahalan, 2011: 346). Students learn when involved with and experiencing the learning material. In learning transfer, the educational design and therefore the design factors have a direct influence on transfer of learning (Baldwin & Ford, 1988: 65-66).

Interactive learning involves active engagement of both teachers and learners in the learning material. The students interacted with the content of the tutorials during the web-based learning (Dolev *et al*., 2010: e166). The case-based and problem-based learning provided the students with the opportunity for interactive learning in solving the case, (Schwartz *et al*., 2007: 131: Steadman *et al*., 2006: 151, 153). During simulation, the students were interactive with other students, the learning material and the learning environment (Lindsey & Jenkins, 2013: 64-65; Schwartz *et al*., 2007: 131-132; Steadman *et al*., 2006: 152-153). Interactivity is considered in relation to other people, the content of the learning material and the learning environment (Dickieson *et al*., 2008: 2). Interactive engagement with the material boosts mastery of content (Stanford School of Medicine, 2014: Online). It provides a stronger learning stimulus and helps maintain the interest of the learner while providing the means for individual practice and reinforcement (Ruiz, Mintzer & Leipzig, 2006: 208). The interaction not only supports, but is also considered by some educators, to define the educational experience.

Cooperative learning involves the opportunities to work collaboratively in groups. The students logged on for the tutorials with individual user identification indicating no cooperative learning took place (Dolev *et al*., 2010: e168). Case-based learning and problem-based learning use cooperative learning to solve the cases as in both studies student participation and verbalisation were sought (Schwartz *et al*., 2007: 131; Steadman *et al*., 2006: 153). Cooperative learning is a given in all the high

fidelity simulation scenarios as the students have to work together as groups (Lindsey & Jenkins, 2013: 64-65; Schwartz *et al*., 2007: 131-132; Steadman *et al*., 2006: 153). The success of the group depends on the work of every individual (John Hopkins School of Education, 2014: Online). Furman and Sibthorp (2013: 19) describe cooperative learning as creating rich environments of learning between students, where the students learn from each other and past experience. Cooperative learning includes discourse, observation and interaction with peers. The use of cooperative learning groups emerged as an effective transfer instruction method (National Literacy Secretariat. Canada, nd: 7).

Higher education moved from a teaching to a learning paradigm. The movement towards a learner-centred focus has become a cornerstone in education. The role of the educator changed to that of a facilitator (Svinicki, 2010: 74). All four studies indicated a learner focus during the educational strategies. The students had to solve the problems themselves with the web-based, case-based, problem-based and simulation (Dolev *et al*., 2010: e170; Lindsey & Jenkins, 2013: 64-65; Schwartz *et al*., 2007: 131-132; Steadman *et al*., 2006: 151). Education or instruction is broadened to include activities producing the desired outcomes. Learner-focus education articulates what is expected of the students to learn (USC Centre for Excellence in Teaching, 2005-2006: 2). The knowledge, skills, attitudes and beliefs that the students bring to the educational setting is the focus of a learner-centred environment (Edgar, 2012: 5). Inability to comply with learner-focussed activities is considered a barrier to learning transfer (Thomas, 2007: 6).

Dolev *et al*. (2010: e170) was the only study indicating scaffolding. The discussion on scaffolding takes place under the fourth key statement recognising scaffolding as an important factor of sequencing. The educational design factors determine if and how learning takes place. Coordination and integration of knowledge, skills and attitudes/values forms the basis of declarative and procedural knowledge through which the student develops conditional and functional knowledge. Additionally, it is important to note that the educational design factors add a qualifier to the quality of the educational strategies used.

THIRD KEY STATEMENT

Third statement
Web-based, case-based and simulation-based educational strategies improved clinical judgement without alliance with another educational strategy when they adhered to the design principles of authenticity, active student engagement, interactive learning, cooperative learning, learner-focussed education and scaffolding.

Each of the educational strategies is able to accomplish learning transfer on their own when the strategies are based on proven educational design factors. The gap between the intended learning outcomes and the demonstrated behaviour of the students indicates a theory-practice gap (Grossman & Salas, 2011: 104). Web-based learning is considered all the educational interventions that use the internet with three broad classifications, namely tutorials, online discussion groups and virtual patients (Cook, 2007: 37). Dolev *et al*. (2010: e168) stated that web-based learning, used as tutorials in the study, alone has proven successful in increasing diagnostic and management skills. The web-based learning was found effective to such an extent that it is an effective alternative to clinical exposure but the material used in the tutorials was based on authentic clinical cases and proven through use by multiple learners (Dolev *et al*., 2010: e166). The effectiveness of web-based learning depends both on how well designed the web-based learning is and on the intended setting that includes the prospective learners (Cook, 2007: 37-38). Cook (2007: 37) indicates that tutorials in web-based learning should be structured in such a way as to facilitate learning. Links to online resources with self-assessment incorporated enhances tutorials. Zubas, Heiss and Pedersen (2005: 75) confirm the effectiveness of online tutorials as stand-alone educational strategy or as supplement to traditional classroom instruction. Cook (2007: 37) supports the use of authentic clinical cases as tutorials found to be effective in web-based learning made use of authentic patient studies. Lockyer, Moule and McGuigan (2007: 279) indicated transfer of learning into practice is possible with web-based learning.

Case-based learning can be defined in several ways depending on the discipline and ‘case’ used. Health professional education defines case-based learning as learning activities based on patient cases (Thistlethwaite, Davies, Ekeocha, Kidd,

MacDougall, Matthews, Purkis & Clay, 2012: 421). Case-based learning and simulation have proved successful in clinical judgement as individual techniques through statistics (Schwartz *et al*., 2007: 133-135) Case-based learning is based on real-life situations, require careful research and study by the student to obtain understanding of the scenario and promote the development of multiple perspectives (Jesus, Gomes & Cruz, 2012: 3). Furthermore, Jesus *et al*. (2012: 3-4) indicates that most studies confirm the effectiveness of case-based learning as an educational strategy as it allows the student to go through a decision making process by active participation. Lauder *et al*. (2004: 41) consider case-based learning as corresponding to how clinical expertise develops and is generalizable to general practice that is consistent with learning transfer. According to Malesela (2009: 3), the case study as method increases theory-practice integration and Macaulay and Cree (1999: 192) indicate case studies as a method to improve transfer of learning. Biggs and Tang (2011: 163) describe case-based learning as a method to reduce the theory-practice gap, as instrumental in moving from declarative knowledge to functional knowledge. Hughes and Quinn (2013: 227) state that case studies are one of the delivery methods of simulation. The relationship of the educational design principles of case-based learning and simulation have been discussed previously.

Issenberg, McGaghie, Petrusa, Gordon, & Scalese (2005: 10) discuss the effectiveness of simulation as educational strategy in a systematic review as the following. Simulation in broad terms is a person, device or set of conditions attempting to present education and evaluation of problems in an authentic manner (McGaghie cited in Issenberg *et al*., 2005: 11). Three of the studies employed high fidelity simulation with clinical judgement as result (Lindsey & Jenkins, 2013: 64; Schwartz *et al*., 2007: 131; Steadman *et al*., 2006: 151-152). Issenberg *et al*. (2005: 10) defined a list of uses in simulation leading to effective learning. The list included providing feedback, the use of clinical variations, a safe controlled environment and educational experiences where the learners are active participants. Maginnis and Croxon (2010: 3-5) state that clinical laboratories provides the simulated situations and activities that afford students with the opportunities to consolidate their knowledge, skills and problem solving strategies. Furthermore, a strong association was found between simulation where psychomotor skills were practiced and the clinical practice thereby reducing the theory-practice gap. High fidelity simulation

increase learning transfer where skills need to be adapted to respond in complex situations (Hardré, 2013: 44) and is a form of active learning where understanding is developed through active participation providing the opportunity to reduce the theory-practice gap (Clapper, 2010: e10). Simulation is considered an authentic educational strategy that, reduces the theory-practice gap (McCormick, Romero de Slavy & Fuller, 2013: 15).

FOURTH KEY STATEMENT

Fourth statement
Sequencing of learning opportunities that first stimulate cognitive thinking and thereafter afford the students the opportunity to practice psychomotor skills supports integration of theory and practice and promote development of clinical judgement.

Steadman *et al*. (2006: 152, 154) stated that their findings supported the hypothesis that incorporating PBL with simulation leads to improved performance. The simulation group first received a PBL session (cognitive session) followed by a simulation session (integration of theory and practice) before assessment in final simulation. Problem-based learning is considered as one of the most distinctive teaching methods based on a cognitive perspective of learning (Yilmaz, 2011: 208-209). One of the possible reasons for failure of optimal learning transfer during PBL is that the educational design does not provide opportunities to apply the theory in practice (Holton III, 1996: 14) as simulation would provide. According to Edwards (2013: 13) transfer of learning is not limited to cognitive learning, but also includes the internal and external elements affecting the educational process and eventually the level of transfer and the performance that occurs. The primary external and internal factors are the educational design, the work environment and the characteristics of the learner. One of the greatest problems in learning is the failure of students to see the relationship between what is learned and how to apply newly learned material in a different context such as the work environment, in other words between ‘now’ and ‘then’ (Lauder, Reynolds & Angus, 1999: 483). Students have to be able to apply their knowledge in different contexts (Lauder *et al*., 1999: 483-484). The use of simulation helps the students to reduce the gap between what was learned and the work environment as knowledge, skills and attitude are contained in

the objectives and goals of a program (Isman, 2011: 140). Lisko and O'Dell (2010: 108) stated that scenario-based evaluation reduces the theory-practice gap, as the student has to integrate theoretical knowledge and psychomotor skills with clinical practice. The combination of different educational designs is important as each provide a different focus of learning transfer. Dolev *et al*. (2010: e167) sequenced web-based learning with clinical practice and considered the use of the tutorials after clinical practice exposure as scaffolding.

Web-based learning preceded by clinical practice, promotes clinical judgement of students when the web-based learning material meets the educational design criteria of authenticity, active student engagement, interactive learning, cooperative learning and learner focussed education. The researcher could not find additional examples from the literature to confirm or amplify the statement regarding web-based learning except the one used in the study. Web-based learning subsequent to clinical practice improved overall learning. The clinical practice provided the opportunity to see, as stated by Dolev *et al*. (2010: e170) the bigger picture by caring for live patients and the web-based learning provided opportunity to focus on the individual lesions and visual details of the material. The web-based learning entailed being a well-developed educational strategy. The combination of web-based learning and clinical practice proved effective in one study but needs further investigation. Dolev *et al*. (2010: e170) considered the tutorials preceded by the clinical exposure as scaffolding.

Jordan, Carlile, and Stack, (2009: 64) states that scaffolding consists of the resources, activities and mentoring provided by the lecturer and more experienced peers. It provides support to the student until he is able to function independently. The structured guidance promotes attaining a higher level of understanding or competence. When the student is able to function independently on that level the scaffolding is removed (Winstone & Millward, 2012: 59). Therefore, the form of scaffolding must relate to the level of the student's performance (Surgenor, 2013: 5). Van Merriënboer, Kirschner and Kester (2003: 5, 6) confirms sequencing as a method of scaffolding and states that sequencing reduces the cognitive load. The educational design according to the learning transfer systemic model includes the principles of learning, sequencing and the educational content (Kontoghiorghes,

2004: 211). The facts relating to sequencing is also relevant in the third key statement discussion.

It is possible that any educational strategy, that fulfils the criteria of the acknowledged theories and the educational design factors, will promote learning transfer. The specific sequences in the following two theories correlate with the sequential applications of the educational strategies. Applying Kolb's theory to the web-based learning, the students had a concrete experience in the clinical practice and they had time to have personal reflection on that experience. The next step involves following a line of reasoning that will allow the drawing of conclusions during abstract conceptualisation followed by active experimentation and application of knowledge during web-based activities (Bruce *et al*., 2011: 128). The same theory can be applied to the educational strategies in the other three studies. Learning transfer did occur in all four studies and the educational strategies fulfil the criteria of educational design factors.

In the same manner as Kolb's theory, the first principles as defined by Merrill (2002: 44-45) can be applied to the educational strategies identified. The first principles identified by Merrill (2002: 44-45) is that learning is promoted when learners are engaged in solving real-world problems. Students learn better when confronted with a problem. The student takes ownership when the student perceives the problem as interesting, relevant and engaging. A worked example of the problem provides the student with a view of the whole task and not just parts as in topic instruction. Topic-centred instruction teaches the components of a topic and problem centred instruction the task as a whole (Merrill, 2002: 45-46). The students in the study by Dolev *et al*. (2010: e166) were confronted with the clinical practice and real-life problems. The second principle is activation of existing knowledge as a foundation for new knowledge. Recalling, describing or demonstrating prior knowledge activates the relevant cognitive structures. Activation takes place when students recall or acquire structure on which to base new knowledge. The structure provided by previous knowledge provides guidance and a basis during demonstration, coaching during application and for reflection during integration (Merrill, 2009: 16). The knowledge obtained from the clinical practice was activated when they started the tutorials (Dolev *et al*., 2020: e166). The third principle is the demonstration of

new knowledge to the student. Consistency between the skill and the content taught promotes learning. Guidance leads the student to see the relationship between general information or structure and specific instances (Merrill, 2009: 5). The fourth principle is application of new knowledge by the learner. The student is required to use the new knowledge to solve problems that are consistent with the objectives (Merrill, 2002: 49). The students in Dolev *et al*. (2010: e168) used the knowledge obtained from the clinical practice and applied it in solving the problems. The last principle is integration of the new knowledge into the learner's world. The student reflects on the new knowledge and creates, invents or explores personal ways to apply and demonstrate the new knowledge or skill (Merrill, 2009: 19). Dolev *et al*. (2010: e168) demonstrated through clinical judgement displayed that the new knowledge was integrated by the students. Therefore, the educational design factors play an important role in all the educational strategies.

4.4 FUNDAMENTAL CONCLUSION STATEMENT

The fundamental conclusion statement: No conclusion was reached regarding the research question as only four primary studies were found. Further research is needed to answer the research question.

4.5 METHODOLOGICAL RIGOR

The following section is a discussion on the biases that may occur during the data analysis and synthesis phases as well as the strategies implemented to reduce bias and to enhance the rigour of the study.

4.5.1. DATA ANALYSIS

The analysis phase requires careful attention to prevent subjectivity and bias. Literature reviews have perceived weaknesses as they "lack the explicit intent to maximise scope or analyse data collected" (Grant & Booth, 2009: 97). The implication of this statement is that all conclusions reached are open to bias, as the potential to omit always exists. Tricco *et al*. (2008: 434), warn against extractor bias during this stage, which occurs through inaccurate data extraction. Outcome reporting bias involves reporting in the study of only the important outcome in a

multiple outcomes primary study (Tricco *et al.*, 2008: 434). The reporting of the summaries in current study includes all the outcomes in all four studies.

Indirect comparison bias involves indirect comparisons instead of direct comparisons when combining the result in a review (Tricco *et al.*, 2008: 434). Direct comparisons were made in the review. It is specifically mentioned when indirect comparisons were made. De Souse *et al*. (2010: 104) indicate that an organised approach reduces bias and the use of experienced researchers provides a validity check on the methods, procedures and relevancy to practice. The iterative method of extraction used as well as reviewing by the supervisor, limited this kind of bias of the study. Adhering to standardised methods also helps to ensure rigour and quality (Emeis, 2012: 275). The paper by Whittemore and Knafl (2005: 545) aims at providing methodological strategies to enhance the rigour of the process and, as such, were applied in the study. Explicit record keeping of the coding structures and analysis decisions increase rigour and transparency during the process (Whittemore, 2005: 60). Primarily, the analysis decisions were based on the educational techniques that were used and the variables that might have had an influence on the strategies or on the execution of the primary studies.

The quality of research relates to the extent to which bias is minimised and maximising internal and external validity takes place. The definition of bias indicates a systematic error where the results produced, systematically depart from the 'true' results. Internal validity indicates the extent to which the design and the manner in which it is conducted, prevents systematic error. External validity is dependent on internal validity. External validity relates to the generalizability of the results of the study (Kitchenham, 2004: 10-11). Conducting the study included following the prescribed methods as delineated in the literature. The use of more than one researcher and a qualified librarian throughout all the stages of the review should provide protection against systematic error and, therefore, provided reasonable internal validity. Evaluating the generalizability and applicability of the results depends on the findings of the study.

Whittemore and Knafl (2005: 547) advised researchers to use systematic methods during data analysis, synthesis and drawing conclusions in order to improve accuracy and reduce bias. De Sousa *et al*. (2010: 104) recommend the use of a

data collection instrument during data extraction in order to reduce the possibility of transcription errors, enhance precision and serve as a record.

A data collection tool in the form of a table was used. Transcription errors were prevented by consultation with the supervisor. (A record is available in Addendum E). Data analysis comprises a systematic analysis through thematic approach. The validity of the results was preserved by systematically indicating how the statements were reached by adequate referencing of the primary studies by page numbers. The statements are not conclusions reached through the data analysis. The fact that only four studies were obtained indicated the need for providing qualifiers regarding the statements. The educational techniques used in the studies were of a high quality as demonstrated by the educational design factors inherent in each.

4.5.2 SYNTHESIS

Validity and reliability of the synthesised findings increase with specific features of a review including comprehensive coverage of literature, the quality of the included studies, a clear and systematic approach to the synthesis as well as a transparent and rigorous process (Victor, 2008: 1). A rigorous attempt was made to reach the above criteria as indicated in each section of the review.

During the discussion of the results, the researchers improved the validity of the study by emphasising the results and interpretations made and explaining the possible biases (De Sousa *et al*., 2010: 105). Evidence from the samples should support all conclusions and recommendations (Whittemore & Knafl, 2005: 552) as indicated consistently in the tables.

Explanations with regard to biases are made as seen in the discussion above. All recommendations and conclusions are supported in the study by referencing the page number of the articles.

In conclusion, Whittemore (2005: 61) suggests that a team conduct the integrative literature review, as the complexity of completing a review without bias is not possible without expertise in the methodology and content area. A team that consisted of the researcher, supervisor and senior researcher in the School of Nursing conducted the study. The researcher and supervisor consulted on each step of the review and independently performed selection of the abstracts and

studies and during analysis. The team reviewed the 47 possible articles and conducted the critical appraisals independently.

4.6 SUMMARY

The chapter included the data analysis stage consisting of the data reduction and data display with the use of tables. Data comparison and conclusion drawing completed the data analysis stage. The use of themes provided the basis for topic summary and a key summary of the findings. The deficit of primary studies provided the basis for no conclusions. Also provided is a section on bias and validity. The last and final chapter involves the interpretations and conclusion from the research.

CHAPTER 5
Conclusion

5.1. INTRODUCTION

Chapter 4 contains a detailed discussion on the analysis and synthesis of the identified studies. This chapter will include the key summaries from the four studies, the foundational conclusion, limitations, recommendations and the future use of the findings.

5.2. THE MOTIVATION FOR THE INTEGRATIVE LITERATURE REVIEW

Educators in healthcare should base educational decisions on the best available evidence as the success of education depends on the decisions. The current integrative literature review forms part of a larger research project, named "Strategies to promote transfer of learning in nursing practice". The outcomes of the integrative literature review were to be used in developing guidelines for the implementation of learning programmes that will enhance clinical practice. A shortage of empirical research on the educational strategies that promote learning transfer exists, demonstrating insufficient evidence for guidelines on which to base learning programmes. A search of the existing literature did not produce an integrative/systematic literature review to provide the evidence for the guidelines on educational strategies regarding clinical judgement in healthcare. The literature found described the examination of a single educational strategy or the comparison of two educational strategies. An integrative literature review was done because it incorporates studies with diverse methodologies.

Globally educators strive to enable students to integrate theoretical knowledge into effective healthcare practice. There is a significant gap between practice and education for that practice. The reversal of education-practice gap to practice-education gap demonstrates the inability of education to keep up with the rapidly changing technology and research-directed practice and has detrimental effects on patient care and clinical practice. Determining effective ways to increase learning

transfer will reduce the theory-practice gap and improve patient care. The researcher, through an integrative literature review, aimed to determine the educational strategies that promote theory-practice integration.

5.3. RESEARCH QUESTION

The research question was “what is the best evidence available regarding educational strategies that will promote clinical judgement in healthcare students? “

The learning transfer model developed for human resource development was adapted to higher educational institutions and provided a foundation for the research. A complete discussion was supplied earlier. The transfer model theorises that the educational design influences the motivation to learn as well as the motivation to transfer. The work environment has a direct influence on individual and organisational performance and an indirect influence on motivation to learn and the motivation to transfer. The performance of the students in the work environment is the evidence of learning transfer. The transfer model demonstrates the transfer of learning from the cognitive domain to application in a specific domain where transfer is the generalisation and maintenance of learning. Figure 5.1 illustrates learning transfer from the educational strategy where learning takes place, to the application of the learning in the work environment. The education of the student moves through different knowledge levels, from declarative and procedural knowledge to functional knowledge. The development of knowledge levels allows the student to develop critical thinking (declarative and procedural knowledge), impacting on clinical reasoning (conditional knowledge), and culminating in the demonstration of clinical judgement (functional knowledge) in the work environment. Learning transfer is demonstrated when the student displays clinical judgement by demonstrating the newly learned material and thereby narrows the theory-practice gap.

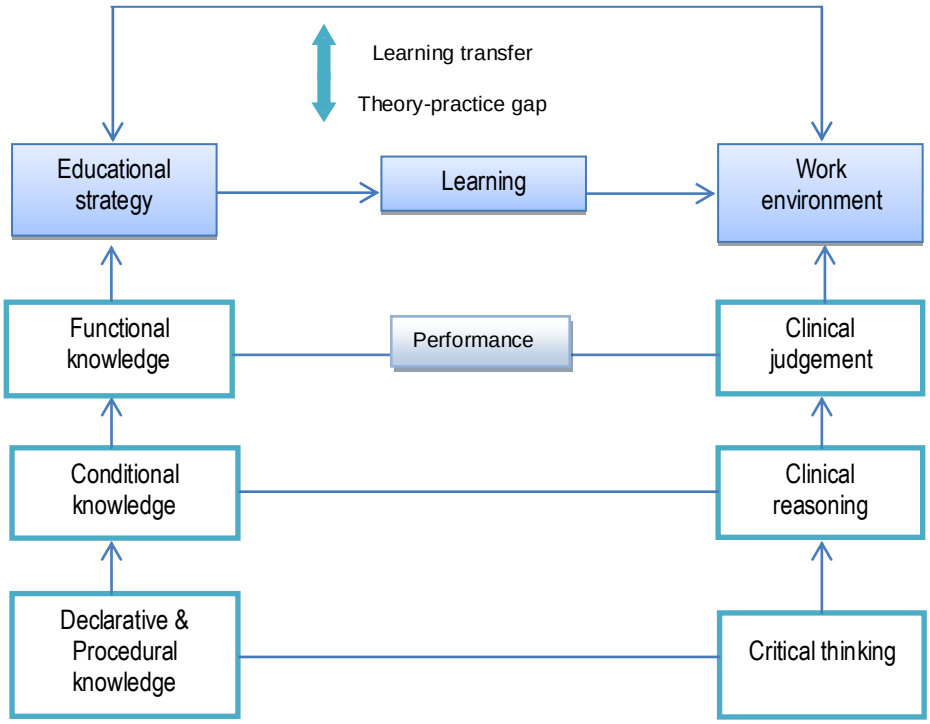

Figure 5. 1 A schematic representation of the research question and related aspects.

5.4. METHODOLOGY

The search identified 897 studies by means of an electronic search, ancestor search and accessing the databases of colleagues in the Faculty of Health Sciences. Seven studies were identified for critical appraisal after review of all the titles, abstracts and full papers. Critical appraisal is part of the standard evaluation of studies to obtain evidence-based research for reviews. The methodological quality of the studies was evaluated with the CASP and QualSyst quality appraisal instruments to determine inclusion or exclusion. The four studies that obtained scores of 80% and above on the QualSyst critical appraisal instruments were analysed.

Data were summarised in tables that aided the researcher in determining thematic similarities or dissimilarities. All four studies were randomised controlled trials that evaluated clinical judgement in senior healthcare students in academic settings, specifically medical and nursing students. The studies included a crossover, a pre-test-post-test 2 group, and two comparison designs. The educational strategies

included high fidelity simulation, case-based learning, problem-based learning and web-based learning.

The sample sizes, duration and type of the interventions varied in all four studies. Age ranged from 20-44 years with two studies not indicating age. Although the outcome was the same, namely clinical judgment, the measurement tools differed in each study. All four the studies were located in the United States. The differences in the four studies made for difficult comparisons. The common outcome (clinical judgment) implies that learning transfer occurred and consequently reduction of the theory-practice gap. High fidelity simulation, case-based learning and web-based learning enabled students to make sound clinical judgements. The limitations as described in the following paragraphs should be considered when reading the results section.

5.5. LIMITATIONS OF THIS STUDY

The a priori decision to include diverse methodological studies made a narrative approach applicable. The critical appraisal process resulted in studies of similar methodology, namely randomised control trials. The narrative approach was continued after consultation with a biostatistician and the supervisor because a meta-analytic approach would be meaningless in view of the few studies selected.

The most noted limitation of the study is the few studies identified despite the researcher having used multiple search strategies. Therefore the lack of a conclusive finding is also considered a limitation. Although the researcher repeated the searches a number of times the search was not updated in 2014 to include the late publications of 2013 because the student had to finalise her research report.

The paucity of results made drawing of reliable conclusions impossible. None of the concluding statements is supported by multiple findings. Broadening the scope of the review would have defeated the initial purpose. The overarching research project requires the specific findings about clinical judgement to develop guidelines for the development and implementation of learning programmes.

The inexperience of the research team regarding integrative literature reviews as a research methodology may have influenced the quality of the research. However,

the supervisor who is an experienced and active researcher counteracted this. The School of Nursing took measures by having experts' present workshops on the topic. The student, supervisor and third researcher attended the workshops. These experts were consulted when doubt existed. Mitigation of the limitation was attempted by rigorously following the prescribed phases of an integrative literature review and documentation of each action.

Exclusion of electronic databases due to fiscal constraints was a limitation as relevant data might have been missed, including the four articles excluded due to language. Publication bias may be a limitation, as primary researchers tend not to publish negative results. Therefore, it is possible that not all relevant studies were obtained.

The researchers were not blinded during the critical appraisal phase. There was no conflict of interest as both the studies and authors of the critically appraised articles were unknown to the researchers. The use of three researchers also mitigated the limitation. The validity of the QualSyst critical appraisal tool was described statistically in the published article, but the instrument is not widely used. Although the researchers were inexperienced with regard to the integrative review methodology, they were experienced researchers in the application of other research designs and were thus capable of critically appraising the selected article.

The intervention times ranging from one to 30 days may be a limitation as all of the studies have different intervention times and the diverse time of exposure does not facilitate a relevant conclusion. In addition, none of the studies performed delayed testing, as is a prerequisite of learning transfer by determining long-term retention.

All of the studies were located in the United States. The diversity in cultures globally could make a generalisation of any research finding a problem with only one country of origin.

5.6. FINDINGS OF THE RESEARCH

The statements, about the findings regarding the outcomes of the four studies in Table 5.1, display the indicators that transfer of learning occurred, ability to make sound clinical judgement developed, and the theory-practice gap was reduced. The

outcomes of the educational strategies, namely the intervention, are influenced by the educational design factors. The researcher is aware that the key findings are an iteration of the findings in the studies because four studies do not allow for making firm conclusions. The drawing of conclusions is constrained by a lack of evidence to provide generalizable data. Statements are tentative and insufficient evidence prevents generalising any findings into conclusions.

Table 5. 1 Key statements of the findings.

Key statements	Learning transfer	Clinical judgement	Reduction of theory-practice gap
Learning transfer as demonstrated by clinical judgement is supported by web-based, simulation-based and case-based educational strategies when these adhere to the design principles.	✓	✓	✓
Educational design factors such as authenticity, active student engagement, interactive learning, cooperative learning, learner-focussed education and scaffolding promote transfer of learning.	✓	✓	✓
Web-based, case-based and simulation-based educational strategies improved clinical judgement without alliance with another educational strategy when they adhered to the design principles of authenticity, active student engagement, interactive learning, cooperative learning, learner-focussed education and scaffolding.	✓	✓	✓
Sequencing of learning opportunities that first stimulate cognitive thinking and thereafter afford the students the opportunity to practice psychomotor skills supports integration of theory and practice and promotes development of clinical judgement.	✓	✓	✓

✓ Indicate improvement in learning transfer, clinical judgement and reduction of the theory-practice gap.

The discussion takes place according to each of the statements. In conclusion, a fundamental statement is provided.

Learning transfer takes place when educational strategies such as web-based learning, high fidelity simulation and case-based learning are used and demonstrated by clinical judgement. Test tasks after education that are similar to the educational tasks as well as transfer to new tasks provides indication of changes in behaviour and maintenance of learning. The authenticity of the learning tasks provides tasks similar to tasks in the clinical practice. In addition, the four studies

provided the opportunity of applying new knowledge in different settings or situations improving learning transfer. Similar tasks and application in different settings were supplied by the interventions and final assessments in the studies. The performance by the student or the organisation provides evidence of the transfer of learning, in this case demonstrating clinical judgement. All four studies demonstrated transfer of learning through clinical judgement.

The educational designs and therefore the design factors inherent to the educational designs are educational factors promoting learning transfer, such as authenticity, active student engagement, interactive learning, learner-focussed and cooperative learning, learner-focussed education and scaffolding. The central characteristic in the three educational strategies demonstrating clinical judgement were authentic learning experiences. Authenticity was reflected by the use of a life-like patient and simulated equipment, the case-stem and history in the case-based learning and the clinical cases in the web-based learning. The web-based learning provided visual educational material from diagnosed and managed cases. The case-based learning compares with regard to high fidelity simulation in the use of a real patient case study. It differs from simulation in the absence of a simulated patient and simulation equipment. All three educational techniques used educational material based on real clinical situations, confirming as stated previously, that pedagogical strategies that integrate relevant, authentic clinical experiences in the classroom will narrow the theory-practice gap. Transfer of learning, clinical judgement and reducing the theory-practice gap or rather, the education-practice gap, takes place when learning material is closely related to the clinical context. The paradigm shift from lecturer- to student-centred education was evident in all the strategies. With the exception of web-based learning, all the strategies employed cooperative learning. Active student engagement and interactive learning was apparent in all four strategies. Educational design factors such as authenticity, active student engagement, interactive learning, learner-focussed education, cooperative learning and scaffolding are apparent in almost all literature concerning educational strategies or methods to enhance learning. The results of the studies have proven these more than mere ‘buzz words’. The inherent characteristics of the educational strategies may be more important than the strategies themselves.

The use of web-based, case-based and simulation-based educational strategies promoted transfer of learning and improved clinical judgment when they adhered to the design principles as stated above. Web-based learning was introduced before and after the clinical exposure. Both times clinical judgement was displayed indicating that web-based learning without the clinical exposure was successful in accomplishing clinical judgement. The web-based educational strategy applied before clinical exposure, was successful, although not to the same degree as after clinical exposure. When attempting to prove superiority between case-based learning and simulation, both indicated clinical judgement was reached individually. All the studies using simulation-based learning demonstrated clinical judgement reached. The fact that three of the studies used high fidelity simulation as intervention is an indication of the importance of simulation as an educational strategy. It is the only educational strategy providing a real-life, authentic learning experience with relevant equipment comparable to clinical practice, where functional knowledge can be applied safely while demonstrating learning transfer and clinical judgement. The high fidelity simulated patient reactions provide immediate feedback on actions, allowing the student to adapt treatment and evaluate any judgements made. Feedback after the simulation allows the student to reflect on the learning experience as an integrated totality. It enables reassessment of actions and the results of actions taken during the simulation, thereby facilitating learning transfer and reducing the theory-practice gap.

Sequential application of educational strategies, first problem-based followed by high fidelity simulation, provides stimulation of cognitive thinking with the opportunity to practice psychomotor skills thereafter. The study that compared high fidelity simulation with problem-based learning indicated that high fidelity simulation was used as psychomotor learning activity after problem-based learning as a cognitive learning activity. Cognitive learning does not provide practice opportunities. When the students are provided with the opportunity to experience clinical practice through high fidelity simulation the cognitive, psychomotor and affective domains comes into play. Providing additional learning opportunities sequentially to high fidelity simulation provides cognitive support. Conversely, the opposite is also true: enhancement of psychomotor activities takes place when a well-developed cognitive knowledge base is provided. Learning transfer states that training should take place

within the context associated with the clinical practice or working conditions and includes the principles of learning, sequencing and the educational content.

Sequential application of web-based learning preceded by clinical practice promotes the development and application of clinical judgement when high standards are set regarding the educational design factors included in the educational strategy. The researchers affirmed the theory and thinking processes after clinical experience with structured online tutorials, which is an example of scaffolding. It is noteworthy with regard to the usual sequence of events in educational strategies. Scaffolding is a supporting and building tool and strategy used in the learning process. Scaffolding in literature is described in terms of use during the instructional strategies and as the student becomes proficient, scaffolding is reduced. In clinical practice, preceptors provide cognitive support in practice using the principles of scaffolding. Additionally web-based learning was used as scaffolding to consolidate learning and knowledge from the clinical practice. In this instance, the students completed the classroom activities and the clinical placements and then received web-based learning. Web-based learning provided the opportunity to apply the knowledge obtained through experience. A comparison was made in the previous chapter, demonstrating sequencing with regard to Kolb's theory and the first principles of instruction by Merrill. It is possible that any educational strategy fulfilling the criteria of acknowledged theories and the educational design factors will promote learning transfer.

5.7. FUNDAMENTAL FINDING

The fundamental conclusion reached: No conclusion was reached regarding the research question as only four primary studies were found. Further research is needed to answer the research question.

5.8. RECOMMENDATIONS

One of the objectives of an integrative literature review is informing research. The recommendations are provided according to relevancy to educators, researchers and students.

5.8.1. EDUCATORS

- The use of educational strategies that teach students how to apply clinical judgement is paramount to providing effective patient care. Therefore, the use of educational strategies such as well-developed web-based learning, case-based learning and high fidelity simulation create learning opportunities to develop and practice clinical judgement.
- Educational design principles such as authenticity, active student engagement, interactive learning, cooperative learning, learner-focussed education and scaffolding increase learning transfer and clinical judgment. Educators should employ educational strategies that include design factors as qualifiers to ensure learning transfer, clinical judgement and reduction in the theory-practice gap.
- The possibility, as demonstrated, exists that any educational strategy fulfilling the criteria of acknowledged theories will promote learning transfer. Educators should apply well-founded and acknowledged theoretical models such as the first principles of instruction by Merrill and Kolb's theory. The section on sequencing has provided prove that such models are effective.

5.8.2. RESEARCHERS

- There are a multitude of educational strategies in use and too few studies comparing or evaluating the effectiveness of different educational techniques regarding clinical judgement. Although there is a tendency towards simulation as demonstrated, it does not exclude other educational strategies as capable of developing clinical judgement in students, and these should be evaluated.
- The available studies do not examine outcomes over time. The second part of the learning transfer definition states maintenance, which is the extent to which educational changes persist over time. Without long-term evaluation, only half of the requirements for learning transfer are met. Research should include whether educational changes persist over time.
- Standardised instrumentation is needed to promote comparability of studies. Research into standardised instrument measuring clinical judgment is needed to provide a comparable instrument during research. The importance of clinical judgement in healthcare cannot be underestimated and although more widely available measurement for competence is available, a standardised

instrument will provide valid comparison between studies. International cooperation in this regard is in the making as well as inter-institutional collaboration in development and testing of instruments. Increased cooperation and additional research is needed. Research indicated that self-assessment of competence varied across borders indicating a need for further research.

- In spite of available concept analyses regarding critical thinking, clinical reasoning, clinical judgment and metacognition, the terms are used interchangeably in the literature and differences exist between these interrelated concepts. Consensus in the literature for the use of terms such as critical thinking, clinical reasoning, clinical judgement and metacognition should be reached. The interrelated use causes confusion as to what exactly is used as measurement.
- Research regarding clinical judgment should be focussed from a common framework such as the systemic learning transfer model providing a comparable frame of reference during research and context is included preventing focussing on only outcomes. Learning transfer is the measurement of successful education and is demonstrated by clinical judgement.
- The systemic learning transfer model, originally developed for human resource development, was adapted for higher education during the current research and should be tested in higher education, especially in Health Sciences to determine applicability for future use
- An increase of studies evaluating clinical judgement with different types of methodologies is needed. The studies found included randomised controlled trials. The few available qualitative studies were found to be either ambivalent in their interpretation of clinical judgement or did not measure clinical judgement.
- A paucity of experimental studies regarding clinical judgement exists. More research studies should focus on students' functional knowledge as it has a direct influence on patient care and outcomes. Large amounts of research on critical thinking and clinical reasoning are available, but few researchers endeavour to measure clinical judgement.

- The four studies evaluating clinical judgement were situated in the United States. Transcultural and transcontinental studies are needed to provide a global view of the effectiveness of educational strategies regarding clinical judgement.

5.8.3. STUDENTS

- The identified studies used senior students in the fourth or final year of study as sample subjects. There is a gap with regard to junior students. The expectations of junior nursing students include application of clinical judgement in clinical practice, although on a less demanding level. The possibility exist that clinical judgement is expected only of senior students in other healthcare professions. Further research is suggested involving all year groups.
- The studies found involved medical and nursing students: research regarding all the different healthcare disciplines and professions should be undertaken.

5.9. VALUE OF THE STUDY

The diversity of healthcare clinical practice makes effective transfer of learning paramount. Students should be able to transfer learning from one clinical area to another, including the community. The expectations are that students demonstrate changes in behaviour that improves quality of patient care and service delivery. Quality patient care is only possible when students are able to make sound clinical judgements. Clinical judgement is not a self-taught skill and educational strategies should create the opportunities for students to develop the competence. Although the study did not provide conclusive results, directions are provided that can be used as guidelines for further research. The study provided three educational techniques that proved to be successful and focussed on cognitive and psychomotor activities; and on web-based learning and clinical practice as well as the relationship between these.

The primary value of the study is to provide directions to the larger research project to develop guidelines for the implementation of learning programmes to make a difference to clinical practice. Reaching of this goal is debatable in view of the paucity of findings.

The increased use of web-based learning takes place on a global scale with the net-generation currently at higher educational institutions. Considering the use of web-based learning in the form of tutorials after clinical placement of students provides a unique application thereof. Web-based learning has not been fully utilised at the School of Nursing and research in sequential use and application may prove to be beneficial.

Learning opportunities should be created where the student can apply and integrate declarative and procedural knowledge within a specific clinical context. For example, immersive or high fidelity simulation affords students such an opportunity. However, any of these learning opportunities should adhere to basic educational design principles.

The integrative literature review provided a much-needed learning opportunity in the School of Nursing at the University of the Free State. The movement towards best available evidence calls for more reviews of all kinds. The current study provided a maiden engagement in reviews.

The study may contribute to the healthcare profession in a small way regarding additional research. The need to practice evidence-based healthcare is increasing. Healthcare workers have to identify problems, make decisions, implement strategies, and judge the results. Enhancing clinical judgement by means of educational strategies in terms of best available evidence provides the opportunity of changing patient care. It provides the foundation to teach and educate competent healthcare workers.

5.10. CONCLUSION

The objective of this research was to obtain the best available evidence regarding educational strategies and was positioned within the theory of learning transfer as it provided a systemic view of the learning transfer factors. The research was initiated to obtain evidence regarding educational strategies that cultivate clinical judgement in students. Providing evidence of clinical judgement indicates learning transfer was accomplished, reducing the theory-practice gap. Integration of theory and practice is necessary for outcome-based and competency-based education that measures the success of education according to clinical competency. The search, review and

critical appraisal of the abstracts and studies provided four studies as evidence. Four studies provided insufficient evidence for conclusion.

The fundamental finding of no conclusion to the research question is based on the search results. The study provided too few studies to reach relevant conclusions. The number of educational interventions available suggested that additional research is needed. The studies included in the review were methodological of the high quality as judged by critical appraisal but the execution of the educational strategies was open to debate. The use of case-based learning, high fidelity simulation and web-based learning provided grounds for stating that learning transfer had occurred as demonstrated by successful application of clinical judgement in the four studies. Although delayed evaluation of the outcomes was not demonstrated in the four studies, students were able to provide proof of clinical judgement demonstrating a narrowing of the education-practice gap. The additional findings provided opportunity for reflection.

Sequential application of educational strategies is not a new concept and neither is the provision of a well-founded cognitive structure. High fidelity simulation, as a relatively new educational strategy, used consecutively to cognitive developing activities, proves to be successful. The concept of providing an educational strategy in the form of tutorials after clinical exposure opens another avenue to explore instead of only providing educational interventions before clinical placement. This technique could be applied, especially as it provides consolidation of newly acquired clinical skills and knowledge. Noteworthy is the possibility that any educational strategy that fulfils the criteria of acknowledged theories and the educational design factors may be able to promote transfer of learning and ultimately the application of clinical judgement. The qualifier in this case is the correct design of the educational strategy. Teaching students clinical judgement is the mainstay of obtaining competent healthcare providers. Clinical judgement provides the appropriate foundation to accomplish optimal patient care as the objective of educating healthcare providers.

The fundamental conclusion reached, is the inability to answer the research question due to insufficiency of evidence for generalizability. As indicated in the above

discussion, the scarcity of studies is considered a limitation preventing drawing conclusions.

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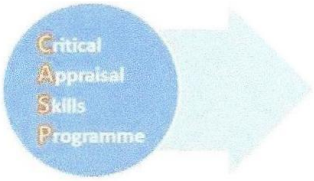
ADDENDUM A – CRITICAL APPRAISAL SKILLS PROGRAMME TOOL



11 questions to help you make sense of a trial

How to use this appraisal tool

Three broad issues need to be considered when appraising the report of a randomised controlled trial:

- **Are the results of the trial valid?** **(Section A)**
- **What are the results?** **(Section B)**
- **Will the results help locally?** **(Section C)**

The 11 questions on the following pages are designed to help you think about these issues systematically.
The first three questions are screening questions and can be answered quickly. If the answer to both is "yes", it is worth proceeding with the remaining questions.

There is some degree of overlap between the questions, you are asked to record a "yes", "no" or "can't tell" to most of the questions. A number of prompts are given after each question. These are designed to remind you why the question is important. Record your reasons for your answers in the spaces provided.

There will not be time in the small groups to answer them all in detail!

(A) Are the results of the review valid?

Screening Questions

1. Did the trial address a clearly focused issue? ☐ Yes ☐ Can't tell ☐ No

HINT: An issue can be 'focused' In terms of

- The population studied
- The intervention given
- The comparator given
- The outcomes considered

---

2. Was the assignment of patients to treatments randomised? ☐ Yes ☐ Can't tell ☐ No

HINT: Consider

- How was this carried out?
- Was the allocation sequence concealed from researchers and patients?

---

3. Were all of the patients who entered the trial properly accounted for at its conclusion? ☐ Yes ☐ Can't tell ☐ No

HINT: Consider

- Was the trial stopped early?
- Were patients analysed in the groups to which they were randomised?

Is it worth continuing?

Detailed questions

4. Were patients, health workers and study personnel 'blind' to treatment? ❑ Yes ❑ Can't tell ❑ No

HINT: Think about
- Patients?
- Health workers?
- Study personnel?

---

5. Were the groups similar at the start of the trial? ❑ Yes ❑ Can't tell ❑ No

HINT: Look at
- Other factors that might affect the outcome such as age, sex, social class

6. Aside from the experimental intervention, were the groups treated equally? ❑ Yes ❑ Can't tell ❑ No

(B) What are the results?

7. How large was the treatment effect?

HINT: Consider

- What outcomes were measured?
- Is the primary outcome clearly specified?
- What results were found for each outcome?

8. How precise was the estimate of the treatment effect?

HINT: Consider

- What are the confidence limits?

(C) Will the results help locally?

9. Can the results be applied in your context? (or to the local population?) ❑ Yes ❑ Can't tell ❑ No

HINT: Consider whether

- Do you think that the patients covered by the trial are similar enough to the patients to whom you will apply this?, if not how to they differ?

---

10. Were all clinically important outcomes considered? ❑ Yes ❑ Can't tell ❑ No

HINT: Consider

- Is there other information you would like to have seen?
- If not, does this affect the decision?

---

11. Are the benefits worth the harms and costs? ❑ Yes ❑ Can't tell ❑ No

HINT: Consider

- Even if this is not addressed by the review, what do you think?

V

ADDENDUM B: QUALSYST APPRAISAL TOOL

Checklist for assessing the quality of quantitative studies					
YE					
	Criteria	Yes (2)	Partial (1)	No (0)	NA
1.	Question / objective sufficiently described.				
2	Study design evident and appropriate?				
3.	Method of subject/comparison group selection or source of information/input variables described and appropriate?				
4.	Subject (and comparison group, if applicable) characteristics sufficiently described?				
5.	If interventional and random allocation was possible, was it described?				
6.	If interventional and blinding of investigators was possible, was it reported?				
7.	If interventional and blinding of subjects was possible, was it reported?				
8.	Outcome and (if applicable) exposure measure(s) well-defined and robust to measurement / misclassification bias? Means of assessment reported?				
9.	Sample size appropriate?				
10.	Analytic methods described/justified and appropriate?				
11.	Some estimate of variance is reported for the main results.				
12.	Controlled for confounding?				
13.	Results reported in sufficient detail?				
14.	Conclusions supported by the results?				

ADDENDUM C: MANUAL FOR QUALITY SCORING OF STUDIES

Manual for Quality Scoring of Quantitative Studies

Definitions and Instructions for Quality Assessment Scoring

How to calculate the summary score

- **Total sum =** (number of "yes" * 2) + (number of "partials" * 1)
- **Total possible sum** = 28 – (number of "N/A" * 2)
- **Summary score:** total sum / total possible sum

Quality assessment

1. *Question or objective sufficiently described?*

Yes: Is easily identified in the introductory section (or first paragraph of methods section). Specifies (where applicable, depending on study design) *all* of the following: purpose, subjects/target population, and the *specific* intervention(s) /association(s)/descriptive parameter(s) under investigation. A study purpose that only becomes apparent after studying other parts of the paper is *not* considered sufficiently described.

Partial: Vaguely/incompletely reported (e.g. "describe the effect of" or "examine the role of" or "assess opinion on many issues" or "explore the general attitudes"...); *or* some information has to be gathered from parts of the paper other than the introduction/background/objective section.

No: Question or objective is not reported, or is incomprehensible.

N/A: Should not be checked for this question.

2. *Design evident and appropriate to answer study question?*

(If the study question is not given, infer from the conclusions).

Yes: Design is easily identified and is appropriate to address the study question / objective.

Partial: Design and /or study question not clearly identified, but gross inappropriateness is not evident; *or* design is easily identified but only partially addresses the study question.

No: Design used does not answer study question (e.g., a comparison group is required to answer the study question, but none was used); *or* design cannot be identified.

N/A: Should not be checked for this question.

3. *Method of subject selection (and comparison group selection, if applicable) or source of information/input variables (e.g., for decision analysis) is described and appropriate.*

Yes: Described and appropriate. Selection strategy *designed* (i.e., consider sampling frame and strategy) to obtain an unbiased sample of the relevant target population or the entire target population of interest (e.g., consecutive patients for clinical trials, population-based random sample for case-control studies or surveys). Where applicable, inclusion/exclusion criteria are described and defined (e.g., "cancer" -- ICD code or equivalent should be provided).
Studies of volunteers: methods and setting of recruitment reported.
Surveys: sampling frame/ strategy clearly described and appropriate.

Partial: Selection methods (and inclusion/exclusion criteria, where applicable) are not completely described, but no obvious inappropriateness. Or selection strategy is not ideal (i.e., likely introduced bias) but did not likely seriously distort the results (e.g., telephone survey sampled from listed phone numbers only; hospital based case-control study identified all cases admitted during the study period, but recruited controls admitted during the day/evening only). Any study describing participants only as "volunteers" or "healthy volunteers".
Surveys: target population mentioned but sampling strategy unclear.

No: No information provided. *Or* obviously inappropriate selection procedures (e.g., inappropriate comparison group if intervention in women is compared to intervention in men). *Or* presence of selection bias which likely seriously distorted the results (e.g., obvious selection on "exposure" in a case-control study).

N/A: Descriptive case series/reports.

4. *Subject (and comparison group, if applicable) characteristics or input variables/information (e.g., for decision analyses) sufficiently described?*

Yes: Sufficient relevant baseline/demographic information clearly characterizing the participants is provided (or reference to previously published baseline data is provided). Where applicable, reproducible criteria used to describe/categorize the participants are clearly defined (e.g., ever-smokers, depression scores, systolic blood pressure > 140). If "healthy volunteers" are used, age and sex must be reported (at minimum).
Decision analyses: baseline estimates for input variables are clearly specified.

Partial: Poorly defined criteria (e.g. "hypertension", "healthy volunteers", "smoking"). *Or* incomplete relevant baseline / demographic information (e.g., information on likely confounders not reported). *Decision analyses:* incomplete reporting of baseline estimates for input variables.

No: No baseline / demographic information provided.
Decision analyses: baseline estimates of input variables not given.

N/A: Should not be checked for this question.

5. *If random allocation to treatment group was possible, is it described?*

Yes: True randomization done - requires a description of the method used (e.g., use of random numbers).

Partial: Randomization mentioned, but method is not (i.e. it may have been possible that randomization was not true).

No: Random allocation not mentioned although it would have been feasible and appropriate (and was possibly done).

N/A: Observational analytic studies. Uncontrolled experimental studies.
Surveys. Descriptive case series / reports. Decision analyses.

6. *If interventional and blinding of investigators to intervention was possible,*

is it reported?

Yes: Blinding reported.

Partial: Blinding reported but it is not clear who was blinded.

No: Blinding would have been possible (and was possibly done) but is not reported.

N/A: Observational analytic studies. Uncontrolled experimental studies.
Surveys. Descriptive case series / reports. Decision analyses.

7. *If interventional and blinding of subjects to intervention was possible, is it reported?*

Yes: Blinding reported.

Partial: Blinding reported but it is not clear who was blinded.

No: Blinding would have been possible (and was possibly done) but is not reported.

N/A: Observational studies. Uncontrolled experimental studies. Surveys. Descriptive case series / reports.

8. *Outcome and (if applicable) exposure measure(s) well defined and robust to measurement / misclassification bias? Means of assessment reported?*

Yes: Defined (or reference to complete definitions is provided) and measured according to reproducible, "objective" criteria (e.g., death, test completion – yes/no, clinical scores). Little or minimal potential for measurement / misclassification errors.
Surveys: clear description (or reference to clear description) of questionnaire/interview content and response options.
Decision analyses: sources of uncertainty are defined for all input variables.

Partial: Definition of measures leaves room for subjectivity, *or* not sure (i.e., not reported in detail, but probably acceptable). *Or* precise definition(s) are missing, but no evidence or problems in the paper that would lead one to assume major problems. *Or* instrument/mode of assessment(s) not reported. Or misclassification errors may have occurred, but they did not likely seriously distort the results (e.g.,

slight difficulty with recall of long-ago events; exposure is measured only at baseline in a long cohort study).
Surveys: description of questionnaire/interview content incomplete; response options unclear.
Decision analyses: sources of uncertainty are defined only for some input variables.

No: Measures not defined, or are inconsistent throughout the paper. *Or* measures employ only ill-defined, subjective assessments, e.g. "anxiety" or "pain." *Or* obvious misclassification errors/measurement bias likely seriously distorted the results (e.g., a prospective cohort relies on self-reported outcomes among the "unexposed" but requires clinical assessment of the "exposed").
Surveys: no description of questionnaire/interview content or response options.
Decision analyses: sources of uncertainty are not defined for input variables.

N/A: Descriptive case series / reports.

9. *Sample size appropriate?*

Yes: Seems reasonable with respect to the outcome under study and the study design. When statistically significant results are achieved for major outcomes, appropriate sample size can usually be assumed, unless large standard errors (SE > ½ effect size) and/or problems with multiple testing are evident.
Decision analyses: size of modelled cohort/number of iterations specified and justified.

Partial: Insufficient data to assess sample size (e.g., sample seems "small" and there is no mention of power/sample size/effect size of interest and/or variance estimates aren't provided). *Or* some statistically significant results with standard errors > ½ effect size (i.e., imprecise results). *Or* some statistically significant results in the absence of variance estimates.
Decision analyses: incomplete description or justification of size of modelled cohort/number of iterations.

No: Obviously inadequate (e.g., statistically non-significant results and standard errors > ½ effect size; or standard deviations > _ of effect size; or statistically non-

significant results with no variance estimates and obviously inadequate sample size). *Decision analyses:* size of modelled cohort / number of iterations not specified.

N/A: Most surveys (except surveys comparing responses between groups or change over time). Descriptive case series / reports.

10. *Analysis described and appropriate?*

Yes: Analytic methods are described (e.g. "chi square"/ "t-tests"/"Kaplan-Meier with log rank tests", etc.) and appropriate.

Partial: Analytic methods are not reported and have to be guessed at, but are probably appropriate. *Or* minor flaws or some tests appropriate, some not (e.g., parametric tests used, but unsure whether appropriate; control group exists but is not used for statistical analysis). *Or* multiple testing problems not addressed.

No: Analysis methods not described and cannot be determined. *Or* obviously inappropriate analysis methods (e.g., chi-square tests for continuous data, SE given where normality is highly unlikely, etc.). *Or* a study with a descriptive goal/objective is over-analysed.

N/A: Descriptive case series / reports.

11. *Some estimate of variance (e.g., confidence intervals, standard errors) is reported for the main results/outcomes (i.e., those directly addressing the study question/objective upon which the conclusions are based)?*

Yes: Appropriate variances estimate(s) is/are provided (e.g., range, distribution, confidence intervals, etc.).
Decision analyses: sensitivity analysis includes all variables in the model.

Partial: Undefined "+/-"expressions. *Or* no specific data given, but insufficient power acknowledged as a problem. *Or* variance estimates not provided for all main results/outcomes. *Or* inappropriate variance estimates (e.g., a study examining change over time provides a variance around the parameter of interest at "time 1" or "time 2", but does not provide an estimate of the variance around the difference).

Decision analyses: sensitivity analysis is limited, including only some variables in the model.

No: No information regarding uncertainty of the estimates.
Decision analyses: No sensitivity analysis.

N/A: Descriptive case series / reports. Descriptive surveys collecting information using open-ended questions.

12. *Controlled for confounding?*

Yes: Randomized study, with comparability of baseline characteristics reported (or non-comparability controlled for in the analysis). *Or* appropriate control at the design or analysis stage (e.g., matching, subgroup analysis, multivariate models, etc).
Decision analyses: dependencies between variables fully accounted for (e.g., joint variables are considered).

Partial: Incomplete control of confounding. *Or* control of confounding reportedly done but not completely described. *Or* randomized study without report of comparability of baseline characteristics. *Or* confounding not considered, but not likely to have seriously distorted the results.
Decision analyses: incomplete consideration of dependencies between variables.

No: Confounding not considered, and may have seriously distorted the results.
Decision analyses: dependencies between variables not considered.

N/A: Cross-sectional surveys of a single group (i.e., surveys examining change over time or surveys comparing different groups should address the potential for confounding). Descriptive studies. Studies explicitly stating the analysis is strictly descriptive/exploratory in nature.

13. *Results reported in sufficient detail?*

Yes: Results include major outcomes and all mentioned secondary outcomes.

Partial: Quantitative results reported only for some outcomes. *Or* difficult to assess as study question/objective not fully described (and is not made clear in the methods section), but results seem appropriate.

No: Quantitative results are reported for a subsample only, or "n" changes continually across the denominator (e.g., reported proportions do not account for the entire study sample, but are reported only for those with complete data-- i.e., the category of "unknown" is not used where needed). *Or* results for some major or mentioned secondary outcomes are only qualitatively reported when quantitative reporting would have been possible (e.g., results include vague comments such as "more likely" without quantitative report of actual numbers).

N/A: Should not be checked for this question.

14. *Do the results support the conclusions?*

Yes: All the conclusions are supported by the data (even if analysis was inappropriate). Conclusions are based on all results relevant to the study question, negative as well as positive ones (e.g., they aren't based on the sole significant finding while ignoring the negative results). Part of the conclusions may expand beyond the results, if made *in addition to* rather than instead of those strictly supported by data, and if including indicators of their interpretative nature (e.g., "suggesting," "possibly").

Partial: Some of the major conclusions are supported by the data, some are not. *Or* speculative interpretations are not indicated as such. *Or* low (or unreported) response rates call into question the validity of generalizing the results to the target population of interest (i.e., the population defined by the sampling frame/strategy).

No: None or a very small minority of the major conclusions are supported by the data. *Or* negative findings clearly due to low power are reported as definitive evidence against the alternate hypothesis. *Or* conclusions are missing. *Or* extremely low response rates invalidate generalizing the results to the target population of interest (i.e., the population defined by the sampling frame/ strategy).

N/A: Should not be checked for this question.

ADDENDUM D - CRITICAL APPRAISAL OF QUANTITATIVE STUDIES

CRITICAL APPRAISAL OF ARTICLES	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/ input variables described and appropriate?	4. Subject (and comparison group, if applicable) characteristics sufficiently described?	5. If interventional and random allocation was possible, was it described?	6. If interventional and blinding of investigators was possible, was it reported?	7. If interventional and blinding of subjects was possible, was it reported?	8. Outcome and (if applicable) exposure measure(s) well defined and robust to measurement / misclassification bias? Means of assessment reported?	9. Sample size appropriate?	10. Analytic methods described/ justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	SCORES
The eDerm online curriculum: A randomized study of effective skin cancer teaching to medical students. **Dolev**, J.C.; O'Sullivan, P.; Berger, T. (C172)															
1ST REVIEWER	2	2	1	1	2	2	N/A	2	2	2	2	0	2	2	86%
2ND REVIEWER	1	2	2	2	2	2	N/A	2	2	2	0	2	2	2	85%
3RD REVIEWER	2	2	2	2	2	2	2	2	2	2	2	2	2	2	100%

CRITICAL APPRAISAL OF ARTICLES	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/ input variables described and appropriate?	4. Subject (and comparison group, if applicable) characteristics sufficiently described?	5. If interventional and random allocation was possible, was it described?	6. If interventional and blinding of investigators was possible, was it reported?	7. If interventional and blinding of subjects was possible, was it reported?	8. Outcome and (if applicable) exposure measure(s) well defined and robust to measurement / misclassification bias? Means of assessment reported?	9. Sample size appropriate?	10. Analytic methods described/ justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	SCORES
Using Online Exercises and Patient Simulation to Improve Students' Clinical Decision-Making. **Guhde** Jacqueline															
1ST REVIEWER	1	1	0	0	0	N/A	N/A	1	1	0	0	0	1	2	29%
2ND REVIEWER	0	0	0	0	0	N/A	N/A	0	1	0	0	0	1	1	13%
3RD REVIEWER	0	0	0	1	N/A	N/A	N/A	2	1	0	0	0	1	2	32%
Nursing Students' Clinical Judgment Regarding Rapid Response: The Influence of a Clinical Simulation Education Intervention. **Lindsey**, P.L. and Jenkins, S. (E238)															

CRITICAL APPRAISAL OF ARTICLES	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/ input variables described and appropriate?	4. Subject (and comparison group, if applicable) characteristics sufficiently described?	5. If interventional and random allocation was possible, was it described?	6. If interventional and blinding of investigators was possible, was it reported?	7. If interventional and blinding of subjects was possible, was it reported?	8. Outcome and (if applicable) exposure measure(s) well defined and robust to measurement / misclassification bias? Means of assessment reported?	9. Sample size appropriate?	10. Analytic methods described/ justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	**SCORES**
1ST REVIEWER	2	2	2	2	1	0	N/A	2	2	2	1	2	2	2	84%
2ND REVIEWER	2	2	2	1	2	0	N/A	2	2	2	1	0	2	2	80%
3RD REVIEWER	2	2	2	1	2	0	0	2	2	2	1	0	2	2	71%
A Randomized Comparison Trial of Case-based Learning versus Human Patient Simulation in Medical Student Education. **Schwartz**, I.R.; Fernandez, R.; Kouyoumjian, S.R.; Jones, K.A.; Compton, S.(C122)															
1ST REVIEWER	2	2	2	2	1	N/A	2	2	2	2	2	2	2	2	90%

CRITICAL APPRAISAL OF ARTICLES	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/ input variables described and appropriate?	4. Subject (and comparison group, if applicable) characteristics sufficiently described?	5. If interventional and random allocation was possible, was it described?	6. If interventional and blinding of investigators was possible, was it reported?	7. If interventional and blinding of subjects was possible, was it reported?	8. Outcome and (if applicable) exposure measure(s) well defined and robust to measurement / misclassification bias? Means of assessment reported?	9. Sample size appropriate?	10. Analytic methods described/ justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	SCORES
2ND REVIEWER	2	2	2	2	2	N/A	N/A	2	2	2	2	0	2	2	92%
3RD REVIEWER	2	2	2	2	2	2	0	2	2	2	2	2	2	1	89%
Lecture" Versus "Cooperative Learning". **Sobhani** Z.; Ahmadi, F.; Jalili, M.; Hatmi, Z.N.; Olang, O.; Eslami, K.; Gatmiri, S.M. (C98)															
1ST REVIEWER	2	2	1	1	1	0	N/A	2	2	2	0	0	2	2	65%
2ND REVIEWER	2	1	1	2	1	0	N/A	1	2	2	0	0	2	2	62%
3RD REVIEWER	2	1	2	2	2	0	2	2	2	2	2	1	2	2	86%

CRITICAL APPRAISAL OF ARTICLES	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/ input variables described and appropriate?	4. Subject (and comparison group, if applicable) characteristics sufficiently described?	5. If interventional and random allocation was possible, was it described?	6. If interventional and blinding of investigators was possible, was it reported?	7. If interventional and blinding of subjects was possible, was it reported?	8. Outcome and (if applicable) exposure measure(s) well defined and robust to measurement / misclassification bias? Means of assessment reported?	9. Sample size appropriate?	10. Analytic methods described/ justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	**SCORES**
Simulation-based training is superior to problem-based learning for the acquisition of critical assessment and management skills. **Steadman**, R.H.; Coates, W.C.; Huang, Y.M.; Matevosian, R.; Larmon, B.R.; McCullough, L.; Ariel, D. (E128a)															
1ST REVIEWER	2	2	1	1	2	2	N/A	2	2	2	2	2	2	2	88%
2ND REVIEWER	2	2	2	2	2	2	N/A	2	0	2	1	0	2	2	81%
3RD REVIEWER	2	2	2	1	2	2	0	2	2	2	2	1	2	1	82%

ADDENDUM E – COMPLETE MATRIX OF SAMPLE

REFERENCES				
	(Dolev *et al*., 2010)	(Lindsey & Jenkins, 2013)	(Schwartz *et al*., 2007)	(Steadman *et al*., 2006)
METHODOLOGY				
Research purpose	Determining the effect of an online eDerm curriculum on the ability of students to diagnose and manage melanoma and non-melanoma skin cancers before and after clinical dermatology clerkship (p e166)	Determining if a clinical simulation educational intervention improves student nurses' clinical judgement. Students are evaluated during management of patients experiencing rapid clinical deterioration (p 61, 63).	Determining the efficacy of simulation compared to case-based learning by measuring behavioural actions (p 131).	Determining if full-scale high fidelity simulation is superior to interactive problem-based learning in teaching acute care assessment and management (p 152).
Research design	Randomised crossover design. Students in arm 1 completed a pre-test, the eDerm online curriculum and post-test 1 in sequence. Then completed clerkship followed by post-test 2. Students in arm 2 completed pre-test, the clerkship and post-test 1 in sequence. Then completed eDerm online curriculum followed by post-test 2 (p e166).	Pre-test–post-test two-group randomised experimental design. Groups were randomly selected into intervention group and control group (p 63). All students did the pre-test. The control group received the traditional Code Blue scenario and completed the post-test. The intervention group together with the control group received the rapid response education intervention. The intervention group completed the post-test Survey (p 64). Students were divided into smaller groups of 3-4 students for the clinical simulation (p 63).	Randomised comparison design. 102 students were randomly assigned to a case-based learning (CBL) or human patient simulation (HPS) group. One group was subjected to the case-based learning intervention and the other group to Human Patient simulation Evaluated by means of an OSCE (p 133).	Randomised comparative group design. A total of 31 students were computer randomised into a problem-based group (PBL) and a simulator group (SIM). The PBL group received a PBL session on dyspnoea and a Sim session on abdominal pain. The SIM group received a PBL session on abdominal pain and a Sim session on dyspnoea (p 152).
Study site/ Location of study	Trial took place at the School of Medicine at the University of California San Francisco, United	The trial took place in a clinical simulation laboratory at a Midwestern Public University in	The trial took place at the School of Medicine Wayne State University in Detroit, United States	The trail took place at a simulation centre in the Acute Care College at the University of

REFERENCES				
	(Dolev *et al*., 2010)	(Lindsey & Jenkins, 2013)	(Schwartz *et al*., 2007)	(Steadman *et al*., 2006)
METHODOLOGY				
	States of America (p e166).	Illinois, United States of America (p 61, 64).	of America. CBL was conducted as a classroom instruction and HPS took place in a simulation laboratory located within the Eugene Applebaum College of Pharmacy and Health Sciences (p 131).	California, Los Angeles, United States of America (p 151-152).
Study protocol description	Study conducted 2005-2007 to determine effect of eDerm on management and diagnosis before or after clinical dermatology internship. Enrolled third and fourth year medical students were used as subjects (n=228). Institutional board approval was obtained. Both groups were subjected to both clerkship and eDerm in a crossover design. A pre-test and post-test were used to obtain the results. Statistical software was used to determine results (p e166, e168).	Study conducted using convenience sampling of Baccalaureate students enrolled in a leadership course during final semester of their programme (n=79). A control group was subjected to traditional Code Blue and the intervention group to rapid response education in simulation. A pre- and post-test were used but both groups received the rapid response education. Approval was obtained from Institutional Review Board (p 64). Scantron forms and Scantron machines provided individual scores and item analysis. PASW 17.0 statistical software was used for individual percentage scores that were used to analyse the data further (p 65).	Students were randomly divided into two groups, a CBL group or HPS group. An initial lecture was provided with all the needed didactic material. The CBL group received a vignette, while the HPS group received a short orientation to simulation. Both groups received information on acute coronary syndrome and ventricular fibrillation and tachycardia. Both groups used the LifePak 9 Cardiac Monitor and identical simulated case and debriefed. An ACS OSCE was used to evaluate all the students. Approval obtained from the Wayne State University Human Investigation Committee (p 131).	The course objectives were used for the study but assessments in the study did not affect course evaluation. Students allocated to a SIM or PBL group were divided further into 4 smaller groups (p 152). Lectures on abdominal pain and dyspnoea before intervention. Randomisation and orientation to simulator for both groups with SIM initial assessment. All students received a PBL and SIM intervention in abdominal pain and dyspnoea. PBL received dyspnoea in PBL and abdominal pain in simulation and vice versa for the SIM. Initial and final assessments were compared as well as the group's final scores.
Study population	Eligibility to participate by	Eligibility depended on	Eligible to participate by	Eligibility to participate by

REFERENCES				
	(Dolev *et al*., 2010)	(Lindsey & Jenkins, 2013)	(Schwartz *et al*., 2007)	(Steadman *et al*., 2006)
METHODOLOGY				
	enrolment in an introductory dermatology elective of third (n=55) and fourth (n=219) year medical students (n=274) (p e166).	participation in a clinical simulation day as part of the programme by final year nursing students (n=79) (p 64).	enrolment in 2005 in a mandatory month-long emergency clerkship of fourth year medical students (n=105) (p 133).	enrolment of fourth year medical students during a week-long acute care course (n=34) (p152).
Sampling	Sampling occurred from 2005 to 2007. Block randomisation was used as method. The first 38 students were blindly included from each group for balanced design. Attrition of 22 students took place, four due to technical difficulties and the remainder due to no identifiable cause. The final sampling completing the trial (n=252) consisted of third and fourth year students. No mention was made regarding age, gender or race in randomisation. The group included for analysis n=228. Arm 1 and 2 each (n=114) (p e166-168).	Randomisation was done by the investigators into an intervention group (n=40) and a control group (n=39). The randomisation method was not discussed further. The students were all in the age group of 20-22 year-old Caucasian females from northern Illinois (p 63-65).	Students were randomly assigned to two groups. Randomisation took place monthly as the students presented for the month-long course. The exact method of randomisation was not discussed further. Fourth year students with a mean age of 26.7 years, range 22-44 years and male 52.0% were included with no mention of race. Students that attended the initial lecture were considered eligible; three students were excluded from the trail due to failure to attend the lecture component of intervention n=102, CBL=52 and HPS=50. The sample size formula by Lauter for MANOVA study designs was used and indicated 46 participants in each group would be needed to achieve a strong power (0.80) when the significance level is set at 0.05 (p 130-133).	A computer randomisation programme randomised the students into two groups, SIM (simulator based learning) n=15 and PBL (problem-based learning) n=16. Female 60% in SIM, female 69% in PBL, no mention was made to age or race in randomisation. Absence from any portion of the week resulted in exclusion from the study. Three students were absent from one or more sessions (n=31) (p 152-154).
Ethics	Institutional board approval was	Institutional Review Board	Approval was obtained from the	Human Subjects Protection

REFERENCES				
	(Dolev *et al*., 2010)	(Lindsey & Jenkins, 2013)	(Schwartz *et al*., 2007)	(Steadman *et al*., 2006)
METHODOLOGY				
	obtained. No mention was made of informed consent, but tutorials formed part of curriculum (e165-e168).	approval was obtained. Written consent was obtained and the study was conducted anonymously. Those who did not wish to participate wrote 'refused' on the forms. The students who refused did not complete the pre- and post-test surveys (p 63-64).	Wayne State University Human Investigation Committee. Consent was obtained and students who did not agree to participation were included in randomisation as the clerkship was mandatory. A confidentiality contract was signed and failure to abide by the contract was considered a violation of the code of honour (p 130-133).	Committee approval was obtained. Written consent was obtained (p 152).
Comparability of groups	Fourth and third year students, no mention was made of gender, age or race (p e166).	Final semester students. The sample was 20-22 year old female Caucasian students (p 63, 65).	Fourth year students. Mean age of 26.7 years, range 22-44 years. Male 52.0%, no mention was made of race (p 130).	Fourth year students. Female 60% in SIM, female 69% in PBL, no mention was made of race or age. The gender distribution between the two groups was determined using a chi-square test to verify the randomisation process (p 152-154).
Study population Initial n	Eligibility to participate by enrolment. Enrolled third (n=55) and fourth (n=219) year medical students were eligible for the trial (n=274) (p e166).	Eligibility depended on participation in a clinical simulation day as part of the programme. Enrolled final year nursing students (n=79). A sample of homogenous final semester Baccalaureate nursing students (n=79) were eligible for the study (p 64).	Eligible to participate by enrolment in 2005 in a mandatory month-long emergency clerkship was eligible for the study. Enrolled fourth year medical students (n=105) in 2005 in a mandatory month-long emergency clerkship were eligible for the study (p 133).	Eligibility to participate by enrolment. Enrolled fourth year medical students during a week-long acute care course were eligible for the study (n=34) (p152).
Attrition rate	Eighteen students elected to withdraw from the study and 4	No attrition (p 65).	Students who did not attend the initial lecture were excluded (n=3)	Students who did not attend any portion of the weeklong course

REFERENCES				
	(Dolev *et al*., 2010)	(Lindsey & Jenkins, 2013)	(Schwartz *et al*., 2007)	(Steadman *et al*., 2006)
METHODOLOGY				
	participants declared inability to finish. Students who did not complete (n=22) (p e168).		(p 131).	were excluded (n=3) (p 152, 154).
Sampling	Sampling occurred from 2005 to 2007. Block randomisation was used as method. The first 38 students were blindly included from each group for balanced design. There was attrition of 22 students, four due to technical difficulties and the remainder due to no identifiable cause. The final sampling that completed the trial (n=252). The group included for analysis (n=228). Arm 1 and 2 each (n=114) (e166-168).	Randomisation was done by the investigators into an intervention group (n=40) and a control group (n=39). The randomisation method was not discussed further. The students were all in the age group of 20-22 year-old Caucasian females from northern Illinois (p 63-64).	Students were randomly assigned to two groups. Randomisation took place monthly as the students presented for the month-long course. The exact method of randomisation was not discussed further. Students that attended the initial lecture were considered eligible; three students were excluded from the trail due to failure to attend the lecture component of intervention n=102, CBL=52 and HPS=50. The fourth year students had a mean age of 26.7 years, range 22-44 years and male 52.0%. The sample size formula by Lauter for MANOVA study designs was used and indicated 46 participants in each group would be needed to achieve a strong power (0.80) when the significance level is set at 0.05 (p 130-133).	A computer randomisation programme randomised the students into two groups, SIM (n=15) and PBL (n=16). Absence from any portion of the week resulted in exclusion from the study. Three students were absent from one or more sessions (n=31). Female 60% in SIM, female 69% in PBL (p 152-154).
Characteristics of participants	Fourth and third year students, no other characteristics described. Dermatology experience reported	Students were 20-22 year old Caucasian females. All were Baccalaureate nursing students in	A questionnaire obtained general demographic information about age, gender, resuscitation	Fourth year medical students. SIM=60% and PBL=69% female (p 154).

REFERENCES				
	(Dolev *et al*., 2010)	(Lindsey & Jenkins, 2013)	(Schwartz *et al*., 2007)	(Steadman *et al*., 2006)
METHODOLOGY				
	in groups, arm 1 (n=70) and arm 2 (n=72) (p e168).	final semester of programme. No other demographic information supplied. 95% of the students reported previous knowledge of the intervention (p 65).	experience as either witness or participant, choice of residency speciality and self-determining learning style. Barsch Learning Styles Inventory was used (p 131). Groups well balanced in the above. Six students in HPS had not witnessed resuscitation (p 133).	
Intervention/s	The intervention consisted of receiving an eDerm web-based programme consisting of 17 tutorials at the beginning or the end of clinical dermatology clerkship that consisted of 2 weeks of 14 half-day outpatients' clinics. eDerm computer-based programme tutorials consisting of discussions with visualisation for evaluation of skin lesions. A lecture provided information on pigmented and non-pigmented skin lesions with information on clinical features and differential diagnosis of melanoma, non-melanoma, skin cancers, nevi and benign dermatoses Clerkship consisted of outpatients' clinics including dermatology, dermatology surgery, paediatric dermatology and other specialities	The rapid response education intervention consisted of a 10-minute lecture followed by a guided rapid response simulation (p 64).	Initial lecture on acute coronary syndrome (ACS) and core objectives provided. CBL session (1h) received a vignette of a patient with classic ACS and reviewed the advanced cardiac life support protocols. HPS session (1h) received a 15-minute mannequin orientation explaining all features, followed by an individual simulation session. Evaluation by OSCE. All students received an emergency medicine management lecture with reading material on acute coronary syndrome (ACS) and core objectives. CBL session (1h) received a vignette of a patient with classic ACS. Students reviewed advanced life support protocols for ventricular fibrillation. HPS session (1h) received a 15-	All students received two intervention sessions, one on PBL and one on simulation. The PBL group received a PBL session on dyspnoea and a simulation session on abdominal pain. The SIM group received a PBL session on abdominal pain. A lecture on vital signs was presented before the initial assessment. Both groups received the equivalent of instruction and time spent on subjects (p 151-152).

REFERENCES				
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	averaging 10-14 patient/day (p e166-e167).		minute mannequin orientation explaining all features (p 131-132).	
Exposure time to intervention	Clerkship=2 weeks and tutorials 1 day, according to description, but 17 tutorials seems a lot for one day (p e166).	Exposure consisted of participation in simulation day (p 66).	One-month clerkship in emergency medicine with chest pain curriculum (p 131).	Five days (p 152).
Blinding	Students logged in with a designated user identification blinded to the investigators. Random rotation of the pre-test, post-test 1 and post-test 2 by user identification (p e168).	All consent forms were placed in an envelope and the lab faculty and investigators did not know which students had consented to participate in the study, although all students participated in the exercise (p 64).	Trained evaluator and physicians (to verify inter-rater reliability) who scored the results were blinded to the training protocol of the students (p 132).	The two raters were blinded to group assignment of the students (p 153).
Data collection methods	Internet assessment took place on a 15-item test; each item had options for diagnosis and management of lesions providing 2 scores ranging from 1-15. The previously used instrument was considered a proven instrument. Correct diagnosis was based on biopsy proven diagnosis of the lesion. Parallel versions of the tests (A, B, C) provided each group with the same amount and difficulty of diagnosis (p e168-e169).	An 11 item multiple-choice survey was used in pre- and post-tests. Questions 1, 5, 6, 8 and 9 assessed knowledge about purpose, function and anticipated outcomes of rapid response systems. Questions 2, 3, 4, 7 and 10 assessed clinical judgement in activating and participating in rapid response calls. Question 11 assessed prior knowledge of rapid response calls. Content validity was determined by consultation of nursing faculty with expertise in critical care and education (p 63-	An ACS OSCE evaluated all the students. A similar scenario with an actor as patient was used for history taking and workup. A Resusci Anne mannequin and LifePak Cardiac Monitor were used for the cardiac arrest. Physicians evaluated the recorded sessions for inter-rater agreement (p 132). The OSCE had 43 behavioural observations, with three subscales, history (n=22), AMI observations and management (n=13) and cardiac	Scenario was managed in pairs in 15 minutes to obtain a primary and secondary assessment and initial critical management. The METI high fidelity simulator was used in all 3 assessments. The checklist was proven by previous use. The same cases and checklists were used in PBL. Both groups were assessed on the simulator for management of dyspnoea with standardised checklists. Final assessments were videotaped for debriefing

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		64).	arrest management (n=8) (p 132).	purposes (p 152-153, 156).
Statistical analysis	Statistical software used (SPSS, Version15.0, SPSS Inc., Chicago, IL) for two-way repeated measures' analysis of covariance for diagnosis and management. Interaction of the 3 test time-periods and arm assignments were evaluated. The Pearson Correlation Coefficient was determined for correlation between diagnosis and management (p e168).	Scantron forms were used for pre- and post-tests. Scantron machines provided individual scores and item analysis. PASW 17.o statistical software was used for individual percentage scores that were used to analyse the data further (p 65).	Descriptive analysis was used regarding the demographics. Multivariate analysis of variance (MANOVA) was used to control for type 1 error inflation. The SPSS version 14.0 (SPSS Inc., Chicago, IL) was used for statistical analysis. A standard deviation of 0.75 was recorded. Adequate sample size was determined using the Lauter formula for MANOVA study designs. A group size of 46 participants was needed to achieve strong power (0.80) with a level of significance set at 0.05 (*p* 132). Cronbach's ∝ was implemented for internal consistency for each scale.	The overall score of each subject was determined (fraction of checklist items performed) for both initial and final assessments. The change in score was determined (present correct in final minus the present correct in initial). Comparison between groups, the means and standard deviation and the change in both initial and final assessments were done using the student's t-test. Significant *p* value of <.05. Verification of randomisation was done using a chi-square test for gender distribution. The Shapiro-Wilkes Test evaluated assessment scores for normality (Gaussian distribution). No other specific statistical software mentioned. Analysis of initial and final scores did not indicate any basis to reject the normal distribution (p 153-154).
Outcomes	Pre-test scores similar Arm 1 diagnosis 38.1% versus arm 2 diagnosis 38.3%. *p*=.94. Arm 1 management 54.7% versus arm 2	Pre-test scores similar Control group M=57.05, SD=16.47 and intervention group M=61.07,	----------	No basis was found to reject a Gaussian (normal) distribution in initial and final assessment. Similar initial assessment scores.

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	management 55.1%. *p*=.87 (p e168).	SD=17.19 (p 65).		Initial assessment scores between groups *p*=.64 (p 154).
	Equal dermatology experience in both groups Dermatology experience Arm 1=70 and Arm 2=72. Fisher exact test *p*=.89 (e168).	Item 11 measured prior exposure to intervention. Gaps in prior knowledge were reduced. Prior knowledge had little effect on the pre-test scores. 34% (n=27) reported that they had heard of rapid response, 39% (n=31) had witnessed a rapid response call, 11% (n=9) had participated in a rapid response call and 5% (n=4) were unfamiliar with rapid response. Gaps in prior knowledge were reduced mean pre-test scores 57% versus mean post-test scores 91% (p 65).	Descriptive analysis of demographic data, learning styles and speciality preference. Six students had not witnessed resuscitation. No differences in mean age (26.7 years; range, 22–44 years), gender (male, 52.0%) or preference for emergency medicine specialty training (28.4%). Learning styles by self-rating were similar overall: 54.9% visual learners, 7.8% auditory learners and 37.3% kinetic learners.	No significant differences between groups regarding gender. SIM 60% female and PBL 69% female *p*=.72.
	Statistical change in diagnostic and management scores over time with increase in scores after both clerkship and eDerm: Arm 1 p<.001. Arm 2 p<.001 (p e168).	Both groups had improved post-test scores. Significant improvement in intervention group through *t*-test. Intervention group M=90.91, SD=8.73. Control group scores M=64.80,	Three subscales were computed: history taking, acute coronary syndrome evaluation, management, and cardiac arrest management. Overall scores not significantly different.	Statistical significant improved performance of SIM group versus PBL group. Mean change in scores (% correct in initial assessment minus % correct in initial assessment.

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		SD=19.69. t(77)=7.65, p<.001 (p 65).	Overall score (43 items) CBL 31.4(4.1) HPS 31.2 (3.6). Mean difference (MD) 0.2 (-1.3, 1.7) History (22 items) CBL 15.9 (2.8) HPS15.5 (2.8) MD 0.4 (-0.8, 1.4) Acute MI evaluation and management (13 items) CBL 9.0 (1.9) HPS 8.7 (1.9) MD 0.3 (-0.4, 1.1). Cardiac arrest Management (8 items) CBL 6.5 (1.3) HPS 7.0 (1.2) MD 0.5 (-1.0, 0.02) (p 133).	Final assessment between groups p<0001. Mean change in scores greater for SIM (25%) than mean change for PBL (8%) with *p*=.04 (p 154).
	In addition, a significant interaction between arm assignment and time was found for diagnosis scores, showing that the order of intervention was important. Overall correlation indicated between diagnosis and management scores. eDerm after clerkship resulted in highest level of diagnosis scores. *P*=.005. eDerm after clerkship resulted in higher level of management scores. Both arms achieved statistically	Intervention group showed improvement in all questions except nr 3. Greatest progress in questions 1, 10, 4 and 5. Nr 1, 5, measured knowledge and nr 4, 10 measured clinical judgement. Control and intervention group comparison. Post-test control and post-test intervention group 1. 33 and 100 2. 89.7 and 97.5 3. 79.5 and 82.5 4. 69.2 and 100 5. 53.9 and 85 6. 74.4 and 100 7. 61.5 and 95	Results of the MANOVA indicated no significant effect. Mean difference between groups and student performance. There was no significant effect with Hotelling's T2 [3,98]=0.053; p=0.164) of education modality (standard or HPS) of the three subscales on the difference in the mean number of observed actions performed there was no overall mean difference in groups (p=0.770) and majority of item. No difference in the subscale measurement of history taking, acute coronary syndrome evaluation and management	There was no effect of order comparing mean pre post or change. The first and last 5 students were used for comparison p≥.38.

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	significant higher scores in management than diagnosis. P<.001. There was a correlation between overall diagnosis and management scores. r Range = 0.58-0.68.	8. 71.8 and 97.5 9. 61.5 and 77.5 10. 25.6 and 72.5. Gains in numbers 1, 5, 6, 8 and 9 indicate knowledge increase. Gains in numbers 2, 4, 7 and 10 indicate clinical judgement. Intervention group scored highest overall with best improvement in specific subscales for knowledge and clinical judgement. All over gain in subscales for knowledge in clinical judgement (p 65).	and cardiac arrest management. (p 133). The researcher with the help of a biostatistician, did further interpretation of the outcomes which indicated that both groups demonstrated clinical judgement. The subscales of acute coronary syndrome evaluation and management and the cardiac management items were respectively n=13 items and n=8 items. AMI evaluation and management indicated mean percentage scores of all the items as CBL=69.2% and HPS=66.9% and the cardiac management scores indicated CBL=81% and HPS=87.5%. The scores indicate how both groups performed with regard to clinical judgement regardless if one could not be proven superior to the other. (p 134-135)	
	In a sub-analysis, results were analysed by whether the lesion was malignant, benign, pigmented or non-pigmented: Diagnosis: No significant difference or interaction between the two arms of the study for	None.	None.	A large effect size regarding the SIM group, according to Colliver, 0.8 is considered a large effect size: The effect size that is the difference of the group means divided by the SD that are

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	benignity and non-pigmentation of lesions. Significant interaction between study arm and time for diagnostic skills for malignant (p<.001) and pigmented (p<.001) lesions. Management: no significant Difference. Results indicate the highest levels of improvement with eDerm after clerkship (p e168).			attributable to SIM-based learning =0.73 and is >0.5 (p 153-154).
Conclusions/Main findings	Significant increase found in diagnosis and management through eDerm. Higher correct diagnosis with eDerm after clerkship (p e169). eDerm provides scaffolding for learning when applied after clinical experience. Improved diagnostic skills found but with also improved management (p e170).	Significant gains in knowledge acquisition and clinical judgement. Decrease in scores for in one subscale (question 3) subsequent to intervention although the majority of students (83%) answered correctly (p 65).	No significant differences were found by comparing CBL and HPS in outcomes as measured in OSCE (p 133).	Improvement in SIM training over PBL. Preceding simulation training with PBL attained improved performance and reaching of learning objectives. Overall final scores showed marked improvement in SIM scores as well as from initial to final assessment (p 154).
Value of study	Finding is important for use in medical schools for physical examinations. eDerm is additive to dermatology clerkship (p e169). Learner led interaction,	Application to teaching early response systems. Gaps in prior knowledge (mean pre-test scores 57%0 were reduced (mean post-test scores 91%). The study	One of few prospective randomised studies comparing different teaching methods. The researchers suggested that as HPS offers the opportunity for	Study indicated simulation as effective means of teaching (p 156).

REFERENCES				
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	standardisation of quality, decreased costs, relief of logistical difficulties in large number of student, large number of students can be taught in different locations. Improved diagnosis with improved management and referral from other medical practitioners with this method improve clinical practice of dermatology. Limited dermatology resources will be better applied in future (p e170).	supports the use of simulation to enhance knowledge and clinical judgement (p 65-66).	deliberate practice, not afforded the students in the study, and may lead to improved outcomes in future (p 133, 135-136).	
Limitations	Delayed testing for knowledge retention was not performed. Limited number of melanoma lesions in eDerm curriculum (p e170).	Convenience sample of senior nursing students was used although sample size was large and randomisation applied. Test sensitisation due to pre- and post-test design may have threatened internal validity. Interaction between pre-test and intervention may have threatened external validity. Results may have been confounded by use of multiple education interventions in close succession (p 66).	A threat to internal validity may have existed through the baseline academic achievement differences despite random assignment and concurrent learning. Equality between the groups was demonstrated in factors that may potentially have influenced the study. Concurrent learning of the students may provide another threat to internal validity as the researchers could not control the number of cardiac patients or codes encountered between intervention and outcome. A difference in study habits may have masked a	Study may have been constrained by the limits of the curriculum within which the study took place. Simulation group had advantage as simulation was used for final assessment (simulator practice bias), but was addressed by providing equal simulation time for both groups. The study did not measure whether the improved scores translates to improved performance in clinical setting. Variability in PBL measurement due to the oral feedback (p 155-156).

REFERENCES				
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			difference in efficacy as the students did study on their own outside of the prescribed reading and didactics (p 133, 136-137.	
Funding source	Sulzberger Educational Grant from the American Academy of Dermatology. Declared no conflicts of interest (p e165).	No funding sources indicated.	No funding sources indicated.	Funded by the David Geffen School of Medicine at UCLA Los Angeles (p 151).

CBL=Case-based learning. HPS=Human patient simulation. SIM=Simulator learning. PBL=Problem-based learning. ACS=Acute Coronary Syndrome.

eDerm=Web-based learning. OSCE=Objective Structures Clinical Exam