

# **Measuring Critical Thinking in Midwifery Students**

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## **Abstract**

Well-developed critical thinking skills are essential for autonomous midwifery practice but strategies to develop these skills are often not made explicit in undergraduate education. There is a dearth of studies investigating the development of critical thinking in undergraduate midwifery students and no published tools that specifically measure critical thinking in relation to midwifery practice.

This program of work aimed to evaluate and measure midwifery students' critical thinking skills in preparation for autonomous midwifery practice. The thesis is presented as a series of published and unpublished works, comprising of six sequential and interlinked studies with five overarching aims.

The methodology used in this body of work was a sequential mixed methods design, where the data and results from one study provided a basis and direction for the next study. Initially, a pilot study examined the effectiveness of an innovative assessment item involving root cause analysis on the development of critical thinking abilities of undergraduate midwifery students. Although the results indicated that this assessment item increased critical thinking skills, only participants' perceptions were measured and there was no validated measure of critical thinking. There was also no baseline and post-intervention measure of critical thinking to demonstrate causal effects of the teaching intervention.

In recognition of the need to use robust, reliable and valid tools to measure critical thinking, the second study involved a systematic review of the literature. This review aimed to identify an appropriate tool to measure critical thinking in midwifery. The review is presented in two publications on 1) the reliability and validity of tools used to measure critical thinking in nursing and midwifery undergraduate students; and 2) the efficacy of teaching methods used to improve critical thinking in nursing and midwifery undergraduate education. These systematic literature reviews found no measures specifically for midwifery and no tools that measured the application of critical thinking in midwifery practice. Conclusions of the reviews established the need to develop discipline specific instruments to explicitly measure the application of critical thinking in midwifery practice. Given the complexity of critical thinking in midwifery practice, a multimethod approach to the measurement of students' critical thinking was chosen.

The next three studies involved the development, piloting and testing of three tools designed to measure critical thinking in midwifery practice for undergraduate midwifery students. The tools were named the Carter Assessment of Critical Thinking in Midwifery (CACTiM) - (Preceptor/Mentor, Student, and Reflection). Psychometric testing of the three tools during each pilot study provided preliminary evidence that all tools were reliable and valid measures of critical thinking skills in midwifery practice.

The final study aimed to further establish the validity and reliability of the three CACTiM tools. A matched cohort of students ( $n = 55$ ) was used. Positive correlations were found between the three scales and student characteristics, including Grade Point Average, year level and previous qualifications. Results also indicated good reliability and concurrent validity.

Critical thinking skills are vital for safe and effective midwifery practice. Assessment of midwifery students' critical thinking development throughout their degree program makes these skills explicit, and could guide teaching innovation to address identified deficits. Adopting a multimethod approach to the measurement of critical thinking in midwifery captures the complexity of critical thinking in midwifery practice, and provides students with useful and objective feedback from multiple sources. The use of reliable, valid and freely available tools promotes and facilitates ongoing research into the development of critical thinking in education and practice. It is therefore recommended that the three CACTiM tools are implemented routinely and used in the longitudinal measurement of students' critical thinking development throughout midwifery education programs. The tools could also be used to measure critical thinking for midwifery graduates and midwives in practice. Further testing of these tools with a larger, more diverse student sample is recommended.

## **Statement of Originality**

This work has not previously been submitted for a degree or diploma in any university. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

(Signed) 

Amanda Carter

30<sup>th</sup> October 2017

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## Glossary

Capstone course	A course with the specific objective of culminating and integrating the diverse elements of the educational program (Durel, 1993).
Clinical decision making	Clinical decision making is the process of choosing from a number of alternative options or actions when planning or implementing care (Raynor & Bluff, 2005).
Critical thinking	Critical thinking is defined as, in-depth and higher order thinking that facilitates knowledge development, contextual decision making and problem solving skills, with analysis of situations from different perspectives (Facione & Facione, 1996). The cognitive process of critical thinking informs clinical decision making.
Habits of the mind	Characteristic attributes that assist individuals to think more effectively or critically.
Industry midwifery partners	Midwifery practitioners, educators, managers or directors representing a health service where midwifery students undertake clinical placement.
Practice lecturer	Midwifery academics employed by the university who provide onsite support to students and preceptors during clinical placement.
Preceptor	A clinical midwife who facilitates, monitors, supports and assesses the student's learning in the clinical environment. May be referred to as a mentor in some countries.
Reflection	Reflection involves purposeful thinking in the form of contemplation of thoughts, feelings and experiences related to a specific event (Kennison & Misselwitz, 2002).
Root cause analysis	Root cause analysis is a systematic process used to promote quality and safety by identifying the source of the problem, and preventing the problem from reoccurring (Connelly, 2012).
Undergraduate midwifery students	Students undertaking a pre-registration midwifery degree

## **Acronyms and Abbreviations**

ACM	Australian College of Midwives
ANMAC	Australian Nursing & Midwifery Accreditation Council
ANMC	Australian Nursing and Midwifery Council
APA	American Philosophical Association
CACTiM	Carter Assessment of Critical Thinking in Midwifery
CASP	Critical Appraisal Skills Program
CCTDI	California Critical Thinking Disposition Inventory
CCTST	California Critical Thinking Skills Test
CVI	Content Validity Index
GPA	Grade Point Average
HSRT	Health Sciences Reasoning Test
ICM	International Confederation of Midwives
NMBA	Nursing and Midwifery Board of Australia
NMC	Nursing and Midwifery Council (UK)
RCA	Root cause analysis
SEC	Student Evaluation of the Course
SET	Student Evaluation of Teaching
SPSS	Statistical Package for the Social Sciences
WGCTA	Watson-Glaser Critical Thinking Appraisal



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## Acknowledgement of Published Papers

Included in this thesis are published or unpublished papers in Chapters 2, 3, 4, 5, 6, 7 and 8 which were co-authored with other researchers. My contribution to each co-authored paper is outlined at the front of the relevant chapter. The bibliographic details/status of these papers including all authors, are:

### Chapter 2:

Carter, A. G., Sidebotham, M., Creedy, D. K., Fenwick, J., & Gamble, J. (2014). Using root cause analysis to promote critical thinking in final year Bachelor of Midwifery students. *Nurse Education Today*, 34(6), 1018-1023. <https://dx.doi.org/10.1016/j.nedt.2013.10.020>

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Carter, A. G., Sidebotham, M., Creedy, D. K., Fenwick, J., & Gamble, J. (2015). Strengthening partnerships: The involvement of health care providers in the evaluation of authentic assessment within midwifery undergraduate education. *Nurse Education in Practice*, 15(4), 327-332. <https://dx.doi.org/10.1016/j.nepr.2015.01.013>

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### Chapter 3:

Carter, A. G., Creedy, D. K., & Sidebotham, M. (2015). Evaluation of tools used to measure critical thinking development in nursing and midwifery undergraduate students: A systematic review. *Nurse Education Today*, 35(7), 864-874. <https://dx.doi.org/10.1016/j.nedt.2015.02.023>

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#### **Chapter 4:**

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#### **Chapter 5:**

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#### **Chapter 6:**

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#### **Chapter 7:**

Carter, A. G., Creedy, D. K., & Sidebotham, M. (2017). Critical thinking evaluation in reflective writing: Development and testing of Carter Assessment of Critical Thinking in Midwifery (Reflection). *Midwifery*, 54, 73-80. <https://dx.doi.org/10.1016/j.midw.2017.08.003>

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## Chapter 8:

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Co-Principal Supervisor: Associate Professor Mary Sidebotham

# Conference Papers Arising from this Thesis

## International Conferences

Carter, A.G., Sidebotham, M., Gamble, J., & Creedy, D.K. (2014, June). *Promoting critical thinking and decision making in final year Bachelor of Midwifery students*. Paper presented at Nurse Education Today/Nurse Education in Practice (NET/NEP) 5<sup>th</sup> International Nurse Educators Conference, The Netherlands.

Carter, A.G., Creedy, D.K., & Sidebotham, M. (2016, April). *Development of critical thinking measure for undergraduate midwifery students*. Paper presented at Nurse Education Today/Nurse Education in Practice (NET/NEP) 6<sup>th</sup> International Nurse Educators Conference, Brisbane.

Carter, A.G., Creedy, D.K., & Sidebotham, M. (2017, June). *Measuring critical thinking development in undergraduate midwifery students*. Poster presented at 31<sup>st</sup> International Confederation of Midwives Triennial Conference: Midwives – Making a Difference in the World, Toronto.

## National conferences

Carter, A.G., Sidebotham, M., Creedy, D.K., Fenwick, J., & Gamble, J. (2014, September). *Using root cause analysis to develop critical thinking skills in midwifery students*. Paper presented at the Australian College of Midwives Queensland National Student Conference, Gold Coast.

Carter, A.G., Creedy, D.K., & Sidebotham, M. (2015, October). *Development of a critical thinking measure for undergraduate midwifery students: Carter Assessment of Critical Thinking in Midwifery (CACTiM)*. Poster presented at the Australian College of Midwives Queensland 19<sup>th</sup> Biennial Conference: Super Midwives Make a Difference, Gold Coast.

## Significant Seminars

Carter, A. G. & Sidebotham, M. (2013, October) *Transition to professional midwifery practice*. Paper presented at Griffith University Conference 'Capstones: The time is NOW', Brisbane.

# CHAPTER 1

## Introduction

*‘Education is not the learning of facts, but training the mind to think’*

*Albert Einstein*

Chapter one provides the background to this thesis. Critical thinking will be briefly defined, followed by a specific discussion around the unique nature of critical thinking in midwifery, and current studies in this area. The research problem will then be presented. Personal background details that situates the student in this program of research follows. Next, an outline of the body of work in chronological order is presented describing the sequential conduct of each study. The final section of this chapter provides an outline of the thesis.

### **Critical Thinking Definition**

The teaching and development of critical thinking skills is a crucial component of any academic program. Critical thinking involves thinking in a conscious, purposeful, analytical and questioning manner (Facione, 1990). This high level cognitive thinking facilitates deep learning through critical analysis of new ideas, facts and information. Learning is greatly improved when critical thinking is applied, encouraging students to interpret new knowledge and analyse its applicability to complex situations (Facione, 2013). Employers highly value critical thinking skills and in the past three years there has been a 158% increased demand for critical thinking skills in advertised positions (Foundation for Young Australians, 2016). Although universities also highly value critical thinking skills and assert it to be an important graduate attribute (Rigby et al., 2010), strategies to promote development of critical thinking are often not clearly articulated in the literature and routine measurement is rare.

A consensus definition of critical thinking originally developed by the American Philosophical Association (APA), is summarised as “...the process of purposeful, self-regulatory judgment. This process gives reasoned consideration to evidence, context, conceptualizations, methods, and criteria” (Facione, 2013, p7). A discipline specific consensus definition of critical thinking in nursing was developed by Scheffer and Rubenfeld (2000) based on the results of a Delphi study with experts. A set of 17 critical thinking skills and habits of the mind in nursing were developed, many of which reflected Facione’s (1990) earlier work with the addition of creativity, intuition and transforming knowledge (Scheffer &

Rubenfeld, 2000). To date, there has not been a consensus definition of critical thinking in midwifery. What is common to all definitions, is the concept that critical thinking is a process to inform judgements and decision making.

Effective problem solving is not possible without the application of critical thinking to the nature of a problem and possible solutions (Paul, Binker, & Willsen, 1995). Critical thinking has been described as the 'cognitive engine' driving professional judgement and competent decision making (Facione & Facione, 1996). Critical thinking development is especially important in healthcare disciplines where clinical decisions are made continuously and sound judgement is crucial in the provision of safe and effective care. In undergraduate midwifery education, critical thinking, critical decision making and critical analysis of evidence are core program components required by midwifery regulatory bodies internationally (Australian Nursing & Midwifery Council, 2014; Nursing and Midwifery Council, 2009).

For the purpose of this thesis critical thinking is defined as in-depth, higher order thinking that facilitates knowledge development, contextualised decision making and problem-solving skills, with analysis of situations from different perspectives (Facione & Facione, 1996).

## **Critical Thinking in Midwifery**

Midwifery decision making is unique and complex. Within most health disciplines, decisions are made using data obtained from diagnostic testing and clinical cues during illness or injury. Using an analytical or rational approach, this clinical information combined with the evidence, is often used to inform decision making. In contrast to other health disciplines, midwifery care is philosophically grounded within a primary healthcare model where pregnancy and birth are viewed as normal, physiological life events (International Confederation of Midwives [ICM], 2014; Jefford, Fahy, & Sundin, 2011). Holistic decision making is required which embraces a variety of knowledges whilst valuing the significance of childbirth as a life event (Siddiqui, 2005). Holistic, individualised care involves thinking critically about each woman and her unique situation, and modifying the approach to care according to the woman's response or preferences (Gilkison, Giddings, & Smythe, 2016).

Midwifery care involves the development of a partnership relationship between the woman and midwife. The midwifery partnership is reciprocal and based on equity, respect, trust,

negotiation, and mutuality (Pairman & McAra-Couper, 2015), where shared decision making is promoted. Shared decision making acknowledges and values the woman's knowledge of her own body and facilitates her own decision making, supporting the ethical principle of autonomy. Within this model the woman's values and preferences are balanced with unbiased information based on the best available evidence (Freeman & Griew, 2007; Noseworthy, Phibbs, & Benn, 2013).

To facilitate the provision of safe appropriate care, clinical judgements and decisions need to be based on suitable evidence. Although there is a proliferation of evidence and clinical guidelines within maternity care, seeking the best available evidence is challenging. Contextual evidence that is congruent with the woman's individual circumstances is often absent. Although clinical guidelines espouse to provide best practice 'recipes' for care, not all are based on the best available evidence, and are often out-of-date (Mènage, 2016; Prusova, Churcher, Tyler, & Lokugamage, 2014). Therefore, an essential skill in critical thinking in midwifery is the critical appraisal of literature to facilitate contextualised, evidence-based decision making.

Sound professional judgment that is informed by critical thinking requires disciplined inquiry complemented by reflection (Paul et al., 1993). The consensus definition of critical thinking in nursing recognises reflection as a fundamental element (Scheffer & Rubenfeld, 2000). The concept of critical thinking is intrinsically linked to reflection as both processes involve profound thought and evaluation of practice. Reflection on clinical practice develops critical thinking skills by fostering self-awareness and understanding, and identification of improvements to practice (Naber, Hall, & Schadler, 2014; Craft, 2005; Kennison, 2006). Self-awareness is a key element of midwifery decision making, facilitating the midwife to reflect on their own knowledge and skills and identify alternative approaches to care (Mènage, 2016).

Midwifery care is unique and complex, where decisions cannot be reasoned from the simple application of knowledge (Gilkison et al., 2016). A high level of cognitive skill is required to balance the philosophical underpinnings of midwifery care and its holistic nature, whilst applying contextualised evidence and honouring the woman's own preferences and choices. Considering the importance of critical thinking skills in midwifery practice, and the emphasis on development by professional regulatory bodies, it is important that undergraduate students develop this skill. To facilitate development of critical thinking in midwifery, and



ensure graduates are proficient in this cognitive skill, progressive measurement needs to occur throughout an undergraduate program. The measurement tool needs to encompass the distinctive nature of critical thinking in midwifery and provide explicit examples of critical thinking in practice so it is meaningful and purposeful, promoting reflection and discourse about this vital skill.

## **Critical Thinking Development and Measurement in Midwifery**

Although critical thinking is well recognised as a core learning outcome of undergraduate midwifery curricula, there is a dearth of literature measuring development of this skill. It is often assumed that critical thinking development increases as academic and clinical competence increases throughout a degree program.

At the commencement of this doctoral program of work, only four studies related to midwifery students' critical thinking development were found through an extensive search of the literature. The first study explored cognitive skill development, including critical thinking, of students enrolled in an undergraduate midwifery program. A qualitative approach using a focus group with ten second and third year midwifery students was undertaken, as well as an analysis of curriculum documentation (Lake & McInnes, 2012). The authors noted a lack of emphasis on cognitive skill development in both the document analysis and thematic analysis of focus group discussions. Students perceived that cognitive skills would develop automatically through exposure to clinical practice and reported that academic assessments tended to focus on clinical skills and knowledge rather than critical thinking and decision making (Lake & McInnes, 2012). These results reinforced the need to explicitly articulate examples of critical thinking in midwifery throughout the curriculum.

Another study evaluated the use of storytelling as an educational strategy (Hunter & Hunter, 2006). Thirty undergraduate midwifery students were exposed to storytelling weekly and asked to evaluate the effectiveness of this strategy by responding to six short open-ended questions, one of which related to cognitive skill development (Hunter & Hunter, 2006). Students reported that storytelling helped them 'put the midwifery process together or gain insight'. Students described how listening to differing opinions and judgment choices gave them confidence in their own clinical decision making abilities and increased their cognitive learning and critical thinking.

Two studies examined the effect of simulation on midwifery students' decision making skills.

The first study compared students' clinical decision making and critical thinking abilities when exposed to clinical simulation (n = 18) or a standard lecture (n = 18) (Cioffi, Purcal, & Arundell, 2005). Students who experienced the clinical simulation collected more clinical information, re-examined collected clinical information less often, made fewer formative judgements, reported higher confidence, and made final decisions quicker than students in the lecture group (Cioffi et al., 2005). This finding was in direct contrast to that of Scholes et al. (2012) who analysed midwifery students' responses and decisions in a complex postpartum haemorrhage simulation. Students struggled to prioritise when more than one response was required to the situation and tended to use rule based responses rather than demonstrate deeper cognitive thinking. The students failed to demonstrate any inductive and/or deductive reasoning or thinking (Scholes et al., 2012). These contradictory results may reflect differences in how students were prepared for the activity, the complexities of the simulation, and how critical thinking was measured. The results support the need for robust, reliable and valid measurement tools that can assess the effect of teaching strategies on critical thinking abilities.

Four research studies related to critical thinking development for midwifery students have been published since the PhD body of work commenced. Two studies examined the effect of a new curriculum on critical thinking skills. The first study evaluated students' perceptions and experiences of a new enquiry based curriculum (Snow & Torney, 2015). The mixed methods design used questionnaires as well as individual and focus group interviews with students. The authors found that 73% of students perceived an increase in critical thinking skills since implementation of the new curriculum (Snow & Torney, 2015). However, no information was provided on the survey items and it was unclear how critical thinking was measured. Details related to development, validity and reliability of the survey tool were not reported.

Another study explored the experiences of midwifery lecturers and students following the implementation of a narrative centred curriculum (Gilkison et al., 2016). Using a participatory hermeneutic design, data was collected from lecturers' research conversations, student focus groups and written reflections (Gilkison et al., 2016). One of the three themes that emerged was 'learning about midwifery thinking from narratives'. Narratives were perceived to promote the use of midwifery thinking, problem solving skills, and reflection on their values and beliefs, improving midwifery students' critical thinking skills (Gilkison et al., 2016). The

authors did not evaluate whether the perceived increase in critical thinking skills translated to students' clinical practice.

Two studies recently evaluated the impact of simulation on learning by midwifery students. The first qualitative study explored midwifery students' experiences of simulation and skills training (Lendahls & Oscarsson, 2017). Data was collected using 13 group interviews (n = 61). Although the authors did not specifically investigate the impact of this teaching strategy on critical thinking skills, or ask a specific related question, it was reported as an outcome. The authors concluded that students perceived an increase in their critical thinking skills following the intervention (Lendahls & Oscarsson, 2017), however the basis of this conclusion was unclear. These results highlight the need for greater discourse on critical thinking in midwifery and objective measurement.

The use of a learning package on management of post-partum haemorrhage using high fidelity simulation was recently evaluated with undergraduate midwifery students (Amod & Brysiewicz, 2017). Using an exploratory, sequential mixed methodology, data were collected using an evaluation checklist from experts, a student satisfaction survey and focus group discussions with student participants and student observers (Amod & Brysiewicz, 2017). The authors reported that using high fidelity simulation improved students' clinical skills, knowledge, critical thinking and self-confidence (Amod & Brysiewicz, 2017). However, there were no specific questions in the student satisfaction survey related to critical thinking. Although a reported theme from the focus groups related to 'Simulation increases self-confidence and stimulates critical thinking skills', student quotes and examples provided no explicit evidence of critical thinking. Reliability and validity testing of the survey tool were not reported.

Literature related to critical thinking development and measurement for undergraduate midwifery students is relatively scarce. Of the published studies, all reported students' perceptions of critical thinking with no objective measure of baseline levels and change. None of the tools were tested for reliability and validity. Some studies reported increases in critical thinking but it was unclear on what basis these conclusions were made, with little reference to critical thinking in survey questions or students' responses. Within the published studies reviewed, critical thinking in midwifery practice was loosely defined and poorly operationalised.

More recently, two authors developed frameworks or models of decision making in midwifery. Ménage (2016) developed an evidence based midwifery decision making model as a guide in clinical practice. The theoretical model contained four elements of decision making; 'evidence from woman', 'evidence from resources', 'evidence from the midwife' and 'evidence from research' (Ménage, 2016). Although the author reported the model had been utilised to guide decision making in practice, no evidence of this was provided and no formal evaluation of the model had been undertaken. The use of this model to guide education of midwifery students had not been explored.

A framework was used to examine the extent to which midwives engaged in clinical reasoning processes when making decisions in the care of women in second stage labour (Jefford & Fahy, 2015). Narratives were collected using interviews with midwives and content was assessed against this framework. Findings indicated that less than half of the midwives demonstrated clinical reasoning in their decision making (Jefford & Fahy, 2015). Drawing on this earlier work, Jefford, Jomeen and Martin (2016) developed a tool called Enhancing Decision making Assessment in Midwifery (EDAM), to assess midwifery decision making and ultimately classify clinical decisions as optimal or sub-optimal. An expert panel of 42 midwives and midwifery academics applied the measure to vignettes involving midwifery care during the second stage of labour (Jefford et al., 2016). Psychometric testing of the tool revealed good reliability and validity (Jefford et al., 2016). However, applicability of the tool to actual midwifery practice, rather than vignettes was not explored. In addition, the facilitation of reflection and improvement of decision making through the provision of feedback to the midwife involved in the clinical scenario was not discussed. This tool appears to measure tasks undertaken during the care of the woman, rather than examining the cognitive and critical thinking skills that inform decision making.

## **Problem Statement**

Highly developed critical thinking skills are required to navigate and inform complex decision making in midwifery. There are no existing studies focussing on the development and measurement of the critical thinking skills that inform midwifery decision making and no available measurement tools. Standardised commercial critical thinking measurement tools are available in the health sciences (which are described in Chapters 3 and 4) but these are unlikely to be suitable for measurement of critical thinking in midwifery, and incongruous with measuring this skill in midwifery practice. Critical thinking tools for use with midwifery

students need to encompass the distinctive nature of midwifery practice, and ensure measurement is meaningful, purposeful and ultimately promotes improvement in practice. The development of a freely available, robust, reliable and valid tool to measure critical thinking skills in undergraduate midwifery students is vital to ensure they can apply critical thinking to practice and decision making. Measurement of this cognitive skill can highlight areas for development and provide academics with feedback on the efficacy of their teaching practices.

## **Situating the Student in this PhD Program**

My interest in the topic of critical thinking grew from my role as a midwifery lecturer and desire to facilitate student inquiry. As a lecturer, I was involved in teaching within the Bachelor of Midwifery program which is delivered in a blended learning model. In addition to teaching, I also developed course content for the online components of the program. One of the core aims of the Bachelor of Midwifery program was to develop students' critical thinking abilities, enabling them to make sound clinical decisions based on critical analysis of the literature, the woman's choices and preferences, and where appropriate, question practice.

As a midwife with a deep-seated woman-centred practice philosophy, my teaching philosophy was based on a student-centred approach. My teaching practice reflected active learning methodologies which encouraged students to discuss and question new ideas or information and participate in reflection on complex clinical scenarios. Whilst teaching a third year capstone course, I was required to develop a new assessment item. I was eager to develop an assessment item that would reflect my teaching philosophy and encourage student enquiry and critical thinking. Motivated to address the practice-theory gap, I also wanted the assessment item to reflect real-world practice problems.

An innovative and real world assessment item was developed that required students to undertake a root cause analysis on a critical event. Students worked in small teams on cases adapted from coroners' reports and presented their findings and recommendations from their root cause analysis. Due to the innovative nature of this assessment piece, I wanted to measure impact on student learning and critical thinking skills. This initial pilot study started my journey investigating the measurement of critical thinking in midwifery practice.

## **Aims of the Thesis**

The thesis addresses five research aims that have developed sequentially from data and findings from the previous study. The aim of the first study was to evaluate the effectiveness of an innovative assessment strategy in developing critical thinking skills. The findings from this study led to a systematic review of the literature which aimed to 1) evaluate the tools used to measure critical thinking in midwifery and 2) assess the efficacy of teaching methods in critical thinking development. Results of these reviews informed the next three studies which aimed to develop and test three tools to measure students' critical thinking in midwifery practice. The final study aimed to further establish reliability and concurrent validity of these tools. Therefore, the aims of this research program can be summarised as:

1. Evaluate the effectiveness of an innovative assessment strategy in developing midwifery students' critical thinking skills.
2. Evaluate existing tools used to measure critical thinking development.
3. Evaluate the efficacy of teaching methods used to develop critical thinking skills.
4. Develop, pilot and test three new tools designed to measure critical thinking in midwifery practice for undergraduate midwifery students.
5. Establish concurrent validity of the three new tools.

## **Significance**

This program of work is unique, as there is limited literature on thinking processes in midwifery, and a dearth of published studies on the measurement of critical thinking in midwifery. The program of work provides a significant scholarly contribution and addresses the lack of knowledge on critical thinking in midwifery. The development of three reliable and valid tools for use with undergraduate midwifery students will facilitate the provision of feedback to students on their progress in the development of this vital skill, and responses on tool items and factors offer specific examples of areas in need of improvement. This is the first program of work to develop and psychometrically test three tools to measure critical thinking in undergraduate midwifery students. The newly developed tools will have abundant application across education programs and in midwifery practice.

## **Outline of the Body of Work**

The thesis is comprised of six studies each with their own aims, designs, and specific

outputs. The program of work is underpinned by a sequential mixed methods design, where the data and findings from each study informed the next (Mertens, 2010). The design for each study was chosen to meet the specific aims of the study.

### **Study 1 – Pilot study to test the effect of root cause analysis in developing midwifery students' critical thinking abilities.**

Study one aimed to examine the effectiveness of an innovative assessment item involving root cause analysis (RCA) on development of critical thinking abilities of undergraduate midwifery students. A mixed method descriptive design was used. This study is presented as Chapter 2 in the format of post-print copies of two publications. In this pilot study third year midwifery students completed a capstone course which introduced a root cause analysis framework as an innovative assessment item. The effect of the assessment item on critical thinking was then evaluated by students and industry midwifery partners. The first publication in Chapter 2 reports on students' evaluation results, and the second publication reports on the industry midwifery partners' assessment.

A tool based on the utility framework by van der Vleuten (1996) was developed to evaluate this assessment item, with a version for students and one for industry midwifery partners. Each version of the survey tool was based on the domain concepts of Educational Acceptability, Educational Impact and Preparation for Practice. Industry partners also participated in a focus group to evaluate the validity of the assessment item in developing students' critical thinking abilities.

The pilot study identified that root cause analysis contributed to the development of critical thinking skills and was evaluated positively by students and industry midwifery partners. There were, however, several limitations of this study. Only perceptions of students' cognitive abilities were reported and there was no objective measure of critical thinking. Furthermore, there were no baseline and post-intervention measures of critical thinking to demonstrate causal effects of the intervention. While the tool demonstrated adequate reliability, this pilot study involved a small convenience sample which precluded further psychometric testing such as factor analysis. In order to test the efficacy of any future teaching or assessment strategies, it was important to include a reliable and valid tool measuring critical thinking.

## **Study 2 – Systematic review of the literature to assess available tools to measure critical thinking**

Following analysis of results from the pilot study, the identification of a tool that measured critical thinking for the midwifery context emerged as the next priority. A systematic review of the literature was undertaken, firstly to evaluate the reliability and validity of tools used to measure critical thinking in nursing and midwifery undergraduate students. This review is presented in Chapter 3, in the format of the post-print version of the publication. An initial review of the literature revealed no studies involving midwifery students. A decision was made to include studies pertaining to undergraduate nursing students due to some parallels between nursing and midwifery practice. In this review, a search of major databases, CINAHL, Ovid Medline, ERIC, Informit, PsycINFO and Scopus resulted in the retrieval of 1191 papers. The inclusion criteria were original research studies that utilised experimental designs to assess critical thinking development in undergraduate nursing and/or midwifery students. Thirty-five studies met the inclusion criteria, one was excluded following the quality appraisal process using the Critical Appraisal Skills Programme (CASP) tool (CASP, 2013).

Sixty percent of studies used at least one of the four standardised commercially available tools to measure critical thinking. Twelve other tools were utilised in the included studies. The reliability, validity and factor domains of the tools were examined. Construct validity was assessed according to the dimensions and skills of critical thinking in the American Philosophical Association (APA) consensus definition of critical thinking (Facione, 1990), and the consensus definition of critical thinking in nursing (Scheffer & Rubenfeld, 2000). The review found limited reporting of tool reliability, and inconsistencies across studies when using the same tool. None of the four new tools developed to measure critical thinking were tested for reliability.

Conclusions of the review indicated a need to develop discipline specific instruments to measure critical thinking in nursing and midwifery, and more specifically tools that measure the application of critical thinking in practice. Considering the complexity of critical thinking in nursing and midwifery practice, and that critical development occurs over time, it was recommended that measurement requires a long term approach and the use of multiple methods of measurement over this time.

A second systematic review evaluated teaching and assessment strategies and their impact on critical thinking development. This review is presented in the thesis as Chapter 4 in the



form of a post-print copy of the publication. Once again, an initial search of the literature revealed no identified studies that met the inclusion criteria involving midwifery students, hence the search was extended to undergraduate nursing students. In this review, a search of major databases, CINAHL, Ovid Medline, ERIC, Informit, PsycINFO and Scopus resulted in the retrieval of 1315 papers. Of these studies, 29 met the inclusion criteria being; original research studies that utilised an experimental design to assess critical thinking development following a specific educational intervention in undergraduate nursing and/or midwifery. One paper was excluded, following quality appraisal, using the CASP tool (CASP, 2013), leaving 28 papers for review.

Of the papers reviewed, twelve different teaching strategies were evaluated, with sixteen tools used to measure the efficacy of teaching in developing critical thinking. Significant limitations included lack of methodological rigour, cultural influences, appropriateness of the measurement tool, duration of the intervention, timing of pre and post testing, and intervention versus control dose. Results varied, with little consistency across studies using similar interventions or the same measurement tool. Findings suggest that the continued use of standardised general critical thinking measurement tools are unlikely to help identify appropriate teaching methods that will improve critical thinking abilities of midwifery and nursing students and prepare them for practice. It was recommended that discipline specific tools were needed to measure critical thinking development.

### **Study 3, 4, and 5 – Development and testing of three tools that measure critical thinking in midwifery practice for undergraduate midwifery students**

In response to the findings and recommendations of the two systematic reviews of the literature, and the absence of tools that measure critical thinking in midwifery practice, a decision was made to develop a multi-method approach. This approach involved the development, piloting and psychometric testing of three tools specially designed to measure critical thinking in undergraduate midwifery students. Items within the three tools were developed to capture the complex and distinct nature of critical thinking in midwifery practice. A further aim of developing multiple tools was to facilitate feedback to students from a variety of sources and promote objective assessment.

The first tool developed was a preceptor rating tool and following testing was named the Carter Assessment of Critical Thinking in Midwifery (CACTiM) (Preceptor/Mentor). This study is presented as Chapter 5 in the format of a post-print version of the published paper.

An eight stage process as suggested by DeVellis (2012; 2017) was utilised to guide tool development in this study. Draft items were developed through an extensive review of the literature and examination of the National Competency Standards for the Midwife (Nursing and Midwifery Board of Australia [NMBA], 2010). The draft items were then tested for conceptual coherence by mapping them against the consensus definition of critical thinking in nursing (Scheffer & Rubenfeld, 2000). Content validity was established through expert review with a Content Validity Index (CVI) of 0.97.

A descriptive cohort design was used to test the new tool with a sample of 106 preceptors, who had supervised at least one student within the last six months. An evaluation of construct validity through factor analysis generated three factors: 'partnership in care', 'reflection on practice' and 'practice improvements'. The scale demonstrated good internal reliability with a Cronbach's alpha coefficient of 0.97. Total and subscale scores correlated significantly. The CACTiM (Preceptor/Mentor) was found to be a valid and reliable tool for use by preceptors to assess critical thinking in undergraduate midwifery students.

A second tool was developed for use by undergraduate midwifery students to self-assess their critical thinking skills in practice. This study is presented as Chapter 6 in the format of a post-print version of the published paper. Draft items were developed through a similar process as described above. Content validity was established through expert review with a Content Validity Index (CVI) of 0.97.

The tool was pilot tested with a convenience sample of 126 midwifery students. Respondents also completed five questions from the Motivated Strategies for Learning Questionnaire (MSLQ). Construct validity via factor analysis revealed four factors: 'seeks information', 'reflects on practice', 'facilitates shared decision making', and 'evaluates practice'. Total and subscale scores correlated significantly. The scale achieved good internal reliability with a Cronbach's alpha coefficient of 0.92. Concurrent validity with the MSLQ subscale was .35 ( $p < .001$ ). These results indicated the CACTiM (Student) was a reliable and valid tool for use by undergraduate midwifery students to self-assess critical thinking in practice.

Finally, a third tool was developed for use by faculty to evaluate undergraduate midwifery students' critical thinking skills in reflective writing. Draft items were derived from an extensive review of the literature where synergies between reflection and critical thinking

were established. The draft items were then tested for conceptual coherence and mapped against the previous defined habits and skills of critical thinking in nursing (Scheffer & Rubenfeld, 2000).

Expert review of the tool revealed a high content validity index score of 0.98. The 15 item tool was pilot tested using 100 pieces of students' reflective writing about their clinical practice. Inter-rater reliability, was established with two raters reaching good absolute agreement of 72% and a significant Kappa coefficient ( $K = 0.43$   $p < 0.001$ ). Construct validity via exploratory factor analysis revealed three factors: 'analyses context', 'reasoned inquiry', and 'self-evaluation'. Total and subscale scores correlated significantly. The scale achieved good internal reliability with a Cronbach's alpha coefficient of 0.93. Reliability and validity was established for the CACTiM (Reflection) for use by faculty to evaluate midwifery students' critical thinking in reflective writing.

### **Study 6: Validation analysis of three tools matched cohort**

The final study aimed to test the concurrent validity of the three newly developed tools. Data was analysed from fifty-five students who had complete data from the CACTiM (Preceptor/Mentor), CACTiM (Student) and CACTiM (Reflection) tools. This study is presented as Chapter 8 in the format of a submitted manuscript. Internal reliability, and concurrent validity were assessed. Correlations, t-tests, multiple regression analysis and confidence levels were calculated for the three scales and associations with student characteristics.

The internal reliability of the three scales revealed a Cronbach's alpha coefficient between 0.93-0.97. Moderate correlations between the three scales for the matched total scores were found between CACTiM; Student/Preceptor ( $r = .36$ ,  $p < 0.01$ ); Student/Reflection ( $r = .38$ ,  $p < 0.01$ ); Preceptor /Reflection ( $r = .30$ ,  $p < 0.05$ ). Students with a previous degree had higher critical thinking mean scores however, only these were significant for CACTiM (Reflection) ( $t(53) = -2.35$ ,  $p = 0.023$ ). CACTiM (Preceptor/Mentor) scores were predictive of Grade Point Average (GPA) ( $\beta = .50$ ,  $p < .001$ , CI = .10 to .30). CACTiM (Student) self-rating scores were predictive of year level ( $\beta = .32$ ,  $p < .05$ , CI = .00 to .03).

This study further established the reliability and validity of the three CACTiM tools. Large and predictive correlations between student's GPA and CACTiM (Preceptor/Mentor) scores indicate that preceptors' assessment of critical thinking provided an accurate and objective

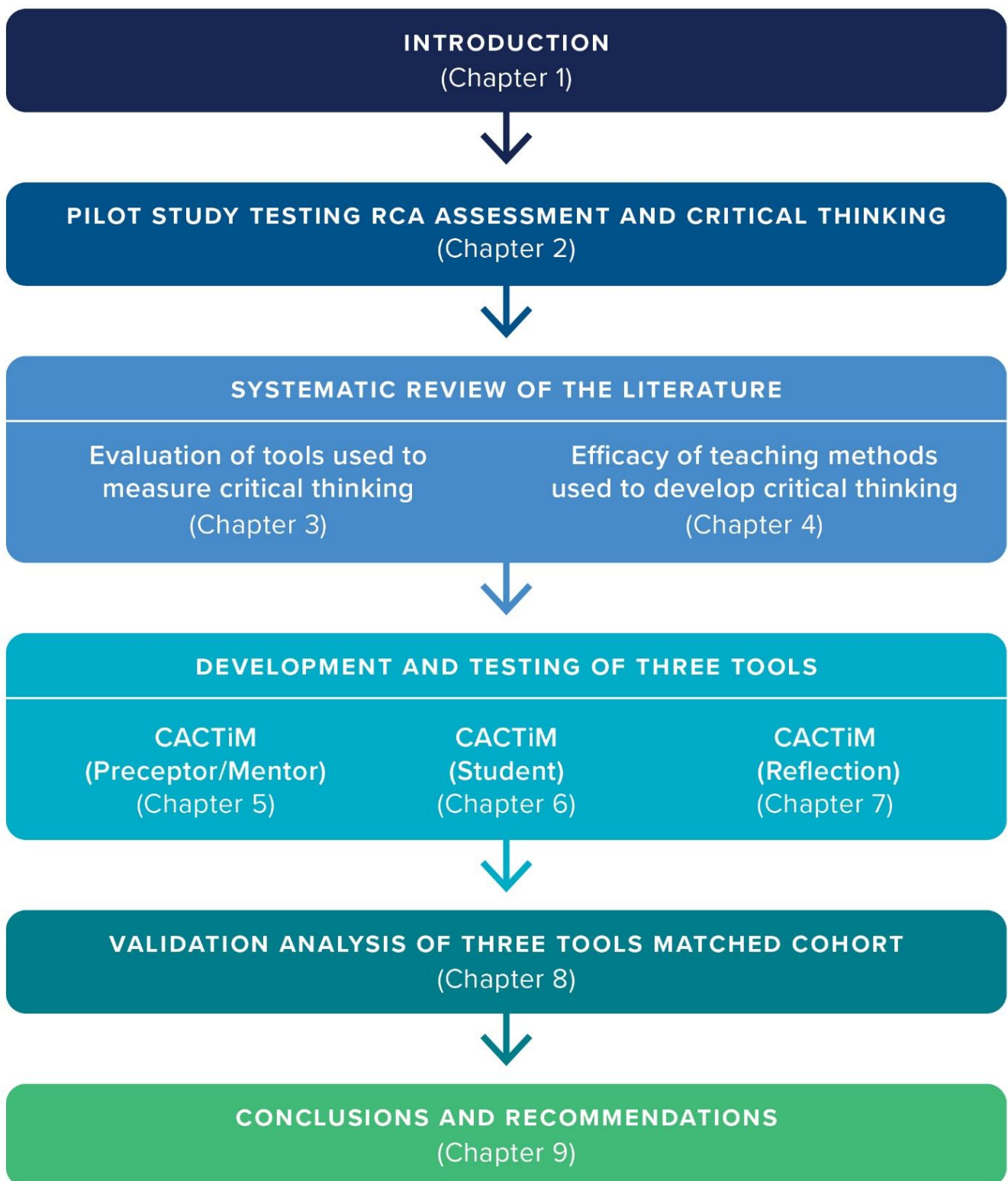
measure of critical thinking in midwifery for undergraduate midwifery students.

## **Organisation of this Thesis**

The thesis consists of nine chapters. The next chapter (Chapter 2) outlines the initial pilot study evaluating the effectiveness of an innovative assessment item on critical thinking skill development. Chapters 3 and 4 contain the two systematic reviews of the literature evaluating the tools used to measure critical thinking in undergraduate nursing and midwifery students and the efficacy of teaching methods on critical thinking. Chapters 5, 6 and 7 outline the development and pilot testing of the three newly developed CACTiM tools designed to measure critical thinking in practice for undergraduate midwifery students. Chapter 8 describes the final study which aimed to establish concurrent validity between the three CACTiM tools. The final chapter of this thesis is Chapter 9, which outlines conclusions derived from the six studies in the thesis, makes recommendations, and proposes implications for research, education and practice. See Figure 1 for a schematic overview of the content and structure of the thesis.

Chapters 2 to 8 which report on the studies are presented in the form of post-print manuscripts and are formatted to meet the requirements of the peer reviewed academic journals (including reference style) where they have been published/submitted. Each paper contains background literature, design, methodology, discussion and results pertinent to that particular study and therefore are not presented separately. The thesis was prepared in accordance with Griffith University policy ([www.griffith.edu.au/higher-degrees-research/current-research-students/thesis/preparation/formatting](http://www.griffith.edu.au/higher-degrees-research/current-research-students/thesis/preparation/formatting)). APA 6<sup>th</sup> edition referencing style is used for chapters that do not include publications, with reference lists provided at the conclusion of each chapter.

Figure 1: Schematic overview of the content and structure of the thesis



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## **CHAPTER 2**

### **Using Root Cause Analysis to Promote Critical Thinking in Final Year Bachelor of Midwifery Students**

#### **Chapter Overview**

This chapter contains two published papers related to Study 1 which involved a pilot study investigating the impact of an innovative assessment item involving root cause analysis on undergraduate midwifery students' critical thinking abilities. Ethics approval related to Study 1 was obtained from Griffith University Human Ethics Committee - NRS/47/12/HREC (see Appendix A). The first paper presents the findings from the students' evaluation of the assessment item. The references and formatting for this paper are presented in accordance with the requirements of *Nurse Education Today*, in which this paper was published. The student survey tool utilised in this study is included as Appendix B, the participant information sheet is included as Appendix C.

#### **Author contributions**

The first paper is a co-authored paper. The bibliographic details of this co-authored paper, are:

Carter, A. G., Sidebotham, M., Creedy, D. K., Fenwick, J., & Gamble, J. (2014). Using root cause analysis to promote critical thinking in final year Bachelor of Midwifery students. *Nurse Education Today*, 34(6), 1018-1023. <https://dx.doi.org/10.1016/j.nedt.2013.10.020> (See Appendix D for published format).

Under the guidance of Professor Debra K. Creedy (Co-Principal Supervisor) and Associate Professor Mary Sidebotham (Co-Principal Supervisor) my contribution to the paper involved preparation of ethics application, development and implementation of the root cause analysis assessment item, development of the survey instrument, statistical analysis and content analysis. My contribution also involved preparation of the manuscript for publication, journal submission and manuscript revisions prior to publication. Professor Jenny Gamble (Head of Midwifery) and Professor Jennifer Fenwick (Professor of Midwifery) were involved in conceptualisation of the study and review of the manuscript.

(Signed)

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## Abstract

**Background:** Midwives require well developed critical thinking to practice autonomously. However, multiple factors impinge on students' deep learning in the clinical context. Analysis of actual case scenarios using root cause analysis may foster students' critical thinking and application of 'best practice' principles in complex clinical situations.

**Objective:** To examine the effectiveness of an innovative teaching strategy involving root cause analysis to develop students' perceptions of their critical thinking abilities.

**Methods:** A descriptive, mixed methods design was used. Final 3<sup>rd</sup> year undergraduate midwifery students (n = 22) worked in teams to complete and present an assessment item based on root cause analysis. The cases were adapted from coroners' reports. After graduation, 17 (77%) students evaluated the course using a standard university assessment tool. In addition 12 (54%) students provided specific feedback on the teaching strategy using a 16-item survey tool based on the domain concepts of Educational Acceptability, Educational Impact, and Preparation for Practice. Survey responses were on a 5-point Likert scale and analysed using descriptive statistics. Open-ended responses were analysed using content analysis.

**Results:** The majority of students perceived the course and this teaching strategy positively. The domain mean scores were high for Educational Acceptability (mean= 4.3, SD= .49) and Educational Impact (mean = 4.19, SD = .75) but slightly lower for Preparation for Practice (mean = 3.7, SD = .77). Overall student responses to each item were positive with no item mean less than 3.42. Students found the root cause analysis challenging and time consuming but reported development of critical thinking skills about the complexity of practice, clinical governance and risk management principles.

**Conclusions:** Analysing complex real life clinical cases to determine a root cause enhanced midwifery students' perceptions of their critical thinking. Teaching and assessment strategies to promote critical thinking need to be made explicit to students in order to foster ongoing development.

## Introduction

Although scientific knowledge underpinning evidence-based midwifery practice is rapidly expanding there remains uncertainty regarding 'best practice' in many clinical situations (Scholes et al., 2012). In order to promote safe autonomous practice, midwives are required to possess and enact high levels of professional judgement, critical thinking and decision making skills (Lake and McInnes, 2012; Cioffi et al., 2005; Kitson-Reynolds, 2009). Critical thinking involves higher level thinking and reasoning skills that facilitate thinking in a controlled, purposeful, focussed and conscious way when making decisions (Simpson and Courtney, 2002). "Cognitive competence" of this nature is critical for effective, safe, autonomous practice (Newstead and Hoskins, 2003; Cronenwett et al., 2007), yet there is a dearth of literature about how midwives make decisions and develop the required cognitive skills (Jefford et al., 2010). Midwives often report limited confidence in their clinical judgment and seek validation of their decisions from perceived higher order authorities such as doctors (Jefford et al., 2010).

Best practice midwifery involves continuity of care throughout the perinatal period provided by a known midwife (Hodnett, 2008). Accredited undergraduate midwifery programs therefore need to develop students' cognitive skills to enable them to work as autonomous practitioners (Australian Nursing and Midwifery Council, 2010). These skills are important in promoting safe, evidence-based practice rather than the adoption of ritualistic behaviour and routines (Kramer and Schmalenberg, 2008; Cronenwett et al., 2007). It is often assumed that students develop critical thinking skills during their clinical placement when engaged in the mentor-student relationship. However, the reluctance of some midwives to be autonomous decision makers may limit students' development of critical thinking skills. With escalating clinical workloads and dwindling staffing levels, the preceptor relationship is often not prioritised (Fisher and Webb, 2007) further limiting opportunities for students to observe and learn critical problem-solving skills. Consequently, it is not surprising that students report observing poor care and decision making practices during clinical placement (Licqurish and Seibold, 2008). Students also report being reluctant to challenge practice. They tend to conform to their preceptor's behaviour, and adopt routine practices rather than learning to develop and apply their own critical thinking to their practice (Begley, 2001).

Although development and assessment of critical thinking and decision making can be addressed during on-campus learning this is not consistently achieved. For example, a

review of a midwifery curriculum by Lake and McInnes (2012) found limited consideration was given to developing students' cognitive abilities. Regardless of whether students were actually developing these skills, the students were not aware of attempts to do so, and did not recognise explicit teaching strategies. Participating in focus group discussions as part of the research study encouraged students to reflect on their learning and recognise instances of cognitive skill development not noted previously during their studies (Lake and McInnes, 2012).

Several teaching strategies aim to enhance critical thinking. Simulated clinical scenarios are a predominant teaching and assessment strategy used in midwifery preparatory programs to develop and assess students' cognitive skills. Cioffi et al. (2005), for example, compared the effects of clinical simulation (n = 18) with a standard lecture (n = 18) on midwifery students' critical thinking abilities. Students who received the simulation intervention collected more clinical information, re-examined collected clinical information less often, made fewer formative judgements, reported higher confidence, and made final decisions quicker than students in the control condition (Cioffi et al., 2005). However, Scholes et al. (2012) studied responses of midwifery students to a complex simulated postpartum haemorrhage scenario and found that students had difficulty prioritising their actions when more than one response was required to a clinical cue. The students failed to demonstrate any inductive and/or deductive reasoning or thinking. Similar findings were reported by Mitchell et al., (2009) in their review of the use of clinical simulation using an OSCE (Objective Structured Clinical Examination). Mitchell et al. (2009) concluded that at the undergraduate level, it is the concrete, measurable aspects of clinical performance that are best assessed by the OSCE and that a variety of assessment methods is required to measure critical thinking skills. While simulation activities are useful for clinical skill development, including decision making, simulation activities are limited in developing critical thinking in clinical situations where interpretation of multiple data sources is required (Mitchell et al., 2009). Mong-Chue (2000) argued that critical thinking requires controlled, purposeful, focussed and conscious processes. Development of critical thinking requires a deeper learning approach using analytical skills and judgements above and beyond standard clinical simulation where rapid decision making is paramount. Similarly, Kitson-Reynolds (2009) argued there is limited evidence measuring the effectiveness of simulation on fitness to practice in the complex world of midwifery practice.

Assessment has the capacity to influence students' behaviour more than the actual teaching they receive. Assessment tasks can prompt students to truly engage with teaching content and promote deeper learning (Biggs and Tang, 2007). It is particularly important for students to be proficient in situations they will encounter when they graduate, therefore assessment should be focussed on meaningful tasks that replicate real world challenges (Mueller, 2005). The authenticity of an assessment is measured by the similarity between the cognitive demands of the assessment compared to that of the real life situation on which the assessment is based (Boud and Falchikov, 2006). An authentic assessment item in midwifery would need to encompass teamwork, communication, and decision making in uncertain and unpredictable circumstances (Homer et al., 2009). Furthermore, such assessment would need to be congruent with the development of critical thinking and decision making and require simultaneous decisions amongst a multitude of variables. Utilising real world assessments that contain multiple complexities for students to problem solve may be effective in developing critical thinking skills.

This study aimed to evaluate the effectiveness of an innovative teaching strategy involving root cause analysis to develop students' critical thinking within a clinical decision making framework. Root cause analysis is a systematic process used to promote quality and safety by identifying the source of the problem, and preventing the problem from reoccurring (Connelly, 2012). In health care, the problem often has multiple, interrelated root causes in areas such as policies and procedures, human resources, environment of care, information management, and communication. An important aspect of root cause analysis is to focus on the system rather than individuals when analysing the situation. A systems approach examines how a particular system failed to produce the desired outcome and led to the error. Connelly (2012) argues that all factors that lead to errors should be examined in order to identify ways to prevent repetition of the error. There is limited research on the use of root cause analysis in health professional education. Lamberton and Mahlmeister (2010) described the use of a simulated root cause analysis with undergraduate nursing students but its use has not been explored in midwifery education. Although Lamberton and Mahlmeister (2010) suggested this simulation activity could reduce the likelihood of errors as students enter the profession, no measurement of changed thinking or improved safe practices was attempted. There is a need to measure the effectiveness of root cause analysis as a teaching strategy.

## **Method**

A descriptive, mixed methods design was used to examine the effectiveness of an innovative assessment process involving root cause analysis designed to develop critical thinking in student midwives.

## **Context**

The Bachelor of Midwifery is an accredited three-year program which commenced in 2010 and offered through the School of Nursing and Midwifery in a publically-funded, research intensive Australian University. The curriculum is designed around a philosophy of woman-centred care and incorporates reflection and development of critical thinking into teaching, learning, and assessment strategies at each year level. The program is delivered in blended mode, which involves a combination of face-to-face intensive teaching, interactive on-line material including “real time” webinars (web-based discussions), supervised clinical practice, and lecturer-led face-to-face tutorials situated in clinical sites. Students are placed within the same practice organisation for the duration of their degree program. This flexible mode of delivery allows students to focus their learning within clinical practice and the single placement option enables students to develop relationships and consolidate learning within one organisation.

The final clinical course (or subject) of the program focuses on transition to professional midwifery practice. This capstone course is designed to consolidate knowledge, provide an opportunity to apply critical thinking to plan, deliver, and evaluate care within a reflective framework. In 2012 there were 22 students enrolled in the final year course.

## **Assessment item and process**

The major assessment item for the course incorporated root cause analysis using real coroners’ reports as the basis for the case scenarios. A web search was conducted to identify suitable and available coroners’ reports of cases involving maternal and newborn care from Australia, New Zealand and the United Kingdom. Each selected case was used to create a scenario. The focus of each case study is outlined in Table 2.1. Topics included post-partum haemorrhage, streptococcus-A septicaemia, amniotic fluid embolism/uterine rupture, and eclampsia.



**Table 2.1: Root cause analysis cases**

Number	Case	Description
1	Post-partum haemorrhage	Caesarean Section, thrombocytopenia, untreated and unrecognised post-partum haemorrhage, maternal death
2	Streptococcus A septicaemia	Spontaneous vaginal birth, pyrexia not investigated, maternal death
3	Neonatal asphyxia	Vaginal group B Streptococcus. Baby found deceased in bed with mother, autopsy consistent with asphyxia
4	Fetal distress	Post-date induction, persistent fetal distress, Caesarean Section, early neonatal death, perinatal asphyxia
5	Amniotic fluid embolism/uterine rupture	VBAC, intravenous syntocinon augmentation, maternal collapse and cardiac arrest, maternal resuscitation, Caesarean Section, hysterectomy, maternal death.
6	Eclampsia	Primigravida, vomiting and epigastric pain at 24 weeks, seizure, Magnesium Sulphate, further seizure, Caesarean Section, baby stillborn, severe hypertension, disseminated intravascular coagulation, maternal death.
7	Post-partum haemorrhage	Multigravida, Induction with Prostin - small recurrent antepartum haemorrhages. Spontaneous vaginal birth, uncontrolled post-partum haemorrhage, hysterectomy, severe coagulopathy, cardiac arrest, maternal death
8	Shoulder Dystocia	Primigravida, spontaneous rupture of membranes 40+10 weeks, intravenous syntocinon augmentation, fetal distress, difficult vacuum performed, shoulder dystocia. Baby born 15 minutes following birth of the head, ventilated, neonatal death 8 days, weight over 5kgs.

## Measures

The utility framework was used to evaluate the value of the assessment task (van der Vleuten, 1996). Within this framework, the value of an assessment format considers aspects inherently linked to the curriculum such as reliability, validity, educational impact, acceptability, and cost effectiveness (van der Vleuten, 1996).

A 16-item survey tool based on the domain concepts of Educational Acceptability, Educational Impact and Preparation for Practice was developed. Item responses were on a 5-point Likert scale of 1 = strongly disagree to 5 = strongly agree. There were also open-

ended questions that asked students what they: (1) enjoy most/least about this assessment item; (2) learned from this assessment item; and (3) how could it be improved. The survey tool was reviewed by an expert panel (n = 8) consisting of midwifery educators, clinicians, managers and government advisors. Panel members were briefed on the purpose of the tool and commented on the extent to which each item accurately reflected the corresponding domain. Discussion followed, modifications to the wording were made, and consensus reached.

Student Evaluation of the Course (SEC) is a 9-item survey that asks students to rate the quality of the course on a 5-point Likert scale of 1 = strongly disagree to 5 = strongly agree (Nulty, 2004). Items include, “My skills in analysis and problem solving increased as a consequence of doing this course”, and “Overall I am satisfied with the quality of this course”. Students may comment on areas for improvement. The SEC is a standardised measure used routinely throughout the university.

## **Procedure**

Students were introduced to root cause analysis during the intensive teaching period at the beginning of semester. The lecturer described a root cause analysis framework and instructions on how to examine a case from the perspective of midwifery and other maternity disciplines involved in the case. Root cause analysis usually consists of 7 critical steps: define the problem, gather evidence, identify causes, identify root causes, identify potential solutions, implement solutions and assess the impact (US Accountability Office, 2004). There may be several root causes for a particular situation.

Class sessions also aimed to develop a deeper awareness of reflective practice and principles of clinical governance. Clinical governance in Australia refers to processes that ensure high standards of clinical performance including, clinical risk management, clinical audit, ongoing professional development and well developed processes to take action to manage adverse events (ACSQHC, 2010). Students used knowledge of the case review process gained from previous courses as well as their clinical practice. Students formed groups of 3-4 and allocated different case scenarios. Students were encouraged to attend case reviews and mortality/ morbidity meetings within their own clinical practice sites to observe multidisciplinary practice-focused discussion in action. To promote teamwork, students worked in small groups. Each group explored and examined their allocated case using risk management and clinical governance principles and reached an agreement about

their analysis. To promote communication, the findings of each group including recommendations for future practice were presented using powerpoint to their fellow students via the WIMBA platform within Blackboard 8 over the internet.

After graduation (approximately 6 weeks after completion of the course), all 22 students were contacted through their university email account and invited to complete the evaluation survey. Responses were anonymous. Ethical approval was obtained from the University Human Research Ethics Committee.

### **Approach to analysis**

Survey responses were analysed using descriptive statistics using SPSS Version 21. Mean scores and standard deviations were calculated for each domain as well as responses to each item.

Latent content analysis was applied to the qualitative data (Graneheim and Lundman, 2004). Responses were typed into a word document table. Hard copies were read and notes made and shared with the team. The survey domains were used as a coding framework. Like-statements or phrases were identified and clustered together. These were then assigned conceptual meaning and grouped. The analysis remained at a descriptive level. Each participating student was allocated a number (such as S1 and S2) for coding and reporting purposes.

## **Results**

### **Sample**

Seventeen (77%) out of 22 students completed the routine evaluation of the course (SEC). Of these 12 (54%) students provided additional feedback on the root cause analysis activity using the Utility Index. Participants consisted of mature-aged, female students, with around two-thirds aged between 26 and 45 years (See Table 2.2). There are no males enrolled in the program. A similar proportion of participants had previously completed a technical college or degree qualification prior to commencing the Bachelor of Midwifery program.

**Table 2.2: Characteristics of students completing the Utility Index**

Characteristic	n (%)
Gender	
Female	12 (100)
Male	0
Age in years	
22-25	2 (16.4)
26-35	4 (33.3)
36-45	4 (33.3)
46-55	1 (8.3)
Previous educational qualifications	
Senior High School or equivalent	4 (33.3)
Technical College (TAFE)	3 (25.0)
Degree	5 (41.7)

### Utility index

The mean scores for each domain were high for Educational Acceptability (mean = 4.3, SD = .49) and Educational Impact (mean = 4.19, SD = .75) but slightly lower for Preparation for Practice (mean = 3.7, SD = .77) as shown in Table 2.3. Overall student responses to each item were positive with no item mean less than 3.42. Highest scores were obtained in the domain of Educational Acceptability with no mean rating below 4.17. Students enjoyed researching the topic and preparing the report and presentation requirements for this assessment (mean = 4.42). Students recommended that this assessment be retained in the course (mean = 4.42). Students also agreed that the critical incidents were similar to those faced in the clinical environment (mean = 4.17).

Items in the domain of Educational Impact were also rated highly. Students consistently agreed that the assessment developed their critical thinking skills (mean = 4.33), challenged their thinking (mean = 4.33) and encouraged them to examine the whole clinical situation rather than the tasks at hand (mean = 4.33). Students also acknowledged that the assessment process developed their decision making skills (mean = 4.07) but indicated less

agreement about its value in consolidating learning from across the program (mean = 3.75).

Responses to items in the domain of Preparation for Practice, were positive but ranked less favourably than responses on other subscales. Students perceived that undertaking the root cause analysis improved their sense of accountability as a midwife (mean = 4.0) and decreased their likelihood of making clinical errors (mean = 4.0). Students reported being more aware of the causes of critical incidents (mean = 3.83), but reported less agreement about the impact of this assessment activity on their preparedness as a midwife (mean = 3.58) and confidence in managing complex cases (mean = 3.42).

**Table 2.3: Student responses: Utility Index Survey.**

<b>Domain – Educational Acceptability</b>	<b>Mean</b> (standard deviation)
1. This assessment item engaged me in learning	4.33 (.49)
2. I enjoyed researching and preparing this assessment item	4.42 (.67)
3. The critical incident was similar to those faced in the clinical environment	4.17 (.94)
4. This is an appropriate assessment for this course	4.25 (.72)
5. I would recommend this assessment item continue within this course	4.42 (.79)
<b>Domain – Educational Impact</b>	
1. This assessment item was beneficial to my learning	4.27 (.65)
2. Developed my critical thinking skills	4.33 (.65)
3. Developed my decision making skills	4.08 (.99)
4. Consolidated my learning in this course and within the Bachelor of Midwifery Program	3.75 (.96)
5. Challenged my thinking	4.33 (.89)
6. Encouraged me to examine the whole clinical situation rather than the tasks at hand	4.33 (.98)
<b>Domain – Preparation as a Midwife</b>	
1. Improved my confidence in managing complex cases	3.42 (1.08)
2. Encouraged me to be more accountable in my practice as a midwife	4.00 (.95)
3. I am more aware of the causes of critical incidents following the completion of this assessment item	3.83 (.72)
4. I believe I am less likely to make clinical errors following completion of this assessment item	4.00 (1.13)
5. I feel more prepared as a midwife following completion of this assessment	3.58 (.99)

## **Qualitative responses**

Using content analysis the majority of students' open ended comments could be clustered under the survey domains of Educational Acceptability and Educational Impact.

### ***Educational acceptability***

Overall students viewed the assessment process favourably. Students valued learning about how errors occur. One student (S6) noted that "The errors in the case seemed extreme, backing these errors with research was really good". Another student (S12) noted "how easy it can be to miss critical information when other outside factors are involved." Students noted that the assessment process helped them by: "Promoting awareness about error prone situations" (S2), and "Realising it was a series of events that enables the holes in the cheese to line up" (S3).

Students also valued learning more about clinical governance and risk management issues. Examples of learning included "not to attribute blame to any one team member" (S3), developing "an understanding of risk management principles" (S4) and looking for "evidence around protocols & guidelines" (S10).

### ***Educational Impact***

Students perceived the assessment task had an educational impact on their understanding of (1) critical thinking pathways; and (2) awareness of clinical governance principles and safety. In regards to critical thinking, students stated that they learned to think in different ways, and be aware that multiple factors contribute to errors. For example, one student (S6) noted that "incomplete documentation created significant risk as other staff had to make assumptions". Another student (S3) learned to "PRIME [incident reporting system] incidents when needed as a way of contributing to clinical governance and patient safety (focus on the issue and not attack any one person). Following a process may highlight a pattern of errors."

A third impact identified by students was increased awareness of communication. Students identified new knowledge around "working in a multidisciplinary team and being accountable for your actions" (S8). Several students (S2, S4, S5, S8, S5) referred to incidents being the result of multiple communication errors or omissions. The root cause analysis enabled students to understand the importance of communication and risk management (S2, S3, S4, S5, S10, S11). Another student (S5) stated that: "It prompted discussion and information

sharing around the topic and this developed our understanding”.

Students also learned that multiple factors contribute to critical events (S4, S5, S7, S8). S2 identified that “Individual, institutional and system based factors are causes for error and compromise safety.” Similarly, S8 noted: “there are many indicators leading up to the “main event” that can be missed”. The importance of “continued professional development”, and “being woman-centred, and reflecting on practice” were also highlighted.

### **Student evaluation of the course**

According to SEC results, students ranked the course highly (mean = 4.2 out of 5, SD = .62). In particular, students agreed that, “My skills in analysis and problem solving increased as a consequence of doing this course (mean = 4.6, SD = .81); and “I received helpful feedback on my assessment work” (mean = 4.6, SD = .66). Open response comments tended to highlight positive aspects of the course. One student (S6) wrote, “the assessment on root cause analysis, examining systems of governance was particularly useful. I see the processes and information covered in this assessment as being fundamental to good midwifery practice, and promoting professional autonomy, and collaborative practice.” Another (S9) wrote that the most positive aspects of the course were, “working through our critical event from the perspective of not attributing blame but actually discerning what went wrong and how so many small failings accumulated to a woman dying; and looking at the case from a governance perspective and forming our own recommendations. I loved researching the evidence.”

Students made recommendations for improvement. One student (S8) wrote, “the professional governance of midwifery practice has not been covered well in the program overall, and this course should ensure that all students graduate with a comprehensive understanding of the legal and professional governance framework for midwifery practice.” Several students suggested that better preparation was required especially in relation to expectations, marking criteria and negotiating group work (S2, S6, S7, S9, S10, S11). Some students struggled with the requirement to consider the root cause analysis from different professional perspectives. Several students also noted that the assessment and associated group work were time consuming (S2, S3, S4, S5, S6).

### **Discussion**

This study aimed to evaluate a novel teaching strategy designed to develop student’s



cognitive capacities in preparation for autonomous midwifery practice. Students perceived that undertaking the root cause analysis of actual coroners' cases promoted critical thinking, and encouraged them to examine the whole clinical situation rather than the immediate task at hand. The validity of the teaching strategy was endorsed with "educational acceptability" and "educational impact" being rated highly, but with slightly less agreement on the effect of the assessment process to "prepare students for practice". Understanding and conducting root cause analysis as part of their coursework will better prepare students to engage in quality improvement as part of their daily practice after graduation (Cronenwett et al., 2007).

The use of root cause analysis of coroner's cases offers several advantages over traditional case studies. First, coroner's reports provide a high level of accurate clinical information to allow for case studies to be easily constructed as well as enabling students to learn about clinically rare events. Second, this type of assessment item provides a 'safe' environment in which students can explore critical adverse situations with peers, teaching and clinical staff. Third, a large number of clinical scenarios can be constructed to meet the educational goals of each cohort without repeating a scenario in subsequent years. Finally, there are minimal direct costs related to acquisition of the reports, construction of case studies, and implementation of the assessment process. Students' evaluation ratings and comments indicated that the assessment process contributed to their critical thinking skills by promoting deep learning (Biggs and Tang, 2007). Furthermore, the assessment was authentic in requiring students to think and problem-solve as they would when practicing, as well as encompass teamwork, communication, and decision making in uncertain and unpredictable circumstances (Mueller, 2005; Homer et al., 2009).

Human interaction and subjective decision making are critical components of midwifery practice. However, even highly trained and well-intentioned individuals will make mistakes. It is important to expose students to the possibility of clinical errors, teach them how to analyse and learn from these, and to implement continuous quality improvement efforts to persistently refine existing systems in which they will practice in order to promote safe practice (Cronenwett et al., 2007). In addition to the use of coroner cases, other teaching strategies to actively engage students include a "mock root cause analysis" after an error in the clinical setting, as well as embedding error and root cause analysis when using simulation (Lamberton and Mahlmeister, 2010). Quraishi et al., (2011) evaluated the effect of teaching root cause analysis using high-fidelity simulation in conjunction with a short

lecture. Participating graduate medical students ( $n = 30$ ) who received a ten minute lecture on root cause analysis and high-fidelity simulation activity involving medical errors had greater knowledge and positive attitudes toward systems improvement compared to students who only received the lecture.

Although our findings are positive, they need to be considered in light of the limitations. Generalizability of results is limited by the use of a single site and small sample of female midwifery students. However, the majority of students (77%) participated, there was a high level of agreement amongst respondents, and consistent findings across measures were found, lending some confidence to the conclusions. On the other hand, it could be that students who favoured the course and the root cause analysis completed the survey and that their views differed from students who did not. The sample size also limited the extent of statistical analysis. Furthermore, the survey tool needs to be examined with a larger sample and tested for reliability.

## **Recommendations and Implications**

Although the results indicated a high level of overall student satisfaction with this teaching strategy, some changes were recommended. Students identified that the assessment task was time consuming, requiring considerable research. The multifaceted nature of the assessment – research, group work, write up and preparation for the group presentation may have contributed to this perception. Students also identified that governance standards, quality, and safety regulations need to be addressed in more detail. Students also identified the need for better preparation to undertake the root cause analysis process. Several improvements to the instructions have now been made to provide explicit details about the nature of the assessment, and some useful tips on how to prioritise work and manage time. In response to the need for explicit marking criteria, the marking guide has been modified and provides exemplars.

Some students identified that the group work was challenging. There is increasing recognition that team work is a useful transferable skill highly valued by employers, and a cooperative vehicle for effective learning (Corby, 2013). However, teamwork may be hampered by students' lack of understanding of group processes. Students often complain of being inadequately prepared for group work exercises, and academic staff may have little or no experience of developing or assessing the process of teamwork as opposed to its

outputs (Corby, 2013). Our experience also suggests that students may become aware that they have a problem when working in a team, but remain unable to pinpoint how to modify their behaviour to improve the situation. Across the curriculum, it may be useful to implement formative assessment in relation to team work so that issues can be identified and possible solutions discussed in a timely way. The principles of group work have now been introduced early in the program and experiential activities are planned so that students are better prepared to work with others, have good process problem-solving skills and improved negotiation and conflict resolution skills.

## **Conclusions**

Analysing complex clinical cases to determine a root cause contributed to students' perceptions of their critical thinking abilities. Coroner's cases can provide a high level of clinical information and expose students to the multitude of factors contributing to adverse clinical outcomes. Midwifery students perceived this teaching strategy and assessment as educationally useful and one that fostered deep learning.

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## **Strengthening Partnerships: The Involvement of Health Care Providers in the Evaluation of Authentic Assessment within Midwifery Undergraduate Education**

Following student evaluation of the root cause analysis assessment, input was sought from industry midwifery partners to confirm the authenticity of the assessment item and its' effect on critical thinking skills. The findings of the industry partners' examination of the root cause analysis assessment is presented here as a post-print version of the published paper.

The references and formatting for this paper are presented in accordance with the requirements of *Nurse Education in Practice*, in which this paper was published. The industry midwifery partners' survey tool utilised in this study is included as Appendix E. The participant information sheet is included as Appendix F.

### **Author contributions**

The second paper is also a co-authored paper. The bibliographic details of this co-authored paper, including all authors, are:

Carter, A. G., Sidebotham, M., Creedy, D. K., Fenwick, J., & Gamble, J. (2015). Strengthening partnerships: The involvement of health care providers in the evaluation of authentic assessment within midwifery undergraduate education. *Nurse Education in Practice*, 15(4), 327-332. <https://dx.doi.org/10.1016/j.nepr.2015.01.013> (See Appendix G for published format).

Under the supervision of Professor Debra K. Creedy (Co-Principal Supervisor) and Associate Professor Mary Sidebotham (Co-Principal Supervisor) my contribution to the paper involved, modification of the survey instrument used for students, facilitating focus group, statistical analysis and content analysis. My contribution also included preparation of the manuscript for publication, journal submission and manuscript revisions prior to publication. Professor Jenny Gamble (Head of Midwifery) and Professor Jennifer Fenwick (Professor of Midwifery) were involved in the conceptualisation of the study and review of the transcript.

(Signed)

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## **Abstract**

Collaborative partnerships between health care providers and academics are essential in the provision of quality undergraduate midwifery programs. While health care providers often contribute to clinical assessment and teaching in midwifery programs, they are rarely involved in assessment design and evaluation.

This paper describes the evaluation of an assessment task designed to develop critical thinking skills in final year undergraduate midwifery students. Health care providers' involvement sought to confirm the authenticity and validity of the assessment task and facilitate further engagement.

A mixed method descriptive study design was used. After reviewing a sample of student work, health care providers completed a 20 item survey and participated in a focus group. Survey items were based on the domains of Educational Acceptability, Educational Impact and Preparation for Practice. Participants gave high scores for each domain and commented positively on the innovative nature of the assessment, students' ability to undertake in-depth analysis of complex cases, and development of student's critical thinking skills. Participants also reported greater confidence in students' competence and the program.

Involving health care providers in evaluation of an assessment task validated the assessment, contributed to clinicians' perceptions of student credibility, and fostered strong links between the program and industry.



## **Introduction**

The use of authentic assessment to promote deep learning in higher education has been increasingly encouraged over the last decade (Biggs and Tang, 2007). Likewise, the development and maintenance of collaborative partnerships between health care providers and academics are essential in the provision of quality teaching and learning experiences for undergraduate health care students (Dignam et al., 2012); especially those leading to registration such as midwifery. Although health care providers often contribute to clinical assessment and teaching in midwifery programs, they are rarely involved in the design and evaluation of specific assessment items.

As part of an ongoing program of scholarship designed to support excellence in teaching and learning we sought input from our health service partners to evaluate the extent to which an assessment task for final year student midwives was appropriate for measuring critical thinking capacity; risk assessment abilities, complex decision making, and teamwork. This paper describes the evaluation of this curriculum initiative undertaken within a Bachelor of Midwifery program at one publically-funded, research intensive Australian university. Both students and health care providers were involved in the evaluation. Students' evaluation responses have been published previously (Carter et al., 2014). This paper reports on the findings from health service partners who evaluated the assessment process. The following critical elements will be discussed in this paper: the significance of health service engagement; development of an authentic assessment task; involvement of health service partners, and clinicians' evaluation of this strategy.

### **Significance of health service engagement**

The concept of 'industry' or health service provider engagement is critical to the contemporaneous nature of midwifery programs but is often neglected. While policy directives and reports in Australia and internationally advocate for engagement of health care providers in educational programs for health professionals (Clare, 2003; Nursing and Midwifery Council, 2009; ANMAC, 2010), a dearth of literature exists evaluating strategies to achieve this. Industry engagement is both under-researched and politically sensitive (Payne, 2008) with very little formal analysis of curriculum activities involving industry. This may be because efforts to engage industry with curriculum are highly variable, often time consuming, and rarely evaluated (Woodley and Johnson, 2010). The lack of collaboration and negative interactions may be underpinned by conflicting philosophies of clinicians and

academics (Lange and Kennedy, 2006). The ideals of the tertiary sector and reality in healthcare settings, may contribute to inconsistencies in information sharing, varying levels of support of students during clinical placements, and mutual dissatisfaction (Greenwood, 2000; Newton et al., 2009). However, authentic engagement that involves frequent contact between academic and health care providers can enhance collaboration by increasing trust and mutual respect (Chalmers et al., 2001; Dignam, et al., 2012; Spouse, 2002).

While health care providers often contribute to clinical teaching and clinical assessment in both nursing and midwifery, they are rarely involved in assessment design and evaluation. In undergraduate midwifery programs in Australia, health service engagement is further hindered by the fragmented model of clinical placement where universities compete for limited places and maternity units/hospitals are often facilitating placement for several universities simultaneously.

Engagement of health care providers in the development of curriculum and evaluation of assessment tasks can be a useful strategy to further develop collaborative partnerships, and build clinicians' confidence in graduates' knowledge and analytic abilities. Health service involvement can promote allegiance and confidence in the program, further engaging clinicians in student learning (Chalmers et al., 2001; Spouse, 2002). From commencement of the Bachelor of Midwifery program at Griffith University in 2010, active and meaningful ways to develop partnerships with health service colleagues were established. Health service partners were consulted and engaged in the design and development of the curriculum. As the three year program was implemented other collaborative engagement activities were devised and clinicians were invited to be members of the program advisory group. University lecturers maintained a regular physical presence at partner hospitals facilitating student placements, and academics were appointed onto hospital reference groups and decision making bodies. The curriculum initiative presented in this paper sought to further develop health service engagement and foster collaborative relationships in learning and teaching by requesting health service partners to evaluate the effectiveness of a third year assessment task. This approach aimed to engage health service partners in the assessment process and showcase the standard of student work.

### **Development of an authentic assessment task**

Assessment is often the most influential force for learning (Biggs and Tang, 2007). Some time ago Elton and Johnston (2002) estimated that students spend less than 10 per cent of

their time on academic work that is non-assessed. The impact of assessment on student learning and use of assessment items that promote deeper learning in higher education has been increasingly recognised as essential to quality educational outcomes (Biggs and Tang, 2007).

As the assessment task occurred in the final capstone course of the degree, the academic team was cognisant of the need to design an authentic assessment task that prepared students for autonomous midwifery practice. An authentic assessment task replicates real world challenges, requires students to demonstrate the same combination of knowledge, skills and attitudes needed in the workplace, and enables them to become proficient in situations they will encounter as practitioners (Mueller, 2005; Tiwari et al., 2005). Authentic assessment has the potential to stimulate deeper learning, enabling students to develop professionally and increases their motivation because all learning is perceived to be relevant to their future professional practice.

In order to prepare for contemporary, autonomous midwifery practice, students require well developed critical thinking skills, an ability to work in teams, and sound clinical decision making abilities in uncertain and unpredictable circumstances (Homer et al., 2009). The ability to practice safely is one of the most important attributes of a competent midwife (Butler et al., 2008). In order for student midwives to become safe practitioners, they need to understand and have the opportunity to participate in risk management and quality improvement activities. This preparation requires both knowledge-based and performance outcomes to be assessed at course level to ensure that graduating midwives are able to effectively implement continuous quality improvement strategies and communicate concerns to demonstrate safe practice. One key element of this preparation deals with widely-adopted formal approaches to assessing or predicting potential medical errors: root cause analysis (RCA). A RCA is a structured approach to investigating sentinel events with a focus on identifying the source of the problem and formulating recommendations that will prevent the problem reoccurring (Connelly, 2012). Unfortunately, “after-the-fact” analyses of medical errors is often focused on individual accountability and reprimand which is an ineffective method of enhancing safe practice and seldom helps to improve the overall quality of care. In contrast a RCA focusses on identifying system and process factors that contributed to errors (Pearson, 2005).

In an effort to transform midwifery education and improve health care quality, the Australian

Nursing and Midwifery Council (ANMAC) Accreditation Guidelines (2010) refer to competencies, systems-based practice, and practice-based learning and improvement. These approaches call for a shift from narrow, discipline-specific views of care practices to an integrated model that enhances organisational excellence. There is an expectation that education programs will teach students how to systematically analyse practice with quality improvement methods, implement change strategies with the goal of practice improvement, work in teams to enhance safe practice, and participate in the identification of “system” errors with the goal of implementing “system” solutions. There is limited research on novel methods to empower graduating midwifery students to meaningfully engage and improve quality.

The use of interactive activities to develop midwifery students’ decision making skills in complex situations is a key strategy to build competent and confident midwives (Skirton et al., 2012). While clinical simulation using an OSCE (Objective Structured Clinical Examination) role play can test knowledge and abilities in a practical way simulation activities are limited in developing critical thinking in clinical situations where interpretation of multiple data sources is required (Mitchell et al., 2009). The use of a simulated RCA with undergraduate nursing students has been reported to reduce the likelihood of clinical errors (Lamberton and Mahlmeister, 2010). This type of assessment has not been examined in midwifery education and its’ ability to develop critical thinking has not been explored.

The assessment item evaluated here required students to undertake a root cause analysis of critical scenarios in small groups (3-4 students per group). The scenarios were taken from real life coroners’ cases involving either maternal or neonatal mortality which were sourced via the internet from Australia, New Zealand and the United Kingdom. Students identified issues within their case, drew on theoretical and clinical knowledge, identified potential system and process errors and made recommendations for practice (Carter et al., 2014). The root cause analysis assessment item allowed time for information gathering, group discussion and reflection within a safe framework. The assessment item enabled students’ to consider the internal and external influences on practice both at an individual level and an institutional level. This activity also tested the students’ ability to work in a group and demonstrate understanding of the value of good communication and interdisciplinary collaboration in practice. Student groups presented their findings and recommendations to colleagues via an online real time classroom.

## **Method**

A mixed method descriptive design was used. The health service partners were five senior midwifery clinicians/managers/educators from maternity services where students were undertaking clinical placement.

## **Measure**

The concepts inherent in the utility framework were used to guide the development of an evaluation survey (van der Vleuten, 1996). According to van der Vleuten (1996) relevant factors include reliability, validity, educational impact, acceptability, and cost effectiveness. Within this framework, the value of an assessment format considers aspects inherently linked to the curriculum. Developing items around the concepts educational acceptability, impact and preparation for practice were considered most relevant to the evaluation process by expert midwifery clinicians.

Twenty items were developed and grouped under the domain headings of Educational Accessibility (n = 5), Educational Impact (n = 7) and Preparation for Practice (n = 8) (Table 2.5). Item responses were on a 5-point Likert scale of 1 = strongly disagree to 5 = strongly agree. Before use, the survey tool was reviewed by an independent expert panel (n = 5) consisting of midwifery educators, clinicians, managers and government advisors. Detail related to the survey development process was published earlier (Carter et al., 2014).

In addition, the health service partners were asked to comment on the positive features of the assessment item; how the assessment item could be improved; and what they considered the most important student learning outcomes would be from this assessment item.

## **Procedure**

Health service providers from each of our partner hospitals were members of the Griffith Midwifery Advisory Group. These midwives have played an integral part in the initial development and ongoing monitoring and evaluation of the Bachelor of Midwifery program and welcomed the opportunity to take part in this study. An email request was sent informing them of the background and significance of the study and inviting them to take part. Participants had an opportunity to question the research team prior to agreeing to take part. A total of nine health service partners were invited to participate in the study and five were able to attend. Reason for non-attendance was competing work requirements.

On arrival to the session participants signed a consent form indicating their willingness to participate and abide by the principles of confidentiality related to viewing student presentations. Health service partners were provided with the associated course profile and learning outcomes, assessment instructions and description, and marking rubric. A group discussion occurred regarding the purpose and conduct of the assessment item. Two student presentations were then viewed. After viewing the presentations, the health service partners were asked to complete the 20-item expert midwifery clinician survey tool. After completing the survey, a semi-structured focus group was conducted by the researcher in order to elicit views about the assessment item and areas for improvement. Ethical approval was obtained from the University Human Research Ethics Committee.

### **Approach to analysis**

Survey responses were entered into SPSS Statistics Version 21, IBM. Descriptive statistics using mean scores and standard deviations were calculated for each domain as well as responses to each item.

Latent content analysis was applied to the qualitative data (Graneheim and Lundman, 2004) gathered from survey and the focus group. Responses were typed up and formatted into a Word document table. Hard copies were read and notes made and shared with the team. Similar significant statements or phrases were identified and clustered together under positive aspects, improvements and perceptions of the most important learning outcomes. Each participant was allocated a number for coding purposes only.

## **Results**

### **Participant characteristics**

Health service participants (n = 5) had varying qualifications ranging from certificate to doctorate. They all had over 5 years clinical midwifery experience with three practising for more than 20 years. Characteristics of participants are outlined in Table 2.4.

**Table 2.4: Health Service Partner characteristics**

<b>Age, years</b>	<b>n (%)</b>
36 – 45	3 (60.0)
46 – 55	2 (40.0)
<b>Education</b>	
Certificate	1 (20.0)
Bachelors	1 (20.0)
Masters	2 (40.0)
Doctorate	1 (20.0)
<b>Years registered as midwife</b>	
5 – 10	1 (20.0)
16 – 20	1 (20.0)
> 20	3 (60.0)
<b>Position</b>	
Midwifery Unit Manager	2 (40.0)
Midwifery Unit Director	2 (40.0)
Clinical Facilitator	1 (20.0)

## **Survey results**

The mean scores for each domain were high for Educational Acceptability (mean = 4.87, SD = .19), Educational Impact (mean = 4.58, SD = .39) and Preparation for Practice (mean = 4.4, SD = .38) as shown in Table 2.5. Overall health services partner responses to each item were positive with no item mean less than 3.60.

Highest scores were obtained in the domain of Educational Acceptability with no mean rating below 4.75. Health service partners unanimously agreed that the assessment item would engage students in learning (mean = 5), and considered that the critical incident case materials reflected those faced in the clinical environment (mean = 4.8). This validates the assessment authenticity and 'real world' application. Health service partners unanimously recommended that this assessment be retained in the course (mean = 5).

Items in the domain of Educational Impact were also rated highly. Health service partners consistently agreed that the assessment items developed student's critical thinking skills

(mean = 4.6), and decision making skills (mean = 4.4), challenged their thinking (mean = 4.6) and encouraged them to examine the whole clinical situation rather than the tasks at hand (mean = 4.6). Health service partners also acknowledged that the assessment process measured the relevant course objectives (mean = 4.6).

Responses to items in the domain of Preparation for Practice were positive but ranked slightly less favourably than responses on other subscales. Expert midwifery clinicians perceived that undertaking the root cause analysis developed students' appreciation of the value and extent of other roles within the wider health care team (mean = 4.8) and promoted the development of skills in collaborative practice (mean = 4.4). They also considered the assessment item enhanced the student's understanding of the midwives' accountability (mean = 4.6) and decreased their likelihood of making clinical errors (mean = 4.0). Health service partners reported student's would be more aware of the causes of critical incidents (mean = 4.6) and prepare students for practice (mean= 4.2), but reported less agreement that following completion of this assessment item students would be less likely to make clinical errors (mean = 3.6).



**Table 2.5: Health Service Partner survey responses**

Utility index survey item	Mean (standard deviation)
<b>Domain – educational acceptability</b>	
1. This assessment item engaged the students in learning	5.0 (0)
2. This assessment item would be interesting for students to research and prepare	4.75 (.50)
3. The critical incidents provided are similar to those faced in the clinical environment	4.80 (.48)
4. This is an appropriate assessment for final year Bachelor of Midwifery students	4.80 (.48)
5. I would recommend this assessment item continue within this course	5.0 (0)
<b>Domain – educational impact</b>	
1. This assessment item enhances student learning	4.80 (.447)
2. This assessment item encourages students' critical thinking skills	4.60 (.548)
3. This assessment item develops a students' decision making skills	4.40 (.548)
4. This assessment item enhances students' ability to assess complex needs	4.50 (.577)
5. This assessment item challenges students' thinking	4.60 (.548)
6. This assessment item encouraged students to examine the whole clinical situation rather than the tasks at hand	4.60 (.548)
7. This assessment item measures the relevant course objectives	4.60 (.548)
<b>Domain – preparation for practice</b>	
1. Students will be more confident and able to make appropriate clinical decisions in complex situations after successfully completing this assessment	4.40 (.548)
2. Students will gain an enhanced understanding of midwives' accountability after successful completion of this assessment	4.60 (.548)
3. This assessment item develops students' appreciation of the value and extent of other roles within the wider health care team	4.80 (.447)
4. This assessment item promotes the development of skills in collaborative practice	4.40 (.894)
5. Students will be more aware of the causes of critical incidents following the completion of this assessment item	4.60 (.548)
6. Students are less likely to make clinical errors following completion of this assessment item	3.60 (.548)
7. Teaching students to use risk management and clinical governance principles in this way assists them in meeting the ANMC Competencies	4.60 (.548)
8. This assessment item assists prepare student midwives for midwifery practice	4.20 (.447)

## Qualitative survey responses and focus group discussions

All participants found the root cause analysis to be a useful assessment item. Participants clearly perceived that the development of critical thinking was fostered in this assessment task. For example, P2 stated, *“Overall consolidation of knowledge was evident in this assessment. Development of critical thinking is an essential skill required to be an excellent midwifery practitioner, this assessment contributes to that skill set”*. Likewise P5 commented, *“It gives students an excellent overview of how important it is to approach any situation in a critical way”*.

Another positive aspect of the assessment item related to clinical governance and risk management. P4 summed this up well when she wrote in point form;

*Real scenarios are relevant to practice/ best practice;*

*A risk management framework was used to identify issues;*

*Students are informed about clinical guidelines and contemporary practice/ evidence-based practice; and*

*No blame approach and systems analysis are highlighted.*

A significant intent of the RCA assessment item was to teach/ consolidate these issues, so it was gratifying to have these aspects affirmed by health service partners.

Health service partners were also asked for suggestions to improve the assessment process. Four out of five midwives felt the process was not in need of improvement. The fifth suggested a restructure to the order in which students' presented their recommended findings from their RCA.

When asked to identify the most important learning outcomes from the assessment item our health service partners firstly noted 'critical thinking' and 'objectivity'. They considered these as being significant in midwifery practice. P1 stated that the assessment led to *“awareness and conscious recognition of all the factors which contribute to governance for safety”*; with P4 saying the assessment drew students' attention to *“National Health and Quality Safety Standards, importance of education and CPD, [and] accountability and responsibility of all health professionals”*.

An awareness of multifaceted approaches to care/ communication was also identified as an important learning outcome. P5 identified that students could learn from this assessment in

that, “*appropriate communication is important*” and “*Collaboration with all the team*” is essential.

In the focus group discussions health service partners commented on the time consuming nature of this assessment task and expressed some concern related to student workload. Considering the time expended on this assessment task several midwives commented they would like to see the students’ work more widely communicated. P4 suggested to “use these presentations in clinical settings/ share with midwives”.

Although health service partners were only asked to evaluate the assessment item and not individual student performance, comments on students’ work were made during the focus group. Several clinicians commented favourably on the high level of student performance, adding that many registered midwives could not undertake such a sophisticated root cause analysis. As P1 said “*There are many practising midwives that would benefit from this [undertaking this assessment item]*”. The process of viewing students’ presentations as part of this evaluation further consolidated health service partners’ confidence in students’ abilities and the curriculum as a whole. This project was undertaken at the end of semester with the program’s first group of graduating students. This may have enhanced employment opportunities for graduates, as following viewing student presentations health service partners expressed interest in employing students from this program. P2 articulated her enthusiasm, “*Well done. I am so excited about the introduction into the workforce of these midwives*”.

## **Discussion**

This descriptive study described a process of health service providers’ engagement in the evaluation of a novel assessment task designed to develop students’ cognitive competence in preparation for autonomous midwifery practice. The validity of the assessment process was endorsed with “educational acceptability” and “educational impact” being rated highly, but with slightly less agreement on the effect of the assessment process to “prepare students for practice”. The lower scoring related to preparation for practice could be due to health service partners not being adequately informed about the scope of assessment that students complete throughout the entire degree program. This root cause analysis assessment process, although innovative and authentic, is only one item within a scaffolded program of assessment preparing midwifery students for practice. Similar evaluation of assessment

items within the program would be beneficial to further validate these items and promote further health service engagement.

Health service partners also commented favourably on the development of students' understanding of various roles within the multidisciplinary team and collaborative skills. Other aspects highlighted during focus group discussions included improved student awareness about the importance of communication in every adverse situation. Health service partners also endorsed the concept of using group work for this assessment as a strategy to develop collaboration and conflict resolution skills. Teamwork skills are not only an effective vehicle to enhance learning but are considered a useful transferable skill highly valued by employers (Corby, 2013).

Concerns raised in the focus groups were primarily about the time consuming nature of the task. Health service partners commented on the multi-faceted nature of the project, complexities of each case being analysed, and research required to complete the analysis. Students made similar comments (Carter et al., 2014), however in a 6 month follow-up of graduates, anecdotal evidence suggests that students reported the RCA was one of the most valuable assessment activities in the degree program to prepare them for safe practice.

Although our findings are positive, they need to be considered in light of limitations of the study. Generalizability of results is limited by the use of a single program and small sample. However, there was a high level of agreement amongst respondents, lending some confidence to the conclusions. The sample size also limited the extent of statistical analysis. Furthermore, the survey tool needs to be examined with a larger sample and tested for reliability.

### **Implications for teaching practice and research**

Although the results indicated a high level of validation and overall satisfaction with the assessment process from health service partners, some changes were highlighted. While the scores were positive in the domain of Preparation for Practice, they ranked slightly less favourably than responses on other subscales. A detailed explanation of the curriculum assessment map and the scaffolding of its complexity and development of skills and knowledge will be provided in the future to health service partners. This would place the RCA assessment item in context and further promote how this assessment item builds on prior knowledge and skills promoting competence, capability and confidence.

Health service partners identified that the assessment task was time consuming, requiring considerable research. The multifaceted nature of the assessment that involved research, group work, write up and preparation for the group presentation may have contributed to this perception. This has subsequently been addressed by providing students with examples of root cause analysis frameworks to use. Furthermore several improvements to the instructions have now been made to provide explicit details about the nature of the assessment, and some useful tips on how to prioritise work and manage time. The marking rubric has been modified with more explicit marking criteria and exemplars are now provided.

The importance of team work was further highlighted by health service partners. Students often dislike group work assessments, and academic staff may have limited experience in teaching group work skills or assessing the process of teamwork as opposed to its outputs (Corby, 2013). Our experience also suggests that students found group work challenging. When difficulties arise while working in groups, students are often unable to pinpoint how to modify their behaviour to improve the situation. The principles of group work have now been introduced early in the program and experiential activities are planned so that students are better prepared to work with others, have good process problem-solving skills and improved negotiation and conflict resolution skills.

## **Conclusions**

Analysing complex clinical cases to determine a root cause was validated by health service providers as an authentic assessment task that represented 'real world' midwifery problems. Health service providers partners perceived this assessment would develop student's critical thinking, decision making and teamwork skills. Coroners' cases can provide a high level of clinical information that is unpredictable, ambiguous and complex, and hence well suited to develop students higher ordered thinking, preparing them for the uncertainties of midwifery practice. The process of involving health service providers in evaluation of this assessment contributed to their confidence in student's credibility and further fostered strong collaborative partnerships.

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## **Chapter Conclusions**

Although the results of this study were positive, with affirmative evaluation from both students and midwifery industry partners, inferences need to be considered with caution. While the survey tool was adapted from a widely validated framework, reliability and validity testing was not possible due to the small sample size. The tool was beneficial as an evaluation methodology of the assessment item. However, feedback from the journal reviewers and reflection by the authors acknowledged that only perceptions of changes to critical thinking abilities were evaluated. Furthermore, there were no baseline and post-intervention measures of critical thinking to demonstrate causal effects of the intervention.

A more rigorous approach to the measurement of critical thinking was therefore required. Rather than repeat this study with a larger sample, as recommended in both papers, a decision was made to explore the wider literature for an objective, reliable and valid tool to measure critical thinking in midwifery practice for undergraduate students. The next sequential study was therefore a systematic review of the literature which focussed on an evaluation of tools used to measure critical thinking development.



# CHAPTER 3

## Evaluation of Tools used to Measure Critical Thinking Development in Nursing and Midwifery Undergraduate Students: A Systematic Review

### Chapter Overview

A post-print copy of the publication forms Chapter 3 of this thesis. The references and formatting for this paper are presented in accordance with the requirements of *Nurse Education Today*, in which this paper was published.

### Author contributions

The paper is a co-authored paper. The bibliographic details of this co-authored paper, including all authors, are:

Carter, A. G., Creedy, D. K., & Sidebotham, M. (2015). Evaluation of tools used to measure critical thinking development in nursing and midwifery undergraduate students: A systematic review. *Nurse Education Today*, 35(7), 864-874. <https://dx.doi.org/10.1016/j.nedt.2015.02.023> (See Appendix H for published format).

Under the supervision of Professor Debra K. Creedy (Co-Principal Supervisor) and Associate Professor Mary Sidebotham (Co-Principal Supervisor) my contribution to the paper involved conceptualisation of the review method, development of search strategies and inclusion criteria, performing the literature search, summary and analysis. My contribution also included preparation of the manuscript for publication and manuscript revisions prior to publication.

(Signed)

(Date) 30<sup>th</sup> October 2017

Amanda Carter

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## **Abstract**

**Background:** Well developed critical thinking skills are essential for nursing and midwifery practices. The development of students' higher-order cognitive abilities, such as critical thinking, is also well recognised in nursing and midwifery education. Measurement of critical thinking development is important to demonstrate change over time and effectiveness of teaching strategies.

**Objective:** To evaluate tools designed to measure critical thinking in nursing and midwifery undergraduate students.

**Data sources:** The following six databases were searched and resulted in the retrieval of 1,191 paper: CINAHL, Ovid Medline, ERIC, Informit, PsycINFO and Scopus.

**Review methods:** After screening for inclusion, each paper was evaluated using the Critical Appraisal Skills Programme Tool. Thirty-four studies met the inclusion criteria and quality appraisal. Sixteen different tools that measure critical thinking were reviewed for reliability and validity and extent to which the domains of critical thinking were evident.

**Results:** Sixty percent of studies utilised one of four standardised commercially available measures of critical thinking. Reliability and validity were not consistently reported and there was a variation in reliability across studies that used the same measure. Of the remaining studies using different tools, there was also limited reporting of reliability making it difficult to assess internal consistency and potential applicability of measures across settings.

**Conclusions:** Discipline specific instruments to measure critical thinking in nursing and midwifery are required, specifically tools that measure the application of critical thinking to practice. Given that critical thinking development occurs over an extended period, measurement needs to be repeated and multiple methods of measurement used over time.

## **Introduction**

The development of critical thinking (CT) skills has long been recognised as a priority in tertiary education. The landmark Delphi study by the American Philosophical Association (APA) produced an international expert consensus definition of critical thinking. Critical thinking is described as purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference (Facione, 1990). Critical thinkers consider events or issues in a controlled, purposeful, focussed and conscious way (Mong-Chue, 2000).

Critical thinking is a crucial skill for nurses and midwives who, like other healthcare clinicians, need to effectively manage complex care situations in fast paced environments that demand increasing accountability (Mong-Chue, 2000; Muoni, 2012; Pucer et al., 2014). The processes of clinical decision making and problem solving require advanced CT skills (Muoni, 2012). CT is also essential for clinicians to critique and apply evidence, especially in situations where uncertainty regarding 'best practice' remains unclear (Scholes et al., 2012).

Although the development of students' higher order cognitive abilities is recognised as important in nursing and midwifery education, the measurement of these vital skills is inconsistent or neglected (Walsh and Seldomridge, 2006). The measurement of CT is important to identify deficits and developments in students' cognitive capacities as well as demonstrate the effectiveness of teaching strategies. The purpose of this systematic review was to evaluate tools used to measure CT development in nursing and midwifery undergraduate students.

## **Search Strategies Utilised**

A search of major databases CINAHL, Ovid Medline, ERIC, Informit, PsycINFO and Scopus, was conducted in September 2014. The search was limited to English language articles published in peer reviewed journals during 2001-2014. This period was chosen as the results of a Delphi study to define CT in nursing was published in 2000 (Scheffer and Rubenfeld, 2000). Scholarly work about CT in nursing would have further developed since that publication.

The inclusion criteria were original research studies that utilised experimental designs to assess CT development in undergraduate nursing and/or midwifery students. Papers were

excluded if CT was not specifically measured on more than one occasion; the sample was post-graduate students, full text was not available in English, discussion papers that did not involve original research, or did not use an experimental design.

Five search terms were entered into the databases with the article title, abstract and body all searched. The search terms used were:

1. "critical thinking" AND midwife\*
2. "critical thinking" AND midwife\* AND measure\*
3. "critical thinking" AND midwife\* AND evaluat\*
4. "critical thinking" AND students, nursing AND measure\*
5. "critical thinking" AND students, nursing AND evaluat\*

The search was conducted sequentially using the search engines and search terms. An initial search, filtering for date, language and source of publication, identified 1,191 papers. Once duplicates were excluded, each identified citation was reviewed using the inclusion and exclusion criteria and filtered through three screening levels i.e., (i) title screening; (ii) title and abstract screening; and (iii) full-text screening. Articles that were not relevant or did not meet inclusion criteria were discarded. Finally 35 papers were included. No papers involving midwifery undergraduate students met the inclusion criteria and hence the samples in all of the papers are undergraduate nursing students.

## **Overview of Tools**

Twenty-one (60%) of the 34 studies reviewed utilised one of four standardised commercially available measures of critical thinking. These were the California CT Disposition Inventory (10 studies), the California CT Skills Test (5 studies), the Watson-Glaser CT Appraisal (3 studies) and Health Sciences Reasoning Test (3 studies). Two studies used both the Californian CT Skills Test and California CT Disposition Inventory. All of these tools have reported psychometric reliability and validity allowing comparison across settings, disciplines, and time. Relatively few of the included studies (9 out of 21) undertook a reliability analysis of the tool for their current context. There were twelve other measurement tools utilised in the studies reviewed. See Table 3.1 for a comparison of tools employed in the studies reviewed.

Included studies were listed in a summary table (Table 3.2) during the search. The studies

are presented in groups according to the tool utilised. After the initial search all articles identified in subsequent searches were checked against articles in the summary table and duplicates excluded. Each article was also entered into a reference management database (Endnote) including the search term and engine used to locate each article. A quality appraisal process was performed using the Critical Appraisal Skills Programme (CASP) tool (CASP, 2013) and one article of poor quality was excluded. The excluded study is identified in the summary table. Following the quality appraisal process 34 papers were selected for review.

**Table 3.1: Description of Tools/Methods to measure critical thinking**

<b>Name of Instrument/ Author/ Year Developed</b>	<b>Aim of tool</b>	<b>Number of Items/ format</b>	<b>Psychometric Testing</b>	<b>Scores</b>	<b>Time to Complete</b>	<b>Factor Domains Measured</b>
The California Critical Thinking Disposition Inventory (CCTDI) / Facione and Facione (1992a)	Measure the extent to which an individual possesses the attitudes of a critical thinker. Designed for use by the general adult population.	75 Likert items, "agree-disagree" scale, student's self report.	Cronbach's alpha .90 for the overall instrument and .71 to .80 for the seven subscales.	Maximum score of 60 in each domain. Negative disposition is a score below 30. The total maximum score is 420 points. Scores > 350 indicate a high CT disposition. Scores less < 280 indicate paucity of CT.	20-30 mins	Open-mindedness, analyticity, cognitive, maturity, truth-seeking, systematicity, inquisitiveness, and self-confidence.
California Critical Thinking Skills Test (CCTST)/ Facione and Facione (1992b)	Designed for assessment of entry or exit level CT skills of various groups of college students and for evaluation of learning outcomes of various curricular programmes.	34 Multiple choice items uses a generic scenario requiring an accurate and complete interpretation of the question.	The Kuder-Richardson (KR-20) estimate of internal consistency of the CCTST is reported in the test manual to be $r = .70$ .	The maximum total score is 34. A score of $\geq 24$ indicates very strong CT skills. A score 13-23 indicates a mid-range skill level Scores of $\leq 12$ indicate fundamental weaknesses in CT skills.	45-50 mins	Analysis, inference, evaluation, deductive and inductive reasoning.
Health Sciences Reasoning Test (HSRT) /Facione et al. (2010)	Adaptation of the CCTST specifically designed for use by health sciences students and professionals to assess their CT and clinical reasoning skills.	33 multiple choice questions uses a health related scenario requiring an accurate and complete interpretation of the question.	Internal consistency .77 to .84. Overall internal consistency value of .81 with Kuder-Richardson formula 20, and an overall .81 reliability coefficient.	Total score reflects overall CT skills. Maximum score is 33. Scores of 25 or above represent strong CT skills, scores from 15 to 24 are considered mid-range and represent competence in CT skills in most situations, and scores of 14 or below represent fundamental weaknesses in CT skills.	30-50 mins	Analysis, inference, evaluation, inductive reasoning and deductive reasoning.

Name of Instrument/ Author/ Year Developed	Aim of tool	Number of Items/ format	Psychometric Testing	Scores	Time to Complete	Factor Domains Measured
The Watson-Glaser Critical Thinking Appraisal (WGCTA) / Watson and Glaser/ (originally developed in 1925, most recent revision 2012)	Measures both logical and creative components of CT and assesses CT ability in individuals with at least a ninth grade education.	40 multiple choice items answering scenario based questions.	Reliability reported to be > .8. Using the Spearman-Brown formula, reliability for the total score of the WGCTA was established at .77. This is consistent with the split-half reliability coefficients, ranging from .76 to .85.	Maximum score is 80	40-50 mins	Inference, recognition of assumptions, deduction, interpretation and evaluation of arguments
Think aloud analytic framework / Daly (2001)	Analyse qualitative data to synthesise conception of CT.	A scale of argument/ epistemological complexity is used to assess videotaped client simulation.	Not stated.	Scores range from 1-4.	No time commitment by student. Uses learning activities integrated into the course.	Structural components of differentiation and integration in reasoning, situation modelling and argument and evidential structure.
Critical Thinking Ability Scale (CTAS) for College Students/ Park (1999)	Assess dimensions of CT of college students.	20 items measured using a Likert scale 1 = absolutely do not agree to 5 = absolutely agree.	Cronbach's alpha was found to be .74 (Park, 1999).	Total scores have a possible range from 5 to 100, with higher score indicating stronger CT ability.	Not stated.	Intellectual curiosity, healthy scepticism, intellectual integrity, prudence, and objectivity.
Critical Thinking Disposition Scale for Nursing Students (CTDS) /Park and Kim (2009) (Korean version only)	Assess of CT disposition in Korean nurses.	35 items assessed a 5-point Likert scale. Student self-report.	Cronbach's alpha = .78 (Park and Kim, 2009).	The total score ranges from 35 to 175, with a higher score indicating a higher level of critical thinking disposition.	Not stated.	Intellectual integrity, creativity, challenge, open-mindedness, prudence, objectivity, truth seeking, inquisitiveness.

<b>Name of Instrument/ Author/ Year Developed</b>	<b>Aim of tool</b>	<b>Number of Items/ format</b>	<b>Psychometric Testing</b>	<b>Scores</b>	<b>Time to Complete</b>	<b>Factor Domains Measured</b>
Critical Thinking Process Test (CTPT)/ Educational Resources Inc. (1999); Anderson et al. (2000)	Developed specifically for nursing students. Focus on critical thinking process skills within a nursing environment, not level of nursing content knowledge.	50 item multiple choice.	The average reliability coefficient was .93 with demonstrated evidence of content and diagnostic validity (Anderson et al, 2000).	Not stated.	60 minutes	Assesses 4 aspects of the critical thinking process: listening, writing, speaking, and reading, and 5 levels of abstract thinking: prioritizing, inferential reasoning, goal setting, application of knowledge, and evaluation of predicted outcomes.
Think aloud protocol / Morey (2002)	Provide a valid source of qualitative data on thinking and thought processes.	A rating tool and rubric using a 4 point Likert scale for eight cognitive processes, level of critical thinking, and for accuracy of nursing diagnosis, conclusions, and evaluation.	Two faculty rated the think-aloud scenario responses with 97.9 to 100 percent rater agreement.	Not provided.	No time commitment by student as uses learning activities integrated into the course.	Collect, review, relate, interpret, infer, diagnosis, act, and evaluate.



Name of Instrument/ Author/ Year Developed	Aim of tool	Number of Items/ format	Psychometric Testing	Scores	Time to Complete	Factor Domains Measured
N3 case report accreditation form /Taiwan Nurses Association (no date available); Chen and Lin (2003)	Not stated.	45 criteria (including 36 strengths and 9 weaknesses).	Inter-rater reliability = .893, internal consistency of KR-20 = .79 and test-retest reliability of .32 ( $p < 0.01$ ).	Total scores ranged from 0-45.	No time commitment by student. Uses learning activities integrated into the course. 60 minutes.	Constructed on the basis of the nursing process. Critical inquiry points are listed under each step of the nursing process.
Discussion board analysis/ Pucer et al. (2014)	Analyse discussion board posts for evidence of CT.	Discussion posts examined against six elements of critical thinking.	Not stated.	Not stated.		Analysis, inference, interpretation, explanation, evaluation, and self-regulation.
Critical Thinking scale (CTS) / Cheng et al. (1996)	Not provided.	60 item multiple choice questions. Participants choose one correct answer from either one in five or dichotomous response sets according to the item situations.	CTS demonstrated adequate reliability (internal consistency as well as split half reliability) and convergent as well as known group validity.	The higher scores indicate better CT skills.	Not provided.	Inference, recognition of assumptions, deduction, interpretation, and evaluation of argument.
Critical Thinking Assessment (CTA) / Assessment Technologies Institute (2001)	Determine students' overall performance on specified CT skills determined to be necessary for success in an academic programme for nursing study.	40 generic multiple choice questions.	CTA has a global alpha of .69 and a standardized item alpha of .70 for all 40 items in first-time examinees (ATI, 2001).	Maximum score of 40.	Not provided.	Interpretation, analysis, evaluation, inference, explanation, self-regulation.

Name of Instrument/ Author/ Year Developed	Aim of tool	Number of Items/ format	Psychometric Testing	Scores	Time to Complete	Factor Domains Measured
Blooms Taxonomy / Jones (2008)	Assess student's developed nursing care plans for evidence of critical thinking.	Using nursing care plans.	Not provided.	Not provided.	No time commitment by student as uses learning activities integrated into the course.	Knowledge, comprehension, application, analysis, synthesis, evaluation.
Concept map scoring / Daley et al. (1999)	Assess student's ability to develop concept maps that reflect CT used in the nursing process.	Using concept maps.	Inter-rater reliability was performed with two assessors in the pilot study and the percentage of agreement of the independent scores was 85%. Content validity establish by Daley et al. (1999).	Not provided	No time commitment by student as uses learning activities integrated into the course.	Meaningful, valid and significant.
Critical Thinking Scale (CTSM) / McMaster University (2002); Tseng et al. (2011)	Not provided.	10 items. Each item is scored on a six-point Likert scale of 1 to 6, with 1 corresponding to "never" and 6 to "always".	Cronbach's alpha coefficient .93 and two-week test-retest reliability coefficient was .92.	Total scores range from 10 to 60 with higher scores indicating higher level of CT competency.	Not provided.	Not stated.

Table 3.2: Articles that met inclusion and quality criteria

Author, year and location	Design/Intervention	Participants	Results	Reliability and validity assessment	Quality Appraisal using CASP
<b>Californian Critical Thinking Disposition Inventory (CCTDI)</b>					
Atay and Karabacak (2012). Turkey	Pre-post test control group design testing effects of using concept plans.	80 freshman and sophomore nursing students.	Statistically significant increase in CT scores for experimental group.	Cronbach's alpha was .88.	Include
Shin et al. (2006) Korea	Longitudinal study using CCTDI each year for 4 years.	60 nursing students commenced on study, 32 completed all four surveys.	Statistically significant improvement in CT disposition.	Cronbach's alpha for the CCTDI was .59 for year 1, .53 for year 2, .66 for year 3, and .73 for year 4. Significantly lower than overall median alpha coefficient of .90 reported by Facione (1994).	Include
Tiwari et al. (2006). Hong Kong	Experimental design, pre-post test testing the effects of PBL. 4 time points tested.	79 1 <sup>st</sup> year nursing students.	Significantly greater improvement in CT scores for experimental group.	No reporting of reliability of CCTDI for this study.	Include
Evans and Bendel, (2004). United States	Quasi-experimental, non-equivalent control group design testing narrative pedagogy.	114 undergraduate nursing students.	No significant differences in CT scores between control and experimental groups.	No reporting of reliability of CCTDI for this study.	Include
Wood and Toronto (2012) USA	Experimental study testing the effects of human patient simulation.	85 2 <sup>nd</sup> year nursing students.	Higher mean post test total scores compared with pre test total scores in experimental group students.	No reporting of reliability of CCTDI for this study.	Include

Author, year and location	Design/Intervention	Participants	Results	Reliability and validity assessment	Quality Appraisal using CASP
<b>Californian Critical Thinking Disposition Inventory (CCTDI)</b>					
Stewart and Dempsey (2005). USA	Longitudinal study, at 5 time-points testing effects of whole programme.	55 nursing students recruited, 34 students completed all surveys.	Subscale and total scores did not significantly increase throughout the programme.	Cronbach's alpha for the CCDDI was calculated at each phase: Sophomore semester 2 = .71. Junior semester 1 = .77 Junior semester 2 = .76 Senior semester 1 = .67 Senior semester 2 = .75 No reporting of reliability of CCTDI for this study.	. Include
Yeh and Chen (2005). Taiwan	A pre-post test quasi-experimental research design testing the effects of a CT lecture and interactive videodisc system	126 RN-BN students	Statistically significant differences between pre-post test overall scores	No reporting of reliability of CCTDI for this study.	Include
Yu et al. (2012). China	Crossover experimental study testing the effects of PBL.	76 2 <sup>nd</sup> year nursing students.	Statistical improvement in overall CTDI scores following PBL.	For this study the overall Cronbach's alpha was .8999.	Include
Dehkordi, and Heydarnejad, (2008). USA	Quasi-experimental design testing the effects of PBL.	40 2 <sup>nd</sup> year nursing students participated.	Statistical improvement in CTDI scores following PBL.	No reporting of reliability of CCTDI for this study.	Include
Zadeh et al. (2014). Iran	Quasi-experimental study testing the effects of an evidence based nursing course.	48 3 <sup>rd</sup> year nursing students.	CCTDI scores were significantly higher following the intervention.	No reporting of reliability of CCTDI.	Include
<b>Californian Critical Thinking Test (CCTST)</b>					
Chau et al. (2001). Hong Kong	Pre-post test design testing the effects of 4 vignettes.	101 1 <sup>st</sup> and 2 <sup>nd</sup> year nursing students recruited of 83 completed both pre and post tests.	No statistical difference in pre and post test scores.	KR-20 of the CCTST was .74 and subscales ranged from .30 to .61.	Include

Author, year and location	Design/Intervention	Participants	Results	Reliability and validity assessment	Quality Appraisal using CASP
<b>Californian Critical Thinking Test (CCTST)</b>					
Beckie et al. (2001). United States	A pre-post test, non-equivalent control group design. Experimental group experienced new curriculum.	183 BN students consisted of 3 cohorts of students, 1 control cohort and 2 cohorts that experienced the new curriculum.	Cohort 1 received the new curriculum, achieved significantly higher CT scores than controls. Cohort 3, the 2nd class to experience the revised curriculum, failed to demonstrate improved CT scores and reported some decreases. Statistically significant increase in CT scores for all pathways.	Cronbach alpha on CCTST ranged from .55 to .83. Internal consistency of tool low and varied across tests.	Include
Spelic, et al. (2001). United States	Longitudinal study testing effects of different pathways.	136 students in 3 undergraduate pathways, traditional, accelerated and RN-BSN.		The CCTST has 34 items. No demonstrated variance (all students scored the same) on some items, $\alpha$ level therefore computed on less than 30 items.	Include
Wheeler and Collins, (2003) United States	Quasi-experimental design. Testing the effects of concept mapping compared to traditional nursing care plans.	A convenience sample (n = 76).	Significant difference between pre – post test scores for both groups. No difference found between experimental and control groups.	No reporting of reliability of CCTST for this study.	Include
Yuan et al. (2008). China	A quasi-experimental, two-group pre–post test design testing the effects of PBL.	All 46 Year 2 nursing students.	PBL students had significantly greater improvements on overall CCTST.	KR-20 for the CCTST-A was .80 for the total scale and between .60-.78 for subscales.	Include
<b>Californian Critical Thinking Skills Test (CCTST) &amp; Californian Critical Thinking Disposition Inventory (CCTDI)</b>					
Ravert (2008). States	Pre-post test design testing effects of human patient simulation.	30 1 <sup>st</sup> year students.	No differences in CT scores.	No reporting of reliability of the CCTST or CCTDI for this study.	Include
Naber and Wyatt, (2014). United States	Experimental, pre–post test design testing effects of reflective writing	70 4 <sup>th</sup> semester nursing students	The experimental group's total CCTST and CCTDI scores did not increase significantly following the intervention.	No reporting of reliability of CCTST or CCTDI scale for this study.	Include

Author, year and location	Design/Intervention	Participants	Results	Reliability and validity assessment	Quality Appraisal using CASP
<b>Health Sciences Reasoning Test (HSRT)</b>					
Sullivan-Mann et al. (2009). United States	Mixed-model experimental design, testing effects of multiple simulation.	53 nursing students from the medical-surgical course.	Statistically significant increase in CT scores for experimental group.	Reliability of the HSRT not reported for this study.	Include
Shinnick and Woo, (2013). United States	One-group, quasi-experimental, pre-post test design. Tested the effects on one human patient simulation.	A convenience sample of 154, 3 <sup>rd</sup> or 4 <sup>th</sup> year nursing students.	Following HPS there were no statistically significant gains in CT, with some decrease in scores (not statistically significant).	No reporting of reliability of HSRT for this study.	Include
Goodstone et al. (2013). USA	A two-group quasi-experimental pre-post test design testing the effects of high fidelity patient simulation (HFPS) compared to case study.	42 1 <sup>st</sup> semester associate degree nursing students. Allocated to two groups, HFPS, and case study group.	There was a significant increase in the HSRT scores for the case study group ( $p = 0.003$ ) but not for the HFPS group.	.No reporting of reliability of HSRT for this study.	Include
<b>Watson-Glaser Critical Thinking Appraisal (WGCTA)</b>					
L'Eplattenier (2001). United States	Longitudinal study testing 4 times over 3 year undergraduate programme.	83 nursing students.	No change in CT scores as student progressed through the programme.	No reporting of reliability of WGCTA for this study.	Include
Brown et al. (2001). United States	Longitudinal study, testing at the beginning and end of degree. Testing different pathways and length of programme.	Convenience sample ( $n = 123$ ) of three groups of baccalaureate nursing students: traditional, RN-BSN, and accelerated.	A significance difference found between pre and post WGCTA scores for traditional students ( $p = 0.007$ ) and RN-BSN ( $p = 0.029$ ), with no difference for accelerated students.	Reliability for the total score of the WGCTA was established at .77 (using Spearman-Brown formula). Consistent with the split-half reliability coefficients (.69 to .85), reported by Watson and Glaser.	Include

Author, year and location	Design/Intervention	Participants	Results	Reliability and validity assessment	Quality Appraisal using CASP
<b>Watson-Glaser Critical Thinking Appraisal (WGCTA) and Think Aloud Analytical Framework</b>					
Daly (2001). United Kingdom	A longitudinal multi-method design with triangulation.	43 nursing students completed WGCTA. 12 students completed think aloud analytical framework.	No statistical difference in WGCTA scores. Little evidence of CT demonstrated in think aloud analytical framework.	No reporting of reliability of WGCTA for this study. No discussion of reliability or validity of think aloud analytical framework. Not clear whether the think aloud tool was validated or reviewed by experts and inter-rater reliability was not discussed.	Include
<b>Critical Thinking Ability Scale (CTAS) for College Students</b>					
Choi et al. (2014). Korea	Non-equivalent control group pre-post test design testing effects of PBL.	90 1 <sup>st</sup> year nursing students.	No significant differences in CT scores between control and experimental groups.	Cronbach's alpha was .71 which is consistent with the reported .74 by Park (1999). Not available in English.	Include
<b>Critical Thinking Disposition Scale for Nursing Students (CTDS)</b>					
Jun et al. (2013). South Korea	Quasi-experimental study testing effects of 5E learning cycle model with PBL.	161 1 <sup>st</sup> year nursing students.	Statistically significant increase in CT scores for experimental group.	Cronbach's alpha was .81. CTDS not available in English, 20 point self report Likert scale measures disposition as a proxy for CT skills.	Include
<b>Critical Thinking Process Test (CTPT)</b>					
DeSimone (2006). United States	Experimental design testing effects of accelerated programme.	38 nursing students undertaking an accelerated programme (12 months in length).	Increase in CT scores not significantly different.	Average reliability coefficient was .93.	Include

Author, year and location	Design/Intervention	Participants	Results	Reliability and validity assessment	Quality Appraisal using CASP
<b>Critical Thinking Process Test + Think Aloud Protocol</b>					
Morey, (2012). United States	An experimental design testing an online animated pedagogical agent.	45 associate degree nursing students in their final semester.	No differences in CT for either tool.	No reporting of reliability of CTPT. Two faculty rated the think-aloud scenario responses with 97.9 to 100 percent rater agreement. Limited information provided regarding the think aloud protocol.	Include
<b>N3 Case Report Accreditation Form</b>					
Chen and Lin (2001) Taiwan	Quasi- experimental design with pre-post test testing effects of a research course.	168 1st year nursing students.	Experimental group reported significantly higher CT scores than control group.	No reporting of reliability of the N3 case report form. Unclear whether tool measured students' ability to critique an article rather than CT abilities.	Include
<b>Discussion Board Analysis</b>					
Pucer et al. (2014) Slovenia	Quasi-experiment study testing the effects of an ICT programme which presented scenarios that mirror clinical situations.	45 1 <sup>st</sup> year nursing students.	Qualitative analysis of the discussion boards showed a significant improvement in % of posts for which the opinions and conclusions of the participants were justified with valid arguments.	No reporting of tool reliability. No discussion regarding development of tools, expert review process or psychometric testing of the tool.	Include
<b>Critical Thinking Scale (CTS)</b>					
Lee et al. (2013) Taiwan	Longitudinal study, measuring at 4 time-points testing the effects of concept mapping.	A convenience sample of 95 students.	Both control and experimental groups had higher initial CT scores that tended to decrease over time.	No reporting of reliability of CT scale for this study.	Include



Author, year and location	Design/Intervention	Participants	Results	Reliability and validity assessment	Quality Appraisal using CASP
<b>Critical Thinking Assessment (CTA)</b>					
Mann (2012). USA	Experimental, pre-post test, mixed method design testing the effects of grand rounds.	21 2 <sup>nd</sup> year nursing students.	No significant difference between CT scores for the two groups. In the control group, students' scores indicated a decrease CT scores.	No reporting of reliability of CTA for this study.	Include
<b>Blooms Taxonomy</b>					
Jones (2008). USA	A quasi-experimental, pre-post test study testing the effects of PBL.	60 2nd year nursing students.	Intervention group demonstrated a higher significant increase in CT compared to the control group.	No reporting of reliability. Unclear whether the tool was validated or reviewed by experts. Blooms taxonomy used to develop the tool, but no attempt to relate this to the recognised definitions of CT.	Include
<b>Concept Map Scoring</b>					
Abel. and Freeze, (2006) USA	Longitudinal study measurement over 4 time points testing the effects of concept mapping	28 associate degree nursing students.	There was a significant increase in mean scores of the first concept map to the average mean score of the last two maps (p = 0.05).	No reporting of reliability of tool. Limited information about scoring criteria, needed more information how this score relates to critical thinking.	Include

Author, year and location	Design/Intervention	Participants	Results	Reliability and validity assessment	Quality Appraisal using CASP
<b>Critical Thinking Likert Scale (CTLIS)</b>					
Stevens et al. (2009) USA	Pre-post test experimental design testing the PALS learning approach.	15 nursing students.	Increase in scores on CTLIS but no statistical analysis performed.	No reporting of reliability of CTLIS for this study or previously.	Exclude due to lack of statistical analysis and reporting of results.
<b>Critical Thinking Scale (CTSM)</b>					
Tseng et al. (2011). Taiwan	A quasi-experimental design measurement over 3 time-points testing the effects of PBL.	120 RN students.	The CTS scores were significantly higher in the experimental group.	Cronbach's alpha coefficient of the CTS was .94. Limited information regarding the CTS tool and how it measured CT.	Include

## Results

All 34 studies measured CT skill development or change, either following completion of a specific educational intervention or an undergraduate nursing programme. Most studies were conducted in Western countries namely USA (n = 20), United Kingdom (n = 1), others were conducted in Taiwan (n = 4), Korea (n = 3), China (n = 2), Iran (n = 1), Hong Kong (n = 2), Turkey (n = 1), and Slovenia (n = 1).

### Reliability, validity and factor domains of the tools

Reliability, validity and factor domains of the tools were examined. This included examination of previous and current reliability and validity testing. In respect to reliability, Facione and Facione (1992b) noted that a Kuder-Richardson (KR-20) range of .65 to .75 for this type of instrument is acceptable. Kaplan and Sacuzzo (1997) similarly reported that reliability estimates in the range of .70 to .80 are acceptable.

### Factor domains

In addition to developing a definition of CT, the APA also concluded that critical thinking comprised two dimensions; cognitive skills and disposition (Facione, 1990). Within the cognitive skills dimension, four sub-skills were defined; interpretation, analysis, evaluation, and inference. The disposition dimension was defined as truth-seeking, open-mindedness, analyticity, systematicity, self-confidence, inquisitiveness, and maturity of judgment (Facione and Facione, 1992a). Some scholars argued about the applicability of the universal definition of CT to the discipline of nursing. Scheffer and Rubenfeld (2000) conducted a Delphi study to develop a consensus definition of CT in nursing. A set of 17 consensus CT skills and habits of the mind were developed, many of which reflected Facione's (1990) earlier work with the addition of creativity, intuition and transforming knowledge (Scheffer and Rubenfeld, 2000). There has not been any published work on a definition of critical thinking for midwifery. The construct validity of the tools was assessed according to the dimensions and sub-skills of CT as outlined in the previous work of Facione (1990) and Scheffer and Rubenfeld (2000).

The California Critical Thinking Disposition Inventory (CCTDI) uses the APA consensus definition of critical thinking as the theoretical basis to measure the extent to which an individual possesses the attitudes of a critical thinker (Facione and Facione, 1992a). The domains assessed are: open-mindedness, analyticity, cognitive, maturity, truth-seeking,

systematicity, inquisitiveness, and self-confidence.

The CCTDI has a reported overall median alpha coefficient of .90 (Facione and Facione, 1994), demonstrating good reliability. Within the twelve studies that utilised the CCTDI only four (Atay and Karabacak, 2012; Shin et al., 2006; Stewart and Dempsey, 2005; Yu et al., 2012) tested reliability of the CCTDI. Two of the studies (Atay and Karabacak, 2012; Yu et al., 2012) reported reliability levels similar to those reported by Facione and Facione (1994) of .88 and .89. However, Stewart and Dempsey (2005) reported only marginal reliability with an alpha coefficient between .67 and .75. Shin (2006) reported a much lower alpha coefficient of .53. These inconsistent results place some doubt on the reliability of this tool in different nursing education contexts.

The California Critical Thinking Skills Test (CCTST) was designed to measure critical thinking in college students (Facione and Facione, 1992b). The CCTST measures the ability of participants to draw conclusions in the areas of analysis, inference, evaluation, deductive and inductive reasoning. (Facione and Facione, 1998). These skills relate to the APA consensus definition of critical thinking (Facione, 1990). The KR-20 estimate of internal consistency of the CCTST was  $r = .70$  (Facione and Facione, 1998). Four of the seven studies that utilised the CCTST reported on reliability. Two studies reported low alpha coefficients of .62 (Beckie et al., 2001) and between .55 and .83 (Spelic et al., 2001). The CCTST was used to track development of CT in students undertaking different study pathways (Spelic et al., 2001). Some concerns were expressed with the internal consistency of the CCTST across the different cohorts. The total score  $\alpha$  for the RN-BSN group was very low ( $\alpha = .31$ ) compared to the traditional and accelerated pathways cohorts ( $\alpha = .66$ ). Spelic et al., (2001) suggested that the reliability of tools with few items and involving a timed test administration is low. The CCTST comprises 34 items, and Spelic et al., (2001) found that on several items all students scored the same. When these items were removed, the  $\alpha$  level for 30 items was .62. This limitation highlights the value of using multiple measures in the assessment of CT.

The second study using the CCTST demonstrated inconsistent results (Beckie, et al., 2001). Two cohorts of nursing students in a new curriculum focussing on CT skills completed the CCTST over three time-points. The first group experienced significantly improved CT scores from baseline but scores of the second group revealed decreased CT scores. This variation in results across the two cohorts undertaking the same curriculum places doubt on the

reliability of this tool.

The other two studies that tested the reliability of the CCTST (Chau et al., 2001; Yuan et al., 2008) reported similar results to Facione and Facione (1998). The differences in findings between these four studies may indicate that the CCTST does not consistently measure CT in nursing practice across different settings.

The HSRT is a commercially available, recent adaptation of the CCTST specifically designed for health sciences students and professionals to assess their CT and clinical reasoning skills (Goodstone et al., 2013). Similar to the CCTST the HSRT uses the sub-skills identified within the APA consensus definition of critical thinking. The HSRT is considered a reliable and valid measure of critical thinking for entry level nursing students with a KR 20 of .81 (Facione, et al., 2010). The three studies that used this tool all tested the effects of simulation on CT but none reported reliability (Sullivan-Mann, et al., 2009; Shinnick and Woo, 2013; Goodstone et al., 2013). One study (Sullivan-Mann et al., 2009) reported an increase in student's CT skills following simulation but the other two studies (Goodstone et al., 2013; Shinnick and Woo, 2013) reported no statistical increase, with decrease in scores in one study. These inconsistent results could indicate the HSRT is not a reliable tool across diverse settings and populations.

The WGCTA, originally developed in the 1920's, measures both logical and creative components of CT and assesses CT ability in individuals with at least a ninth grade education (Watson and Glaser, 1980). The test comprises 80 proposed arguments related to 25 statements that include problems, arguments, and interpretations. On completion a total score is produced based on the assessment of five critical thinking skills: inference, recognition of assumptions, deduction, interpretation and evaluation of arguments, which align to the CT sub-skills defined by Facione (1990). The WGCTA measures the underlying constructs of classical logic and general reasoning skills rather than application of CT skills (Walsh and Seldomridge, 2006). Only the study by Brown et al. (2001) reported an alpha coefficient of .77. This is consistent with the split-half reliability coefficients of .69 to .85 reported by Watson and Glaser (1980). The three studies that used the WGCTA were all conducted in the USA and used a longitudinal design to detect change in CT across different undergraduate nursing degrees (L'Eplattenier, 2001; Brown et al., 2001; Daly, 2001). Two of the studies (L'Eplattenier, 2001; Daly, 2001) found no change in CT scores whereas Brown et al. (2001) reported increases in CT scores of students undertaking traditional and

RN-BSN pathways but no change for students in the accelerated pathway. These inconsistencies in findings may support claims that the constructs within the WGCTA are not suited to measure CT skills in the nursing discipline (Walsh and Seldomridge, 2006).

Of the twelve non-standardised tools utilised to measure critical thinking in this review, only four tested reliability. The Critical Thinking Ability Scale (CTAS) for College Students has a reported Cronbach's alpha of .74 (Park, 1999). The CTAS was used by Choi et al. (2014) to measure the effect of problem based learning (PBL) on CT and had a reported Cronbach's alpha of .71. Although the aim was to measure changes in students' CT abilities, the CTAS is a self-report tool that assesses the domains of; intellectual curiosity, healthy scepticism, intellectual integrity, prudence, and objectivity, which relate more to CT disposition rather than skills.

The Critical Thinking Disposition Scale (CTDS) for Nursing Students developed by Park and Kim (2009) has a reported Cronbach's alpha of .78. Jun et al. (2013) used the CTDS to measure critical thinking development in 161 nursing students, and reported a Cronbach's alpha of .81. The CTDS uses the concepts of intellectual integrity, creativity, challenge, open-mindedness, prudence, objectivity, truth seeking, inquisitiveness, which directly relate to dispositional characteristics identified by both Facione (1990) and Scheffer and Rubenfeld (2000). This tool is not available in English which limits use in other settings. Similar to the CCTDI, the CTDS only measures CT disposition not the application of these skills in practice.

The N3 case report accreditation form developed by the Taiwan Nurses Association was used to assess students' CT abilities in the critique of case study reports (Chen and Lin, 2003). Testing of this tool resulted in good inter-rater reliability = .89 (Pearson  $r$ ), internal consistency of KR-20 = .79, but low test-retest reliability of .32 after a 16 week interval. However, the construct validity of this tool is questionable. The criteria of the tool do not reflect any of the CT constructs. Instead the tool was constructed on the basis of the nursing process with critical inquiry points listed under each step of the nursing process (Chen and Lin, 2003). The study tested the effects of a research course, and found significantly higher CT scores in students who undertook the course. However, it was unclear whether the tool measured students' abilities to critique an article rather than their CT abilities.

The Critical Thinking Process Test (CTPT), a commercial tool developed by Educational

Resources, has a reported reliability coefficient of .93 (Anderson et al., 2000). The CTPT measured CT development in two studies but neither reported on reliability (DeSimone, 2006; Morey, 2012). The CTPT assesses four aspects of the critical thinking process; listening, writing, speaking, and reading, and five levels of abstract thinking; prioritizing, inferential reasoning, goal setting, application of knowledge, and evaluation of predicted outcomes. Several concepts partially relate to elements of the recognised definition of CT. This tool is expensive to administer and not widely used (Fountain, 2011).

The Critical Thinking Scale (CTSM) developed by McMaster University assesses the effects of PBL and concept mapping on CT (Tseng et al., 2011). The reported Cronbach's coefficient of .94 (Tseng et al., 2011), was replicated in another study which reported .93 (Chou et al., 2014). The concepts of inference, recognition of assumptions, deduction, interpretation, and evaluation of argument reflect the critical thinking sub-skills identified by Facione (1990). The CTSM is a student self-report test but may not measure CT in practice.

A validated concept map scoring criteria was used to measure CT development over a one year period (Abel and Freeze, 2006). Inter-rater reliability with two assessors found an 85% level of agreement (Abel and Freeze, 2006). The authors stated that content validity had previously been established, and no further testing of internal consistency was performed. The scoring criteria were: 1) meaningful relationships between two concepts indicated by a connecting line; 2) hierarchy shows a general to specific approach; 3) cross-links show meaningful connections between one segment of the hierarchy; and 4) examples describe specific instances of a concept (Lawson, 2012). It was unclear how the scoring criteria related to the dimensions of CT. The study demonstrated increases in students' concept map scores as they progressed through the curriculum, but it is uncertain whether this increase was representative of increases in critical thinking or simply improved competence in concept mapping.

The Critical Thinking Scale (CTS) assesses CT through the concepts of inference, recognition of assumptions, deduction, interpretation, and evaluation of argument (Lee et al., 2013). These concepts match those suggested within the two recognised definitions of CT. In a study examining the effects of concept mapping on CT skills, Lee et al. (2013) reported that previous reliability testing convergent as well as known group validity was conducted by the developer of the tool Cheng et al. (1996). No further testing of the reliability of the tool was conducted by Lee et al. Using a longitudinal design, students' CT scores

were compared between those exposed to one semester of teaching on concept mapping with a control group (Lee et al., 2013). Initial increases in CT scores were found in both groups but decreased over time. These findings infer the teaching methodologies were not effective but also may indicate the CTS is not reliable in measuring changes in CT over time.

The Critical Thinking Assessment (CTA) tool was used to evaluate the effects of a grand round education strategy on CT (Mann, 2012). The CTA has a reported alpha of .69 and a standardized item alpha of .70 in first-time examinees (Assessment Technologies Institute, 2001). No reliability testing was performed by Mann (2012). The CTA uses 40 multiple choice questions based on the domains of interpretation, analysis, evaluation, inference, explanation and self-regulation (Assessment Technologies Institute, 2001). Four of these domains (interpretation, analysis, evaluation and inference) directly relate to the recognised domains of CT. There were no differences in the CT scores in the control or experimental groups, with a decrease in scores in the control group (Mann, 2012). The unexpected decrease in CT scores could be due to the very small sample size of 21, with only 4 students in the control group.

Four of the twelve non-standardised tools were newly developed with the specific purpose of measuring critical thinking in action (Daly, 2001; Jones, 2008; Morey, 2012; Pucer et al., 2014). The studies utilised practice-based teaching, learning, and assessment activities to measure CT which not only presents opportunities to evaluate the application of CT but also reduces survey and response burden as the activities are embedded in student learning. However, none of these studies reported reliability of these newly developed tools.

Pucer et al. (2014) used a discussion board tool to analyse student's postings according to identified core key elements of critical thinking (as defined by Facione, 1990). A significant improvement in the percentage of posts where the opinions and conclusions of participants were justified with valid arguments was reported (Pucer et al., 2014). However, limited information was presented on the development of the tool, process of expert review and validation, or inter-rater reliability.

The effect of PBL on students' CT development was measured by grading nursing care plans over a semester (Jones, 2008). The grading system was based on the six levels of Blooms taxonomy of cognitive learning and were described as; comprehending information, organising ideas, and evaluating information and actions. Students who experienced the



PBL educational intervention reported higher CT scores. It was not clear however, whether the tool was validated or reviewed by experts. Although Blooms taxonomy was used as the basis of the tool, there did not seem to be any attempt to relate the grading domains to the recognised definitional elements of CT (Facione, 1990; Scheffer and Rubenfeld, 2000).

In an attempt to establish concurrent validity Morey (2012) used both a newly developed qualitative tool based on a 'think aloud protocol', and a standardised tool (CTPT) to measure the effects of an animated pedagogical agent on critical thinking. The think aloud protocol used elements of the nursing process to assess students' thinking in solving a clinical scenario (Morey, 2012). The elements of collect, review, relate, interpret, infer, diagnosis, act, and evaluate did not align directly with the recognise definitions of CT. Both groups displayed significant improvements in CT levels and correct conclusions from baseline to post-intervention on the think-aloud protocol, but only the pedagogical agent group had a significant result for "evaluation". These mixed results may indicate the difficulty in measuring CT development in a standardised exam format. Reliability testing and construct validity of the think aloud were not reported, therefore results must be viewed with caution.

Daly (2001) also compared the use of a newly developed think-aloud analytic framework and a standardised tool (WGCTA) to measure CT development over an 18 month period. No statistical improvement in the WGCTA scores was found. The think aloud qualitative assessment demonstrated consistent evidence of reasoning that reflected an "enduring absolutist epistemology" but portrayed little evidence of CT (Daly, 2001). The authors explained that reasoning of this nature usually involves a single theory structured argument which is contradictory to the principles of CT (Daly, 2001). Although both tools indicated similar results, no reliability testing was conducted. The constructs of this new tool were described as differentiation and integration in reasoning, situation modelling and argument and evidential structure (Daly, 2001), which do not incorporate the recognised definitional elements of CT (Facione, 1990; Scheffer and Rubenfeld, 2000).

## **Discussion**

This review included studies from 9 different countries using 16 different tools. This section discusses the findings in relation to the reliability, validity and factor domains of the standardised tools and then examines the non-standardised tools.

The reliability of tools used to measure CT in nursing practice was not reported consistently

and varied considerably. Only two authors of new tools reported on internal stability using a test-retest, and at best, split-half reliability for internal consistency was reported. The review included four commercially available tools and this cost may limit their use for routine evaluation of classroom teaching effectiveness. The CCTDI and the CCTST had reported reliability ranging from .31 to .89 and some authors using these tools did not test reliability for their specific context. The CCTDI measures students' self-report CT disposition and does not measure the development of CT skills. Relying on student self-report may be affected by recall bias and a socially desirable response set (Tiwari et al., 2006). The act of critical thinking involves both skills and habit of the mind (Scheffer and Rubenfeld, 2000). The CCTDI only measures the habits of the mind. For a complete assessment of student's critical thinking both skills and disposition need to be measured, and the CCTST should be used in conjunction with the CCTDI (Insight Assessment, 2013).

A lack of congruence between items in the CCTST and the CCTDI could account for inconsistencies in reliability. Although the cognitive skills underlying the framework for the CCTST and the CCTDI were identified as important to the practice of nursing (Stone et al., 2001), the same study found less agreement on whether the items reflected CT skills required of nurses. Inconsistent results across studies have prompted questions related to the reliability of the CCTDI to measure dispositional attitudes (Walsh and Seldomridge, 2006), and the lack of stability of the instrument (Walsh and Hardy, 1997; Kakai, 2003).

Limited reporting of tool reliability makes it difficult to assess their applicability in the nursing and midwifery contexts. Concern could also be justified over the focus of existing tools (especially standardised tools) on the measurement of formal logic and general thinking skills, rather than the application of CT in practice (Seldomridge and Walsh, 2006).

Four new tools that measure the application of CT skills in nursing in practice were reviewed. However, none of these new tools were tested for reliability. When the domains were compared to the recognised definition of CT, construct validity was only established for one tool (Jones, 2008). None of the studies conducted a factor analysis to establish validity. In the development of the new tools, items were drawn from concepts thought to be useful but no testing was conducted to confirm this. Therefore, further research with large samples, factor analysis, and testing of different forms of reliability and validity, are required before implementing these tools into practice.

CT is also considered to be a multidimensional concept, and a single test in a multiple choice format may be inadequate to accurately detect change in development. There is a need to ensure that measures of CT development address the complexity of practice and are adaptive to the nursing and midwifery environments (Rubenfeld and Scheffer, 2006). A mixed method approach and triangulation of findings may provide greater validity, reliability, and insight into CT development.

## **Conclusion**

There was limited reporting of the reliability of tools in the included studies. Overall there was relatively little emphasis placed on validity of newly developed tools. Inconsistent results were found in studies using standardised tools, placing doubt of the reliability of these tools in the nursing context. On examination of the domain concepts construct validity was questionable with several non-standardised tools used.

Nursing and midwifery education needs to prepare graduates to work effectively in complex, fast paced and uncertain environments. Continued collection of data using measures of generalised CT is unlikely to help improve curricula, teaching methods, or preparation of students for professional practice. There is a need to develop discipline specific instruments to measure CT in nursing and midwifery, and more specifically tools that measure the application of CT to practice. Considering the complexity of critical thinking in nursing and midwifery practice, and that CT development occurs over a long time, measurement requires a long term, multi-method approach over this time.

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## **Chapter Conclusions**

This systematic review evaluated tools used to measure critical thinking. As the first study in this body of work was centred on the evaluation of a teaching innovation, it was considered appropriate to also assess the efficacy of teaching strategies used to develop critical thinking skills. Therefore, a systematic review of the literature evaluating the efficacy of teaching methods used to develop critical thinking skills was designated as the next sequential study.

## **CHAPTER 4**

# **Efficacy of Teaching Methods used to Develop Critical Thinking in Nursing and Midwifery Undergraduate Students: A Systematic Review**

### **Chapter Overview**

A post-print copy of the publication forms Chapter 4 of this thesis. The references and formatting for this paper are presented in accordance with the requirements of *Nurse Education Today*, in which this paper was published.

### **Author contributions**

The paper included in this chapter is a co-authored paper. The bibliographic details of this co-authored paper, including all authors, are:

Carter, A. G., Creedy, D. K., & Sidebotham, M. (2016). Efficacy of teaching methods used to develop critical thinking in nursing and midwifery undergraduate students: A systematic review of the literature. *Nurse Education Today*, 40, 209-218. <https://dx.doi.org/10.1016/j.nedt.2016.03.010> (See Appendix I for published format).

Under the supervision of Professor Debra K. Creedy (Co-Principal Supervisor) and Associate Professor Mary Sidebotham (Co-Principal Supervisor) my contribution to the paper involved conceptualisation of the review method, development of search strategies and inclusion criteria, undertaking the literature search, summary and analysis. My contribution also included preparation of the manuscript for publication, including journal submission and manuscript revisions prior to publication.

(Signed)

(Date) 30<sup>th</sup> October 2017

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## **Abstract**

**Background:** The value and importance of incorporating strategies that promote critical thinking in nursing and midwifery undergraduate programmes is well documented. However, relatively little is known about the effectiveness of teaching strategies in promoting CT. Evaluating effectiveness is important to promote 'best practice' in teaching.

**Objective:** To evaluate the efficacy of teaching methods used to develop critical thinking skills in nursing and midwifery undergraduate students.

**Data sources:** The following six databases; CINAHL, Ovid Medline, ERIC, Informit, PsycINFO and Scopus were searched and resulted in the retrieval of 1,315 papers.

**Review methods:** After screening for inclusion, each paper was evaluated using the Critical Appraisal Skills Programme tool. Twenty-eight studies met the inclusion criteria and quality appraisal.

**Results:** Twelve different teaching interventions were tested in 8 countries. Results varied, with little consistency across studies using the same type of intervention or outcome tool. Sixteen tools were used to measure the efficacy of teaching in developing critical thinking. Seventeen studies identified a significant increase in critical thinking, while nine studies found no increases, and two found unexplained decreases in CT when using a similar educational intervention.

**Conclusions:** Whilst this review aimed to identify effective teaching strategies that promote and develop critical thinking, flaws in methodology and outcome measures contributed to inconsistent findings. The continued use of generalised CT tools is unlikely to help identify appropriate teaching methods that will improve CT abilities of midwifery and nursing students and prepare them for practice. The review was limited to empirical studies published in English that used measures of critical thinking with midwifery and nursing students. Discipline specific strategies and tools that measure students' abilities to apply CT in practice are needed.

## **Introduction**

Critical thinking (CT) involves making judicious purposeful judgements as a result of engaging in a process of analysis, interpretation evaluation, inference, explanation, and reflection (Facione, 1990). According to Castledine (2010), critical thinking requires clinicians to carefully define and analyse problems, with a sense of inquisitiveness and questioning of information and decisions. This sense of inquiry is crucial for nurses and midwives working in complex and demanding environments with increased accountability, autonomy and collaboration with other disciplines (Muoni, 2012; Pucer et al., 2014; Castledine, 2010). Therefore, an important aim of nursing and midwifery undergraduate education is to develop students' critical thinking abilities in preparation for practice.

Although there is agreement about the value and importance of incorporating strategies that promote critical thinking in nursing and midwifery undergraduate programmes there is little understanding regarding the best approaches to develop these skills (Tiwari et al., 2006). The inadequacy of the traditional lecture format to promote critical thinking is well documented (Banfield et al., 2012; Popil, 2011). However, relatively little is known about the effectiveness of active learning strategies in promoting critical thinking.

A qualitative systematic review of critical thinking development in nursing explored participant's perspectives, as well as facilitators and barriers (Chan, 2013). Analysis of the 17 studies illustrated that the definition and concept of critical thinking changed from time to time, and identified the need to clarify educators' perspectives towards critical thinking. This review did not include any quantitative studies and tools used to measure the impact of teaching strategies on critical thinking development were not reported. Accordingly, Chan (2013) recommended an evaluation of teaching strategies designed to develop critical thinking skills be undertaken.

Evaluating the effectiveness of teaching strategies and their impact on critical thinking is important to promote 'best practice'. The purpose of the current systematic review was to determine the efficacy of teaching methods used to develop critical thinking in nursing and midwifery undergraduate students.

## **Search Strategies Utilised**

A search of major databases CINAHL, Ovid Medline, ERIC, Informit, PsycINFO and Scopus,

was conducted in October 2015. The search criteria was limited to articles published in English and within peer reviewed journals for the period 2001- 2015. This timeframe was identified to build on from the publication by Scheffer and Rubenfeld (2000) who used a Delphi study to develop a consensus definition of CT in nursing. It was considered that scholarly research in this area would have occurred following this seminal work.

The inclusion criteria were original research studies that utilised an experimental design to assess CT development following a specific educational intervention in undergraduate nursing and/or midwifery. Papers were excluded if critical thinking was not specifically measured more than once, did not test a specific educational strategy, the sample was post-graduate students, full text was not available in English, discussion papers that did not involve original research study, or did not use an experimental design.

Five search terms were entered into the databases with the article title, abstract and body searched. The search terms used were:

1. "critical thinking" AND midwife\*
2. "critical thinking" AND midwife\* AND measure\*
3. "critical thinking" AND midwife\* AND evaluat\*
4. "critical thinking" AND students, nursing AND measure\*
5. "critical thinking" AND students, nursing AND evaluat\*

The search was conducted sequentially using the six databases and search terms. An initial search, filtering for date, language and source of publication, identified 1,315 papers. Following the guidelines suggested by Kable et al. (2012), once duplicates were excluded, each identified citation was reviewed and filtered through three screening levels; (i) title; (ii) title and abstract; and (iii) full-text. Articles that were not relevant or did not meet inclusion criteria were discarded. Twenty-nine papers were included. No papers involving midwifery undergraduate students met the inclusion criteria, therefore the samples of all included studies were undergraduate nursing students.

Each paper was assessed for relevance by reading the abstract (and where necessary the entire paper) using the inclusion and exclusion criteria to assess relevance to this review. Articles that met the inclusion criteria were listed in a summary table (Table 4.1) during the search. After the initial search all articles identified in subsequent searches were checked against articles in the summary table and duplicates excluded. Each article was also

entered into a reference management database (Endnote) including the search term and engine used to locate each article. A quality appraisal process was performed using the Critical Appraisal Skills Programme (CASP) tool (CASP, 2013) and one article of poor quality was excluded, the excluded study was listed in the summary table. Following the quality appraisal process 28 papers were selected for review.

## Results

All 28 included studies involved the measurement of critical thinking skill development or change following completion of a specific educational intervention. The most common educational interventions were problem-based learning (PBL) (7 studies), simulation (6 studies), concept mapping (4 studies), and a combination of PBL and concept mapping (2 studies). The remaining 9 studies examined a diverse range of teaching interventions.

A variety of tools ( $n = 16$ ) were used to measure critical thinking development. Sixteen (57%) of the 28 studies utilised one of three standardised commercially available tools to measure critical thinking. These were the California Critical Thinking Disposition Inventory (CCTDI) (8 studies), the California Critical Thinking Skills Test (CCTST) (3 studies), and Health Sciences Reasoning Test (HSRT) (3 studies). Two studies used both the Californian Critical Thinking Skills Test and California Critical Thinking Disposition Inventory. A previous systematic review of tools used to measure critical thinking found limited reporting of the reliability of these three tools, little emphasis placed on establishing validity of newly developed tools, and inconsistent results across studies using standardised tools (Carter et al., 2015). Although the results of the studies in this current review could be affected by the reliability and validity of the outcome measures, the focus of this systematic review is to establish the efficacy of different teaching methods in critical thinking development.

Most studies were conducted in the USA ( $n = 13$ ). There was an increasing number of studies from countries where traditional lecture style teaching formats have predominated such as Taiwan ( $n = 4$ ), Korea ( $n = 3$ ), China ( $n = 2$ ), Hong Kong ( $n = 2$ ), Iran ( $n = 2$ ), Turkey ( $n = 1$ ), and Slovenia ( $n = 1$ ). The results of the papers reviewed will be outlined below and grouped according to the specific teaching strategy utilised.

Table 4.1: Articles that met inclusion and quality criteria

No	Author, year and country	Teaching intervention	Participants	Measurement tool time between pre-post test interventions	Results	Limitations	Quality appraisal using CASP
<b>Problem Based Learning (PBL)</b>							
1	Choi et al. (2014). Korea	16 week programme of PBL compared to traditional lecture.	1 <sup>st</sup> year nursing students (n = 90) recruited from 2 colleges. Students from college A received PBL and students from college B received lectures.	Critical Thinking Ability Scale (CTAS) for College Students used at baseline and 16 weeks following instruction.	No significant differences in critical thinking scores between PBL and traditional lecture groups.	Students recruited from two different colleges and may have differed in academic ability. Small sample underpowered study.	Include
2	Jun et al. (2013). South Korea	Intervention group experienced the 5E learning cycle model with PBL for five weeks. Control group received lecture and practice.	1 <sup>st</sup> year nursing students (n = 161).	Critical Thinking Disposition Scale for Nursing Students (CTDS). Pre and post tests performed 4 weeks apart.	Statistically significant increase in critical thinking scores for experimental group.	CTDS not available in English, 20 point self report Likert scale measures disposition as a proxy for critical thinking skills. The education intervention was brief, limiting its impact.	Include
3	Tiwari et al. (2006). Hong Kong	Intervention was a 12 month PBL programme. Control group had traditional lectures.	1 <sup>st</sup> year nursing students (n = 79).	Californian Critical Thinking Disposition Inventory (CCTDI), at 4 time points, pretest, end of 1st, 2 <sup>nd</sup> and 3rd years. Qualitative comments were also collected from students.	Significantly greater improvement in critical thinking scores for experimental group on completion of course. Scores still significantly higher after 2 years, although lower than immediately following the programme.	PBL conducted for one year, perhaps greater differences could have been achieved if continued throughout degree. Could be argued that 1 year was enough to bring about change. Measured critical thinking disposition rather than skill.	Include

No	Author, year and country	Teaching intervention	Participants	Measurement tool time between pre-post test interventions	Results	Limitations	Quality appraisal using CASP
4	Jones, (2008). USA	Intervention of traditional teaching for two weeks and then weekly PBL sessions. Control group received traditional teaching involving pre and post conference lectures.	2nd year nursing students (n = 60).	Critical Thinking measured by grading students' written care plans based on 6 levels of Bloom's taxonomy of cognitive learning.	Intervention group demonstrated higher critical thinking scores compared to control group.	Potential bias as principal investigator taught both groups, evaluated their work, and was not blinded to the intervention.	Include
5	Yu et al. (2012). China	Intervention consisted of PBL, control group received lecture based learning. Timeframe of these approaches was not stated.	2 <sup>nd</sup> year nursing students (n = 76).	Chinese Version of Californian Critical Thinking Disposition Inventory (CCTDI) administered before, after the first learning process (timeframe not stated) and after the semester-long course.	Statistical improvement in overall CTDI scores following PBL. However, PBL students' critical thinking disposition scores did not show improvement on analyticity, systematicity, and critical thinking self-confidence subscale scores.	The subscales of Truth seeking, systematicity, and self-confidence scored below the cut-off of 40, this may be explained by cultural approaches to learning which do not encourage critical thinking. Potential contamination of results if students shared learning experiences.	Include
6	Dehkordi and Heydarnejad, (2008). Iran	PBL for a one semester course. Control group received traditional lectures.	2 <sup>nd</sup> year nursing students (n = 40).	Californian Critical Thinking Disposition Inventory (CCTDI) given prior to and following the semester.	Statistical improvement in CTDI scores following PBL.	Students may have had limited previous exposure to any active teaching strategies and therefore responded positively to PBL.	Include



No	Author, year and country	Teaching intervention	Participants	Measurement tool time between pre-post test interventions	Results	Limitations	Quality appraisal using CASP
7	Yuan et al. (2008). China	Intervention received PBL (36 learning hours, 2hrs x 18 weeks) Control received lectures.	2 <sup>nd</sup> year nursing students (n = 46).	California Critical Thinking Skills Test (CCTST) Chinese-Taiwan Version used at baseline and end of semester.	PBL students had significantly greater improvements on overall CCTST.	Small sample. Involved a single PBL course embedded in a traditional non-PBL curriculum, which might hinder the development of students' critical thinking over time. Potential contamination of results if students shared learning experiences.	Include
<b>Concept Mapping</b>							
8	Atay and Karabacak (2012). Turkey	Intervention was 3 x 3-4 hour education sessions on preparing concept map care plans. Control group prepared care plans using the column format.	80 freshman and sophomore nursing students.	Used Californian Critical Thinking Disposition Inventory (CCTDI). Timeframe between pre-post test not stated.	Statistically significant increase in CT scores for experimental group.	Timeframe between pre-post test not stated. Intervention group received an extra 9-12 hours of education compared to control group.	Include
9	Wheeler and Collins (2003). United States	Intervention involved concept mapping of patient information. Control group taught to use traditional nursing care plans.	A convenience sample (n = 76) was randomly assigned to experimental (n = 44) and control (n = 32) groups.	California Critical Thinking Skills Test (CCTST) given between pre-post tests (7.5 week timeframe).	Significant difference between pre-post test scores for both groups. No difference found between experimental and control groups.	Students exposed to concept mapping for 7.5 weeks which may be insufficient. Only 1/3 of students in one course prepared concept maps. Possible contamination of the 2/3 who did not complete a concept map.	Include

No	Author, year and country	Teaching intervention	Participants	Measurement tool time between pre-post test interventions	Results	Limitations	Quality appraisal using CASP
10	Lee et al. (2013). Taiwan	Intervention concept map teaching over 15 weeks. Control received traditional lectures.	95 students.	Used Critical Thinking Scale (CTS) at 4 points (beginning of 1 <sup>st</sup> semester, before the intervention, after the intervention and before graduation).	Both control and experimental groups had higher initial critical thinking scores that tended to decrease over time.	The intervention was only one semester, then teaching reverted to lecture format. Yet Critical thinking scores were measured for duration of programme.	Include
11	Abel. and Freeze, (2006). USA	Intervention involved student developing 4 concept maps over 4 semesters. No control group.	28 associate degree nursing students.	Used concept map scoring for each of the 4 concept maps completed.	There was a significant increase in mean scores of the first concept map to the average mean score of the last two maps ( $p = 0.05$ ).	Tool measured competence in using a concept map rather than critical thinking. No relationship between measurement tool and critical thinking.	Include
<b>Concept Mapping and PBL</b>							
12	Tseng et al. (2011). Taiwan	Intervention was 3 hrs of PBL for 14 weeks and 42 hours of scenario and discussion of concept mapping. Control group received traditional lecture based teaching.	120 RN students.	10-item Critical-Thinking Scale (CTS) used before the course began (pre test), at the end of the course (post test), and six months after the course (follow-up).	CTS scores were significantly higher in the experimental group at post test and follow-up.	Promising results regarding retention of higher critical thinking scores following graduation. Potential contamination from students talking to each other about PBL.	Include

No	Author, year and country	Teaching intervention	Participants	Measurement tool time between pre-post test interventions	Results	Limitations	Quality appraisal using CASP
13	Orique and McCarthy (2015). USA	Intervention 2 sessions of PBL instruction and 1 session of concept mapping in relation to the development of nursing care plans.	1 <sup>st</sup> year nursing students (n = 49).	Holistic Critical Thinking Rubric (HCTR) measured critical thinking in nursing care plans. Students submitted 4 nursing care plans, prior to PBL or concept map teaching, following PBL, following concept mapping and then finally following both teaching methodologies.	There was a significant increase in critical thinking scores across the four nursing care plans submitted.	Results may reflect students' increasing expertise in care planning rather than critical thinking per se. No reporting of inter-rater reliability of the tool. No description of assessment process, and who completed ratings.	Include
<b>Simulation</b>							
14	Sullivan-Mann et al. (2009). United States	Controls received two simulation scenarios. Students in the intervention received five scenarios.	Associate degree nursing students (n = 53).	Health Sciences Reasoning Tool (HSRT). 6 week period between pre-post testing.	Statistically significant increase in critical thinking scores for experimental group.	Small sample size, different facilitators for the groups with varied levels of experience. Unclear if controls received any instruction in lieu of the remaining 3 sessions.	Include
15	Ravert, (2008). United States	Two experimental groups (1) 5 sessions in non Human Patient Simulation (HPS) + 5 discussion group sessions + education sessions. (2) HPS group –5 patient simulation + education sessions. Control group attended education sessions only.	1 <sup>st</sup> nursing students (n = 30).	Californian Critical Thinking Skills Test (CCTST) and Californian Critical Thinking Disposition Inventory (CCTDI). One semester between pre and post test.	No differences in critical thinking scores between groups.	Small sample size may limit statistical differences. The critical thinking instruments do not measure concepts related to discipline-specific content. Disparity between intervention vs control dose. Potential contamination from students talking to each other about HPS and what was learnt.	Include

No	Author, year and country	Teaching intervention	Participants	Measurement tool time between pre-post test interventions	Results	Limitations	Quality appraisal using CASP
16	Shinnick. and Woo, (2013). United States	Intervention consisted of a single Human Patient Simulation session. No control group used.	3 <sup>rd</sup> and 4 <sup>th</sup> year nursing students (n = 154) from three Schools of Nursing.	Used Health Sciences Reasoning Tool (HSRT) at baseline and two weeks after a single Human Patient Simulation.	Following HPS there were no statistically significant gains in critical thinking. There was a decrease in scores (not statistically significant).	Very short intervention and assessment timeframe and hence limited ability to impact critical thinking.	Include
17	Wood and Toronto (2012). USA	Intervention group practised critical assessment skills for 2 hours using HPS plus traditional practice (out of class practice with peers). Control group used traditional practice only.	2 <sup>nd</sup> year nursing students (n = 85).	Californian Critical Thinking Disposition Inventory administered 2 weeks prior to and following intervention.	Higher mean post test total scores compared with pre test total scores in experimental group students.	The intervention group received an extra two hours of education than the control group. Measured critical thinking disposition rather than skill.	Include
18	Goodstone et al. (2013). USA	Intervention high fidelity patient simulation (HFPS) vs Control consisted of paper-and-pencil case study group work.	1 <sup>st</sup> semester associate degree nursing students (n = 42).	Health Sciences Reasoning Tool (HSRT) used at week 2 and week 14.	There was a significant increase in the HSRT scores for the case study group (p = 0.003) but not for the HFPS group.	Small sample size. Students in case study group still received 1 session of HFPS which was originally in the curriculum potentially affecting differences between groups	Include

No	Author, year and country	Teaching intervention	Participants	Measurement tool time between pre-post test interventions	Results	Limitations	Quality appraisal using CASP
19	Shin et al. (2015). Korea	Students from University A completed one simulation, Students from University B completed two simulations and C three.	3 <sup>rd</sup> and 4 <sup>th</sup> year nursing students (n = 237) across 3 universities.	Yoon's Critical Thinking Disposition (CTD) tool completed prior to intervention and on completion of paediatric practicum (timeframe not stated).	Students with one or two exposures to simulation did not demonstrate a significant increase in critical thinking scores. Students exposed to three simulations showed a significant increase in critical thinking scores.	Differences of teaching methodology between the 3 universities, with one using an integrated curriculum and others using a traditional curriculum. All students had experienced simulation prior to intervention at different degrees. CTD tool was specifically designed for use in Korea and measured disposition only.	Include
<b>Narrative Pedagogy</b>							
20	Evans and Bendel, (2004). United States	Intervention Narrative Pedagogy for one semester. Control consisted of traditional teaching methods (not stated what these were).	Undergraduate nursing students (n = 114).	Used Californian Critical Thinking Disposition Inventory (CCTDI) pre and post test over one semester.	Statistically significant improvement in CCTDI scores for both groups, but no significant differences between control and experimental groups.	Statistically significant improvement for both groups may indicate that involvement in academia increased critical thinking rather than the teaching strategy.	Include

No	Author, year and country	Teaching intervention	Participants	Measurement tool between pre-post interventions	time test	Results	Limitations	Quality appraisal using CASP
<b>Critical reading and writing course</b>								
21	Chen, and Lin, (2003). Taiwan	Intervention was a 32 hour course in which students learnt literature searching, critiquing and academic writing. It was unclear what education the control group received.	1st year nursing students (n = 168).	Used N3 case report accreditation form. Collected data using student's critique of a case study. Data collected at baseline and following completion of the course.		Experimental group reported significantly higher scores than control group.	Unclear whether tool measured students' ability to critique an article rather than critical thinking. 67% of students had previously written a literature review and 79% had written a case study which may have introduced bias. Improvements may be accounted for by repeated exposure to the critique process rather than thinking critically.	Include
<b>Videotaped Vignettes</b>								
22	Chau, et al. (2001). Hong Kong	Intervention was 4 vignettes. No control group was used.	1st and 2 <sup>nd</sup> year nursing students (n = 83).	Pre-post test design using the Californian Critical Thinking Skills Test (CCTST) at baseline and 13 weeks following intervention.		No statistical difference in pre and post test scores.	Students exposed to 4 vignettes over 13 week semester. Low dose may account for the minimal effect on critical thinking skills. No control group for comparison.	Include
<b>Information Communication Technology (ICT) Based Approach</b>								
23	Pucer et al. (2014). Slovenia	Intervention was an ICT programme of scenarios that mirror clinical situations. No control group.	1 <sup>st</sup> year nursing students (n = 40).	Used analysis tool of pre and post discussion board postings.		Qualitative analysis of the discussion board posts showed a significant improvement in number of posts (12.2%) for which opinions and conclusions of participants were justified with valid arguments.	Unclear whether tool measured critical thinking or competence in discussion board postings.	Include

No	Author, year and country	Teaching intervention	Participants	Measurement tool time between pre-post test interventions	Results	Limitations	Quality appraisal using CASP
<b>Web-Based Animated Pedagogical Agents</b>							
24	Morey, (2012). United States	Intervention online animated pedagogical agent. Control group received traditional face to face teaching.	Final semester nursing students (n = 45).	Used the Critical Thinking Process Test (CTPT) a nursing specific quantitative measure and a think-aloud protocol as the qualitative measure. Both measures completed at baseline and 16 weeks later.	No differences in CT levels on either tool.	Limited information regarding the think aloud protocol. Elements seemed to relate to nursing process ie collect, review, relate, interpret, infer, diagnosis, act, and evaluate, rather than critical thinking.	Include
<b>Reflective Writing</b>							
25	Naber and Wyatt, (2014). United States	Intervention group completed six reflective writing assignments. Unclear what education the control group received.	4 <sup>th</sup> semester nursing students (n = 70).	Californian Critical Thinking Skills Test and Californian Critical Thinking Disposition Inventory completed at baseline and 8 weeks later.	Total CCTST and CCTDI scores of intervention group did not increase significantly following the intervention. No reporting of reliability of CCTST or CCTDI scale for this study.	Only eight weeks between pre and post tests. Perhaps critical thinking takes longer than 8 weeks to develop. Potential contamination if students discussed their learning.	Include
<b>Grand Rounds</b>							
26	Mann, (2012). USA	Students resolved a healthcare dilemma as a group following a simulation technique. The education strategy appears to be grand rounds but not specified. Control condition not specified.	2 <sup>nd</sup> year nursing students (n = 21).	Assessment Technologies Institute (ATI) Critical Thinking Assessment (CTA) at commencement of programme and at completion of course.	No significant difference between CT scores for the two groups. Students in control group reported decreased critical thinking ability.	The educational intervention was not clearly described. Very small sample size. As critical thinking initially measured at beginning of programme rather than immediately prior to the intervention other variables/factors could have affected critical thinking skills.	Include

No	Author, year and country	Teaching intervention	Participants	Measurement tool time between pre-post test interventions	Results	Limitations	Quality appraisal using CASP
<b>Interactive Videodisc System (IVS)</b>							
27	Yeh and Chen (2005). Taiwan	Educational intervention - 2 hour lecture on critical thinking and an optional IVS programme.	RN-BN students (n = 126) enrolled in a medical-surgical course.	Californian Critical Thinking Disposition Inventory (CCTDI) at baseline and 6 weeks later following the course.	Statistically significant differences between pre and post test overall scores.	Only measured critical thinking disposition rather than CT skills. IVS participation ranged from 15 to 150 minutes. Did not correlate changes in CCTDI with time spent on IVS.	Include
<b>Evidence-Based Nursing Education Course</b>							
28	Zadeh et al. (2014). Iran	Intervention research methodology and evidence based nursing course. Control condition not described.	3rd year nursing students (n = 48).	Used Californian Critical Thinking Disposition Inventory (CCTDI) prior to intervention and one month later.	CCTDI scores were significantly higher in intervention group.	Low pre and post test scores (means of 26 and 36). Relevance to other countries may be limited.	Include
<b>Peer Active Learning Strategies Approach (PALS)</b>							
29	Stevens et al. (2009). USA	Peer active learning strategies approach (PALS). No control group.	Undergraduate nursing students (n = 15).	Critical Thinking Likert Scale (CTLS) completed prior to and following clinical experience (no timeframe given).	Increase in scores on CTLS but no statistical analysis performed. No reporting of reliability of CTLS for this study or previously.	No information provided on recruitment of sample. No validity or reliability testing of tool. Very small sample size.	Exclude. No statistical analysis. Descriptive design. Tool validity and reliability unknown.



## Teaching strategies

### Problem based learning

Seven studies measured the effects of problem based learning (PBL) on the development of critical thinking (Choi et al., 2014; Tiwar, et al., 2006; Jones, 2008; Jun et al., 2013; Yu, et al., 2012; Yuan et al., 2008; Dehkordi and Heydarnejad, 2008). Two studies measured the effect of both PBL and concept mapping on critical thinking (Tseng et al., 2011; Orique and McCarthy, 2015). All but one study (Choi et al., 2014) found PBL to have a positive effect with an increase in critical thinking scores. Three studies that tested a PBL intervention used the CCTDI to measure critical thinking change. In a 2-year longitudinal study students in the intervention group experienced PBL for an academic year (Tiwari et al., 2006). Students receiving the intervention had significantly higher overall CCTDI scores which they attributed to PBL. Similar results were obtained by Yu et al. (2012) and Dehkordi and Heydarnejad (2008) who also used the CCTDI to measure the effects of PBL on critical thinking. However, Yu et al. (2012) found no differences in the subscale scores related to analyticity, systematicity, and self-confidence. The conflicting results between these studies using the same intervention and tool may indicate a lack of sensitivity by the CCTDI to measure critical thinking change in nursing practice. The CCTDI relies on self-report which may be affected by social response bias (Tiwari et al., 2006). Furthermore, the CCTDI measures students' critical thinking disposition, or the self-perceived likelihood of them thinking critically, whereas critical thinking is considered to have two dimensions; disposition and skills (Facione, 1990). The increase in critical thinking disposition may not translate into the application of critical thinking skills in nursing practice.

Seven of the nine studies involving PBL were conducted in Asian and Middle Eastern countries (Korea, Hong Kong, Taiwan, China and Iran), where cultural influences may adversely affect critical thinking development of students. According to the recommended minimum cut-off scores on the CCTDI, scores between 30 and 40 indicates "weakness to ambivalence" towards that critical thinking domain (Facione and Facione, 1992). In two of the three PBL studies using the CCTDI (Tiwari et al., 2006; Yu et al., 2012), domain scores did not reach the cut-off score of 40 in either pre or post tests, indicating a weak critical thinking disposition. This may be indicative of cultural influences in those Asian countries. Predominant characteristics of learning environments in Asia such as adherence to didactic models of teaching, dominance of the medical model, and not questioning those in authority,

do not foster independent thinking (Lim et al., 2009; Chan et al., 2011). Thus, the applicability of results from these studies to other cultures where students are encouraged to question and think independently may be limited. Nevertheless, these studies do provide a baseline from which future studies in those countries may demonstrate general improvement.

The impact of culture on different learning environments may also influence teaching approaches. In four of the nine studies related to PBL students had previously only been exposed to didactic teaching methods (Dehkordi and Heydarnejad, 2008; Jun et al., 2013; Tiwari et al., 2006; Yuan et al., 2008). Didactic teaching promotes rote learning and offers little opportunity for students to question and consider the application of nursing knowledge to practice. Although results from four studies were favourable, PBL was the only active learning approach students had experienced. The increase in critical thinking scores may simply reflect encouragement by teachers for students to think actively.

Critical thinking skills were found to improve in the intervention group following PBL, measured through grading of developed nursing care plans (Jones, 2008). However, it was not clear whether the tool used to grade the care plans was validated by experts or if the items measured dimensions of critical thinking. Methodological rigour is questionable as the principal investigator taught both groups, and graded the care plans, introducing potential bias.

The use of both PBL and concept mapping on critical thinking was examined in two studies (Tseng et al., 2011; Orique and McCarthy, 2015). Students receiving PBL and concept mapping reported significantly higher Critical Thinking Scale (CTS) scores upon completion of course and 6 months later (Tseng et al., 2011). There was limited information regarding the CTS tool and how it measured critical thinking. However, promising follow-up results suggested that PBL was an effective long term strategy to increase critical thinking in this cohort. As this study was conducted in Taiwan, baseline levels of critical thinking may have been low, small changes may have been significant, and culture may have contributed to positive results.

Orique and McCarthy (2015) measured the effects of PBL and concept mapping separately on critical thinking using the Holistic Critical Thinking Rubric (HCTR). Students submitted nursing care plans prior to and following, PBL instruction and concept mapping sessions. The significant increase in critical thinking scores across time for these first year students

could have related to students' developing care planning expertise rather than improved cognitive skills. The assessment process was not well described; there was no detail on whether assessment was undertaken by a lecturer who was blind to the intervention; and if teachers' ratings of students' work were moderated.

The effect of PBL on critical thinking development appears favourable, with seven of the nine studies reporting positive outcomes. However, due to the use of different measurement tools (some of which had not been validated), different cultural influences on critical thinking development and learning approaches, and lack of methodological rigour, these results need to be viewed with caution. None of the included studies provided sufficient descriptions of PBL processes to ensure fidelity and enable replication by other researchers. There was no information on the preparation of staff to teach PBL methods and no quality review of classroom processes reported such as the extent to which students were encouraged to question, the extent to which teachers facilitated rather than lead learning; ability of students to work together to generate new knowledge, quality of the case studies and quality of supplementary resource materials for each case.

### **Concept mapping**

Four studies measured the effect of concept mapping on critical thinking. Three studies (Atay and Karabacak, 2012; Lee et al., 2013; Abel and Freeze, 2006) found an increase in CT scores following concept mapping education and activities. The effects of preparing care plans using concept maps on critical thinking was measured using the CCTDI (Atay and Karabacak, 2012). Students receiving the intervention had statistically significant higher critical thinking scores and mean scores on concept map care plan evaluation criteria. However, there were inconsistencies in the length of the educational intervention, with the intervention group receiving an extra nine to twelve hours of education specifically on concept mapping. The increase in critical thinking scores could have been a result of extra educational hours rather than as a direct result of the concept mapping education.

A two year longitudinal study tested the effects of concept map education on critical thinking skills using the Critical Thinking Scale (CTS) at four time-points. The CTS measures critical thinking through assessment of inference, recognition of assumptions, deduction, interpretation, and evaluation of argument concepts (Lee et al., 2013). The 15 week course on concept mapping produced an initial improvement in critical thinking scores but this decreased over time for all students. The results may indicate that the intervention was not

integrated or impactful as students experienced didactic teaching methods for the remainder of the programme.

Another longitudinal study evaluated the effects of concept mapping with 28 associate degree nursing students (Abel and Freeze, 2006). A validated concept map scoring criteria was used to measure critical thinking development at four time-points over a one year period (Abel and Freeze, 2006). The authors demonstrated increases in students' concept map scores as they progressed through the curriculum. However, it was unclear how the scoring criteria related to critical thinking and whether increased scores were a true reflection of improved critical thinking or simply improved competence in concept mapping.

Wheeler and Collins (2003) did not demonstrate the same effect in their 7.5 week study. Pre and post test scores on the California Critical Thinking Skills Test (CCTST) of students taught concept mapping compared to a control group who received instruction on preparing traditional nursing care plans did not differ. Increased critical thinking scores were discerned in both groups, with no difference between groups. This suggests that both teaching approaches were effective in increasing critical thinking development.

## **Simulation**

Six studies examining the effects of simulation on development of critical thinking had variable findings. Two studies reported increased critical thinking scores following the intervention (Sullivan-Mann et al., 2009; Wood and Toronto 2012). Shin et al., (2015) found the increase in critical thinking was dose dependent, with increases in scores occurring with three simulations but not with two or one. Another study demonstrated no increase in critical thinking scores, and some decreases (Shinnick and Woo 2013), while another study found higher scores in the control group (Goodstone et al., 2013). The final study which used two outcome measures reported contradictory findings between tools (Ravert, 2008).

The effect of multiple simulations on critical thinking over a period of six weeks was measured using the HSRT (Sullivan-Mann et al., 2009). Groups were exposed to two (control) and five (intervention) clinical simulations. Although both groups had increased scores on the post test, the intervention group had statistically higher scores. The authors suggested results may have been affected by the experience of the clinical facilitator (Sullivan-Mann et al., 2009).

Another study tested a brief intervention involving a single human patient simulation with a

two week lapse between pre and post test using the HSRT (Shinnick and Woo, 2013). There was a decrease in critical thinking scores, perhaps related to response burden. The HSRT takes 40-50 minutes and asking students to complete this tool twice in two weeks may have been time intensive particularly in response to a low-dose intervention. In contrast, a brief two hour human patient simulation intervention with the same two week timeframe between testing resulted in higher mean post test scores for the experimental group using the CCTDI (Wood and Toronto, 2012). The CCTDI takes around 20-30 minutes to complete. As the HSRT measures the application of critical thinking and the CCTDI measures student's disposition for critical thinking, differences in results in these two studies could suggest that a short intervention may influence a change in students' tendency to think critically but does not change their ability to apply critical thinking skills.

To test the effect of simulations on critical thinking Shin et al. (2015) used a multisite approach where one site offered one simulation, another offered two simulations and the third site conducted three simulations. Improved critical thinking scores were only noted for the students who participated in three simulations. It was not clear whether students who participated in fewer sessions still received teaching for the same length of time. Results could also have been affected by different teaching approaches at the three universities with one using an integrated curriculum and the other two using a traditional one. A potential limitation of the study was that the Critical Thinking Disposition (CTD) tool measures students' disposition whereas simulation requires the practical application of critical thinking skills. The CTD was specifically designed for use in Korea and items may not be applicable to education in other countries.

Ravert (2008) used the CCTST and CCTDI to measure critical thinking development in undergraduate nursing students allocated into simulation (5 hours), non-simulation (5 hours) and control groups. The control group demonstrated higher scores on the CCTDI compared to non- simulation and simulation groups whereas the two intervention groups scored higher on the CCTST. Differences in scores did not reach statistical significance as the small sample (n = 30) size may have been under-powered to detect group differences.

Contradictory results were also found in a study comparing the effect of high fidelity patient simulation to case study teaching (Goodstone et al., 2013). The post test HSRT administered 14 weeks later revealed significantly higher scores for the case study group compared to the high fidelity patient simulation group. Results may have been affected by

the small sample size ( $n = 42$ ), and possible contamination as the case study group experienced one simulation session as well.

Contradictory findings were demonstrated by the five studies measuring the effect of simulation on critical thinking. Three studies utilised the HSRT and found inconsistent results. The effect of simulation on critical thinking is uncertain and may have been affected by the relatively short intervention dose and short timeframe between pre and post testing. Critical thinking is considered by some to be an 'ingrained' trait (Ravert, 2008) and take significant time to change or develop (Choi, 2014). Thus a short intervention may not be adequate to impact on critical thinking abilities.

### **Narrative pedagogy**

The effect of narrative pedagogy on critical thinking development was examined over one semester using the CCTDI (Evans and Bendel, 2004). Critical thinking scores were expected to increase based on results of a five year project on narrative pedagogy which demonstrated improved integration of theory with practice, and empowerment as clinicians (Severtsen and Evans 2000). However, although critical thinking scores improved for both groups, no statistical differences between the control and experimental groups were noted. It could be that critical thinking disposition increases in an excellent academic environment regardless of the teaching strategy.

### **Critical reading and writing course**

The N3 case report accreditation form developed by the Taiwan Nurses Association was used to assess students' critical thinking abilities in the critique of case study reports (Chen and Lin, 2003). Students in the intervention group received education on the process of literature searching, critical reading and writing. Students in the experimental group had significantly higher case study scores than the control group. Improved scores by the experimental group may be accounted for by their repeated exposure to the critique process and may reflect their improved ability to critique an article rather than think critically.

### **Videotaped vignettes**

The effect of videotaped vignettes on critical thinking skills for 1<sup>st</sup> and 2<sup>nd</sup> year students was measured using the CCTST (Chau et al., 2001). There was no control group and no statistical difference was found between pre and post test scores. Although the course was conducted over 13 weeks, students were only exposed to 4 vignettes in this period.

Intervention dose may have been insufficient to develop students' capacity to address problems that were new to them (Chau, et al., 2001).

### **ICT based modern approach**

Pucer et al. (2014) used a newly developed discussion board analysis tool to identified core key elements of critical thinking as defined by Facione (1990). A significant improvement in the percentage of posts where students' opinions and conclusions were justified with valid arguments was reported (Pucer et al., 2014). However, there was limited information on development of the tool, process of expert review and validation, or inter-rater reliability. It was unclear whether the tool measured student's critical thinking abilities or their competence in discussion board postings.

### **Web-based animated pedagogical agents**

Both a newly developed qualitative tool using a think aloud protocol, and a standardised tool named the Critical Thinking Process Test (CTPT) were used to measure the effects of an animated pedagogical agent on critical thinking (Morey, 2012). Results differed according to the tool used. Although both groups improved there were no significant differences on CTPT scores and correct conclusions using the think-aloud protocol. The pedagogical agent group had significantly better results on the cognitive process of evaluation. These mixed results may indicate the difficulty in measuring critical thinking development in an exam context.

### **Reflective writing intervention**

An eight week reflective writing intervention was used with 70 fourth semester students randomised into control and intervention groups (Naber and Wyatt, 2014). No statistically significant increases in critical thinking scores using the CCTDI and CCTST were demonstrated in the intervention group and there were no differences between groups.

### **Grand rounds**

The effectiveness of a 'grand round' education strategy on critical thinking was assessed using the CTA (Mann, 2012). No statistical differences between intervention and control groups were found however the intervention group improved more. The intervention group received more hours of education and instruction from the researcher which could have affected results. Also the pre test was conducted at the beginning of the programme rather than immediately prior to the intervention so results may have been confounded by variables not considered in this study.

### **Interactive videodisc systems (IVS)**

A brief intervention consisting of a two hour lecture and an optional interactive videodisc system (IVS) produced increased scores on the CCTDI with 6 weeks between pre and post test (Yeh and Chen, 2005). However, student participation in the interactive videodisc system ranged from five to 150 minutes. It would have been useful to correlate changed CCTDI scores with duration of participation with the interactive videodisc system. The increased scores may have also been affected by cultural influences as four of the seven pre test domain scores and one post test domain did not reach the minimum cut-off score of 40, indicating weak baseline critical thinking disposition in students.

### **Evidence based course**

A study in Iran examined the effects of an evidenced based nursing course reported improved CCTDI scores (Zadeh et al., 2014). However, the low mean pre and post test scores on the CCTDI (means of 26 and 36 retrospectively), indicated improved, but still weak critical thinking disposition in students. This may relate to Iranian culture where nursing education methods concentrate on memorisation of facts. Prior to this course students had only been exposed to didactic teaching methods (Zadeh et al., 2014). The relevance of these findings is limited in other countries where evidence based education is embedded within curricula.

### **Discussion**

This review included 28 studies from 8 different countries testing 12 different teaching interventions to promote the development of critical thinking. None of the included studies involved midwifery students and highlights a significant gap in midwifery education literature. The findings of the review also need to be considered in light of limitations associated with methodological rigour, cultural influences, appropriateness of the measurement tool, duration of intervention, timing of pre and post testing, and intervention versus control dose.

Results of included studies varied, with little consistency across studies using the same type of intervention or outcome tool. Seventeen studies identified a significant increase in CT of nursing students following an educational intervention, while nine reported no increases and some found unexplained decreases in critical thinking. In four studies, the education intervention was longer than the control condition (Ravert, 2008; Atay and Karabacak, 2012; Wood and Toronto, 2012; Mann, 2012). These discrepancies in 'dose' across conditions



may have biased results.

Critical thinking in these nursing studies was often measured following a single brief intervention (Shinnick and Woo, 2013; Wood and Toronto, 2013; Sullivan-Mann et al., 2009; Ravert, 2008; Yeh and Chen, 2005) with limited success. Given that critical thinking is considered to develop over time (Paul, 1993; Choi et al., 2014), the length of an intervention is an important educational and research consideration. Other methodological weaknesses related to the timing of pre and post test measurement which ranged from 2 weeks to 4 years. A short testing interval may not only result in survey fatigue but only reflect short-term improvement of critical thinking due to new learning. Sustained longer term effects were rarely assessed. Interventions are more likely to successfully develop critical thinking if offered over an extended period of time, there is a progressive scaffolding of skills; educators are competent to offer the intervention, and interventions are integrated throughout the curriculum.

Promising results were found on the effects of PBL and concept mapping on critical thinking development. This is not surprising given the constructivist principles underpinning these teaching methodologies. PBL and concept mapping challenge students to actively participate in building knowledge from what is known towards a new understanding (Piaget, 1977; Vygotsky, 1986). Although the construction of new knowledge commonly involves engagement in research activities, and the use of intelligence and reasoning, the co-operative and interactive nature of problem based learning fosters students' critical thinking in relation to clinical problems.

Variable results were found on critical thinking development when using simulation. Inconsistencies in the intervention dose and small samples sizes could account from some of this variation. However, using simulation as a teaching strategy to improve critical thinking requires further investigation. According to Mong-Chue (2000) critical thinking involves controlled, purposeful and conscious thought processes. Although simulation activities can be useful in developing clinical skills it is uncertain whether they develop critical thinking skills which involves the interpretation of multiple data sources (Mitchell et al., 2009). Within clinical simulation students are often required to make rapid decisions, critical thinking requires a deeper learning methodology using analytical skills and analytical skills and acumens beyond this (Carter et al., 2014).

Positive and promising results were found with a small number of studies using other interventions including; the use of discussion boards, critical reading and writing courses and narrative pedagogy, which require further investigation. Positive findings related to these interventions could be due to the use of active constructivist-based learning strategies.

The increases in critical thinking performance can be understood more readily by exploring cognitive development theories by researchers such as Piaget (1977) and Vygotsky (1986). When students engage in a clinical problem which cannot be easily resolved cognitive dissonance occurs. Active learning strategies such as PBL, concept mapping and simulation framed around clinical scenarios, enable students to further construct their knowledge in relation to the concepts in question. Constructivist learning is enhanced by using experiential learning methods (such as simulation) and peer interaction (during PBL) which promotes cognitive development because of discussion around critical cognitive conflicts. Given that constructivists see learners as constructing their own knowledge, more attention also needs to be paid to learning from experience (Boud and Edwards, 1999).

Some results of this review may have been influenced by possible cultural influences. Seven studies using PBL and one testing concept mapping were conducted in Asian and Middle Eastern countries where didactic methods are the norm. Passive learning through lectures is well known to limit critical thinking development as it focusses on the memorisation of content (Diekelmann and Smythe, 2004; Ironside, 2004). It could be that any type of active teaching strategy will increase critical thinking disposition and skill scores in these circumstances. The evaluation of similar strategies in countries where a diverse range of teaching methods are used may not achieve the same level of change in critical thinking development.

Educational and practice contexts in countries such as the United Kingdom, United States and Australia reflect a wide variety of active teaching and assessment strategies. Increasingly, midwifery and nursing programmes in Australia involve blended and online learning. Rather than using one specific teaching or learning strategy, a scaffolded approach of active learning and authentic assessment, including clinical assessment is used (Carter et al., 2014). Assessing the development of critical thinking in these programmes would require longitudinal, multi-method measurement. Many studies in the review used brief teaching and learning interventions which had limited impact on nursing students' critical thinking. Raymond-Seniuk and Profetto-McGrath (2011) suggest pluralism or multiple

lenses are also needed to capture the depth and breadth of the knowledge and essence of midwifery and nursing practice. The use of multiple outcome measures and triangulation of data may provide greater insight into the effectiveness of teaching methods on critical thinking. Such approaches may also contribute to the development of critical thinking methodologies specifically in nursing and midwifery. Understanding and testing the theories underpinning different teaching interventions is needed in order to continue advance our knowledge in this field.

The review itself was limited to empirical studies published in English that used measures of critical thinking with midwifery and nursing students. It could be that these criteria unnecessarily restricted the scope of the review. Future reviews could consider an evaluation of teaching interventions to promote critical thinking across health professional groups. Given the high proportion of researchers using the California Critical Thinking Disposition Inventory (CCTDI) (8 studies), the California Critical Thinking Skills Test (CCTST) (3 studies), future reviews could also consider a meta-analysis of results from these tools across a broad range of health professional students. However, it could also be argued that the continued use of generalised critical thinking tools is unlikely to help identify appropriate teaching methods to improve critical thinking abilities of nursing and midwifery students. Discipline specific strategies and tools that measure the student's ability to apply critical thinking in practice are needed.

## **Conclusion**

Common educational interventions used to promote critical thinking development were PBL, simulation, and concept mapping. There were methodological concerns about most studies such as small sample size and a lack of quality assurance on the delivery of an intervention. The short duration of interventions did not allow sufficient time for students to develop critical thinking skills. Variability in the timing between pre and post tests was evident, with the majority of studies repeating the outcome measures soon after the completion of the intervention. Longer term effects of interventions on critical thinking were rarely reported. There were also inconsistencies in intervention and control doses and in some studies, the control group experienced smaller doses, introducing potential bias. In some studies, these factors were confounded by cultural influences on critical thinking development.

Academics need to continue to strive to maximise student's critical thinking abilities,

preparing them to be competent, effective and autonomous nursing and midwifery graduates. Whilst this review aimed to identify effective teaching strategies that promote and develop critical thinking, flaws in methodology and outcome measures contributed to inconsistent findings.

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## **Chapter Conclusions**

No measures specifically designed for use in midwifery were found in this systematic review of teaching interventions to enhance the development of students' critical thinking. Recommendations from both reviews suggested the development of discipline specific instruments to measure critical thinking in undergraduate midwifery students, and more specifically, tools that measure the application of critical thinking to practice. The next designated sequential study was to develop a tool to meet this purpose. Due to the significant role of the preceptor/mentor in assessing and observing students' midwifery clinical practice, the inclusion of a preceptor rating tool to measure this cognitive skill was seen as a priority.

## **CHAPTER 5**

### **Development and Psychometric Testing of the Carter Assessment of Critical Thinking in Midwifery (Preceptor/Mentor Version)**

#### **Chapter Overview**

A post-print copy of the publication forms Chapter 5 of this thesis. The references and formatting for this paper are presented in accordance with the requirements of *Midwifery*, in which this paper was published. Ethics approval was obtained for this study from Griffith University Human Ethics Committee - NRS/39/14/HREC (see Appendix A). The survey tool utilised in this study is included as Appendix J, the participant information sheet is included as Appendix K.

#### **Author contributions**

The paper contained within this chapter is a co-authored paper. The bibliographic details of this co-authored paper, including all authors, are:

Carter, A. G., Creedy, D. K., & Sidebotham, M. (2016). Development and psychometric testing of the Carter Assessment of Critical Thinking in Midwifery (Preceptor/Mentor version). *Midwifery*, 34, 141-149. <https://dx.doi.org/10.1016/j.midw.2015.12.002> (See Appendix L for published format).

Under the supervision of Professor Debra K. Creedy (Co-Principal Supervisor) and Associate Professor Mary Sidebotham (Co-Principal Supervisor) my contribution to the paper involved tool development including; review of the literature, development of draft items, mapping of draft items, and facilitating expert review. My contribution also included recruitment of the sample, data analysis, and preparation of the manuscript for publication including journal submission and manuscript revisions prior to publication.

(Signed)  
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## **Abstract**

**Objective:** Develop and test a tool designed for use by preceptors/mentors to assess undergraduate midwifery students' critical thinking in practice.

**Design:** A descriptive cohort design was used.

**Setting:** Participants worked in a range of maternity settings in Queensland, Australia.

**Participants:** 106 midwifery clinicians who had acted in the role of preceptor for undergraduate midwifery students.

**Methods:** This study followed a staged model for tool development recommended by DeVellis (2012). This included generation of items, content validity testing through mapping of draft items to critical thinking concepts and expert review, administration of items to a convenience sample of preceptors, and psychometric testing. A 24 item tool titled the Carter Assessment of Critical Thinking in Midwifery (CACTiM) was completed by registered midwives in relation to students they had recently preceptored in the clinical environment.

**Findings:** Ratings by experts revealed a content validity index score of 0.97, representing good content validity. An evaluation of construct validity through factor analysis generated three factors: 'partnership in care', 'reflection on practice' and 'practice improvements'. The scale demonstrated good internal reliability with a Cronbach alpha coefficient of 0.97. The mean total score for the CACTiM scale was 116.77 (SD = 16.68) with a range of 60-144. Total and subscale scores correlated significantly.

**Conclusion:** The CACTiM (Preceptor/Mentor version) was found to be a valid and reliable tool for use by preceptors to assess critical thinking in undergraduate midwifery students.

**Implications for practice:** Given the importance of critical thinking skills for midwifery practice, mapping and assessing critical thinking development in students' practice across an undergraduate program is vital. The CACTiM (Preceptor/Mentor version) has utility for clinical education, research and practice. The tool can inform and guide preceptors' assessment of students' critical thinking in practice. The availability of a reliable and valid tool can be used to research the development of critical thinking in practice.

## Introduction

Critical thinking is essential for safe, effective midwifery practice. However, there is variable understanding and use of the term across different contexts and disciplines (Petress, 2004). Warnick and Inch (1994, p.11) defined critical thinking as “involving the ability to explore a problem, question, or situation; integrate all the available information about it; arrive at a solution or hypothesis; and justify one's position.” This definition aligns to the requirements of safe autonomous midwifery practice and justifies the importance of ensuring midwives develop their critical thinking capacity. Critical thinking in midwifery practice is further characterised by the incorporation of women’s preferences, and use of expert judgement informed by evidence when making clinical decisions (Fullerton and Thompson, 2005). The ability to demonstrate and apply critical thinking is particularly important when there is uncertainty regarding ‘best’ practice in clinical situations (Scholes et al., 2012). In response to growing recognition of midwifery as an autonomous profession there is a need for midwives to develop their critical thinking skills to enable effective decision making and problem solving in complex situations where they have increased accountability (Muoni, 2012; Pucer, et al., 2014).

In order to ensure effective clinical decision making, students’ cognitive competence needs to be developed and monitored throughout undergraduate education programmes. The development of students’ critical thinking is recognised as important in both midwifery and nursing education; however, the measurement of critical thinking skills is often inconsistent or overlooked (Walsh and Seldomridge, 2006; Carter et al., 2015). Critical thinking development is assumed to occur as students’ progress through their undergraduate programme. However, in a review of curricula, Lake and McInnes (2012) found teaching and learning strategies for critical thinking were not made explicit and limited consideration was given to developing students’ cognitive abilities. Furthermore, students were not aware of specific teaching and learning strategies that aimed to develop their critical thinking. It was only when students participated in a focus group discussion as part of the research study that they recognised instances of cognitive skill development (Lake and McInnes 2012).

In practice professions such as nursing, the acquisition of knowledge and cognitive competence are demonstrated through application in the practice setting (Myrick, 2002). This understanding is applied to midwifery education programmes too, as reflected in the

ICM Education Standards which specify that at least 50% of midwifery curricula needs to be based in practice (ICM, 2013). This requirement is endorsed by the Australian Midwifery Education Standards which mandate that 50% of midwifery degree programme hours are dedicated to clinical learning (ANMAC, 2014). During clinical practice placements midwifery students are supervised by practicing midwives in their role as preceptor. For the purpose of this paper the term preceptor will be used in reference to the qualified midwife who provides supervision and support to the student whilst on clinical practice. It is acknowledged that a variety of other terms are used to describe this role across countries including mentor, clinical facilitator, and clinical assessor. The preceptor makes a significant contribution to students' learning and is responsible for monitoring progress, student support, and assessment of practice (Licqurish and Seibold, 2008). Yet little explicit guidance is offered to preceptors to help them understand and assess elements of students' critical thinking. Given the preceptor's role in observing practice and providing feedback to students it is pertinent that they are involved in the measurement and development of this cognitive skill.

A recent systematic review that evaluated tools used to measure critical thinking development in midwifery and nursing undergraduate students found no measures specifically designed for use in midwifery, and no tools that measured the application of critical thinking in practice (Carter et al., 2015). Of the 34 studies that met the inclusion criteria, 16 different tools were used to measure critical thinking development. Twenty-three studies used a standardised licenced tool (such as the California Critical Thinking Disposition Inventory, California Critical Thinking Skills Test, or the Watson–Glaser Critical Thinking Appraisal and Health Sciences Reasoning Test). Carter et al., (2015) found limited reporting of the reliability and validity of tools and reported inconsistent results across some studies, placing doubt about the validity of these tools in midwifery or nursing contexts. An examination of the domain concepts or factors of scales also revealed the construct validity to be narrowly conceived or not specific to the health practice context. Development of discipline-specific instruments to measure critical thinking by midwifery students was recommended, and more specifically, tools that measure the application of critical thinking to practice (Carter et al., 2015). In the absence of freely available tools specific to midwifery practice, this methodological study reports on the development and testing of a specific tool designed for use by preceptors to measure undergraduate midwifery students' critical thinking in the practice context.

## **Research questions**

1. To what extent is the Carter Assessment of Critical Thinking in Midwifery (CACTiM) (Preceptor/Mentor version) a reliable and valid tool for use by preceptors to measure critical thinking in practice by undergraduate midwifery students?
2. What is the level of students' critical thinking in practice identified by preceptors?
3. In which areas do preceptors perceive students have well developed and less developed critical thinking skills?

## **Methods**

### **Design**

A descriptive cohort design was used to test the new tool.

### **Setting**

Within the three-year Bachelor of Midwifery programme, students complete up to 1,800 clinical practice hours mostly in the same organisation for the duration of their degree. During their clinical practicum, midwifery students are commonly allocated to work with a registered midwife who becomes the student's named preceptor. The preceptor facilitates, monitors, supports and assesses the student's learning in the clinical environment. Preceptors are prepared for their role through attendance at an education session provided by the University. Preceptors are further supported in their role by the presence of at least one University lecturer available five days per week at the clinical site. This model of clinical support and preceptorship facilitates the development of a close working relationship between students and preceptors over time. The preceptor is therefore ideally placed to assess students' clinical skills and competence, including the development of their critical thinking skills.

### **Ethical considerations**

Ethical approval for the study was granted by the Human Research Ethics Committee of Griffith University. Participants were informed about the aim of the study, that participation was voluntary; their responses would be anonymous; reported in group aggregate form; and not released to the individual student. Completion of the survey implied consent.

### **Participants**

Criteria for inclusion were midwives practising either in a hospital setting or private midwifery

practice and had preceptored at least one student within the last six months (or semester). Potential participants were initially identified through attendance lists at the preceptor education workshops offered by the participating university. Preceptors were also identified by university lecturers at each clinical site.

## Instrument development

This study followed a staged model for tool development recommended by DeVellis (2012). This included: generation of items; content validity testing through mapping of draft items to critical thinking concepts and expert review; administration of items to a development sample; and psychometric testing. The approach to psychometric testing of the tool is outlined in Table 5.1.

**Table 5.1: Approach to development and testing procedures**

<b>Aim</b>	<b>Analyses</b>	<b>Approach</b>
Content validity	Items mapped against consensus definition of critical thinking in nursing. Item content validity index (CVI) score for each item. Average item CVI score for total scale.	Process to ensure content validity.  Items with a low CVI score <0.8 were deleted.
Item analysis (item-total/item-subscale/subscale-total correlation)	Pearson product-moment correlation.	Items with low item-total correlation 0.3 deleted.
Construct validity	Exploratory factor analysis (principal component analysis).	Sample adequacy for factor analysis: Kaiser Meyer Olkin using an $r$ value ( $0 > .6$ ). Suitability of data for factor analysis; Bartlett's sphericity test ( $p < 0.05$ ). Variance described by each factor; eigenvalue $> 1$ . Factors should explain 50-60% of total variance. Factor loadings $> 0.30$ .
Internal reliability (for total scale and subscales)	Cronbach's coefficient	$\alpha$ 0.60-0.79 good, 0.80-1.00 high reliability.

Ref: Adapted from Gungor and Beji (2012)

## **Literature review and generation of item pool**

According to DeVellis (2012) Stage 1 of the tool development process involves having a clear understanding of what is to be measured and Stage 2 concerns generation of an item pool. Items were generated through a comprehensive review of the literature to identify possible item content and establish relevant conceptual domains. This process also involved an examination of items included in the National Competency Standards for the Midwife (ANMC, 2006). In the absence of tools specifically for midwifery, a review of nursing literature identified two tools relevant to measuring critical thinking and approaches to learning in nursing practice. The Nursing Executive Center Critical Thinking Diagnostic (Berkow et al., 2011) and the Competency Inventory for Nursing (Hsu and Hsieh, 2013) were reviewed. Both tools were designed to measure critical thinking in nursing practice but were characterised by items that focussed on recognising changes in a patient's condition and initiation of nursing interventions. Therefore, we developed items that reflected midwifery values and practice where the woman and midwife work in partnership and informed decision making and choice is promoted (ACM, 2011; Renfrew et al., 2014).

## **Content validity**

Content validity was established through a two staged process which involved preliminary expert view and mapping the draft items to the concepts of critical thinking. The preliminary review of draft pool of items was conducted by two experienced midwifery researchers and an experienced midwifery practitioner. The wording of items were further refined in minor ways according to feedback received.

## **Mapping**

The items were then tested for conceptual coherence. Items were mapped against the consensus definition of critical thinking in nursing developed by Scheffer and Rubenfeld (2000), who identified and defined 10 habits of mind (affective components) and 7 skills (cognitive components) (see Table 5.2). For example, the item 'Explores a woman's preferences of care and plans care accordingly' was considered to measure the affective domains of contextual perspective, creativity, flexibility and open mindedness and the cognitive domains of analysing and information seeking.

This mapping ensured that all identified concepts underpinning critical thinking were reflected in the tool. The mapping identified the need for further refinement of existing items as well as development of new items as not all domains of critical thinking had been



addressed. Following this mapping process, the response option for the tool was selected (Stage 3). The tool was formatted using a six point Likert scale of 1 = strongly disagree to 6 = strongly agree. A six-point response option precludes equivocation (DeVellis, 2012). The draft tool contained 25 items.

**Table 5.2: Consensus definition of critical thinking in nursing**

<b>Habit</b>	<b>Definition</b>
<b>Confidence</b>	Assurance of one's reasoning abilities
<b>Contextual perspective</b>	Considerate of the whole situation, including relationships, background and environment, relevant to some happening
<b>Creativity</b>	Intellectual inventiveness used to generate, discover, or restructure ideas, imagining alternatives
<b>Flexibility</b>	Capacity to adapt, accommodate, modify or change thoughts, ideas and behaviours
<b>Inquisitiveness</b>	An eagerness to know by seeking knowledge and understanding through observation and thoughtful questioning in order to explore possibilities and alternatives
<b>Intellectual Integrity</b>	Seeking the truth through sincere, honest processes, even if the results are contrary to one's assumptions and beliefs
<b>Intuition</b>	Insightful sense of knowing without conscious use of reason
<b>Open-mindedness</b>	A viewpoint characterised by being receptive to divergent views and sensitive to one's biases
<b>Perseverance</b>	Pursuit of a course with determination to overcome obstacles
<b>Reflection</b>	Contemplation upon a subject especially one's assumptions and thinking for the purpose of understanding and self-evaluation
<b>Skill</b>	
<b>Analysing</b>	Separating or breaking a whole into parts to discover their nature, function and relationships
<b>Applying Standards</b>	Judging according to established personal judgement, professional or social rules or criteria
<b>Discriminating</b>	Recognising differences and similarities among things or situations and distinguishing carefully as to category or rank
<b>Information Seeking</b>	Searching for evidence, facts and knowledge by identifying relevant sources and gathering objective, subjective, historical, and current data from these sources
<b>Habit</b>	<b>Definition</b>
<b>Logical Reasoning</b>	Drawing inferences or conclusions that are supported in or justified by evidence
<b>Predicting</b>	Envisioning a plan and its consequences
<b>Transforming Knowledge</b>	Changing or converting the condition, nature, form, or function of concepts among contexts

Ref: Scheffer and Rubenfeld (2000, p358)

### **Expert review: judgement-quantification**

Judgement-quantification (Stage 4) involves an evaluation of survey items by panel of experts. The soundness of this process depends largely on the recruitment and selection of content experts (DeVellis, 2012). In the current study, eleven content experts provided a review. The experts were invited because of their (1) recognised clinical expertise, (2) academic expertise, and (3) commitment and understanding of the development of critical thinking in midwifery. The number of content experts necessary for content validity depends on the desired level of expertise and diversity of knowledge needed (Grant and Davis, 1997). A panel of 2 to 20 experts has been suggested in the literature (Gable and Wolf, 1993; Walz et al., 1991). Of the nine academics involved, mean years as an academic was 8.3 years with a range of 1-15 years. Years of experience as a midwife ranged from 8 to 31 years with a mean of 20.3 years. The two midwifery clinicians had a mean length of experience as a midwife of 19 years with a range of 14-24 years.

Members of the expert panel were briefed on the purpose of the study and provided with instructions. A Content Validity Index (CVI) was completed by each member of the panel to assess validity of items. Expert reviewers rated items on a scale of 1 to 4 according to relevance (1 = not relevant, 2 = needs major revision to be relevant, 3 = needs minor revision to be relevant, 4 = relevant). They were also asked to comment on the clarity of items, identify any complex or ambiguous phrases and recommend any changes. The CVI was calculated by the proportion of items rated by experts as either 3 or 4; a CVI above 0.8 was considered to be valid (Polit and Beck, 2006). This study required nine of the eleven expert ratings to be 3 or 4, giving a minimum score of 0.8. Item CVI scores ranged from 0.73 and 1. The CVI analysis revealed that 24 out of 25 items achieved CVI above 0.8. The one item that did not achieve the CVI cut-off score was removed. Written comments regarding the clarity of items were analysed. Ambiguous and / or complex phrases were rephrased. Following the removal of the one item, the CVI score for the total scale (average item CVI) was 0.97, representing good content validity. The draft tool had 24 items in the domains of “habits of mind”, and “skills in critical thinking” and was ready for pilot testing. The results of this pilot test are outlined below.

## **Survey and psychometric testing**

A link to the online version of the CACTiM was distributed via email to preceptors. Paper copies of the survey were also distributed during preceptor workshops, hospital site visits, and professional meetings. Preceptors were requested to complete the tool by assessing the critical thinking skills of any 2<sup>nd</sup> or 3<sup>rd</sup> year midwifery student whom they had supervised in the current semester/term. It was estimated that 215 preceptors were invited to participate. Data was collected between November-December 2014.

### **Sample size**

There is a lack of agreement on establishing a minimum desirable sample size for factor analysis. Sample size was calculated according to the ratio of 2, in that there were at least twice as many participants as variables for the factor analysis with a minimum 100 participants (Kline, 1979). According to Costello and Osborne (2005) uniformly high communalities without cross loadings, plus several variables loading strongly on each factor are desirable. As long as communalities are high, the number of expected factors is relatively small, and model error is low (a condition which often goes hand-in-hand with high communalities), researchers should not be overly concerned about small sample size.

### **Approach to analysis**

Data were analysed using the Statistical Package for the Social Sciences (SPSS) 22.0 (2014) personal computer version. Descriptive statistics were used to analyse characteristics of the sample and survey responses. An alpha level of 0.05 was used for all statistical tests.

### **Item analysis**

Higher correlation among items reflects a stronger relationship between each item and the nature of content being measured (DeVellis, 2012). Items with an average inter-item correlation of above 0.30 were considered valid.

### **Construct validity**

The 24 items were analysed using principal components analysis (PCA) with varimax rotation and exploratory factor analysis (Tabachnick and Fidell, 2013). First an inspection of the correlation matrix was performed to assess feasibility for factor analysis, screening for coefficients of 0.3 and above (Costello and Osborne, 2005). Prior to performing the PCA,

the adequacy of data was assessed using Kaiser-Meyer-Olkin (KMO) with a recommended value of .6 (Kaiser, 1974). The Bartlett's Test of Significance (Bartlett, 1954) was used to determine the suitability of the correlation matrix. For factor analysis, the cut-off level for item values of communality was 0.45. The criterion for factor extraction was an eigenvalue >1 and item factor loading of >0.30 (DeVellis, 2012).

### **Subscale analysis**

As a measure of internal consistency, an evaluation of each subscale extracted from the factor analysis was conducted. Correlations between factor scores and total scale score as well as the item-subscale correlation were calculated.

### **Internal reliability**

Cronbach's alpha coefficient is the one of the most commonly used indicators of internal consistency. A reliability coefficient of above 0.7 is ideal (DeVellis, 2012).

## **Findings**

### **Participant characteristics/sample**

A response rate of 49% (n = 106 out of 215) was achieved. Preceptor midwives had qualifications ranging from certificate to Master degree. Age ranged from 26 to 64 years with a mean age of 45.6 years. This age range is representative of the Australian midwifery workforce where the average age is 48.1 years (AIHW, 2013). Most preceptors had significant clinical experience as a midwife with a mean of 15 years, ranging from 1 to 42 years. All respondents were female but one. Midwives practiced in a variety of settings and roles included midwives employed within a hospital setting, midwives working in caseload practice, self-employed midwives, midwifery educators and managers.

### **Findings of item analysis**

All items had positive and statistically significant item-total correlation coefficients (Table 5.3). No items had an average inter-item correlation of less than 0.3 and no items were removed (DeVellis, 2012). All corrected item-total correlations were 100% positive, with corrected item total correlations between 0.674 and 0.815.

### **Findings of construct validity**

The scale demonstrated good sampling adequacy for factor analysis. The Kaiser-Meyer-Olkin (KMO) using a r value was .930 which exceeds the recommended value of 0.6 (Kaiser,

1974). The Bartlett's Test of Significance (Bartlett, 1954) was statistically significant enabling factorability of the correlation matrix.

Evaluation of construct validity through principal components analysis with varimax rotation revealed the presence of three components with eigenvalues exceeding 1, explaining 59.9%, 7.1%, and 4.6% of the variance respectively (Table 5.3). Factor loadings of all items were sufficient ( $> 0.3$ ). The three factors were named according to the underlying construct: 'partnership in care' (Factor 1); 'reflection on practice' (Factor 2); and 'practice improvements' (Factor 3). Three items (items 10, 12, 19) were split loaded, however from a conceptual and practical perspective a decision was made to allocate them to the factor according to their highest loading.

### **Internal reliability**

The coefficient alpha for the total scale was .97, demonstrating good internal consistency (DeVellis, 2012). Cronbach's  $\alpha$  coefficient for each subscale ranged from 0.90 to 0.96 (Table 5.3).

### **CACTiM (Preceptor/Mentor version) scores**

The mean total score for the CACTiM scale was 116.77 (SD = 16.68) with a range of 60-144. The mean item score was 4.87 (SD 0.89), with a range of 1-6. This high item mean indicated that overall preceptors assessed midwifery students as displaying a reasonably high level of critical thinking in practice. Table 5.4 presents a summary of the mean scores and valid percentages for all items.

#### ***Factor 1: Partnership in care***

This 12 item factor had good internal reliability (Cronbach's alpha 0.96). The factor total mean score was 58.4 (SD = 8.8) out of a possible 72. The item mean for this factor was 4.86.

The highest scoring item in this factor was 'explores the woman's preferences of care and plans care accordingly' with a mean score of 5.21. The majority of preceptors (83%) agreed/strongly agreed that students explored women's preferences when planning care. Another high scoring item related to the student's ability to demonstrate insight into providing individualised care, with a mean score of 5.08, and 73.6% of preceptors agreed/strongly agreed with this item. The third highest scoring item related to liaison and negotiation of care

with colleagues with an item mean of 4.97.

This factor also contained the lowest scoring item of the CACTiM scale of 'seeks root cause if problems arise whilst caring for the woman', with a mean item score of 4.59, and 16% of preceptors tending to disagree that students demonstrated this cognitive skill. The ability of students to explore multiple solutions to a given problem also scored less with a mean item score of 4.62, and only 59.5% of preceptors agreed/strongly agreed with this item.

### ***Factor 2: Reflection on Practice***

This seven item factor had good internal reliability (Cronbach's alpha 0.93). The factor total mean score was 34.5 (SD = 5.4) out of a possible 42. This factor achieved the highest mean item score of 4.92. The highest scoring item related to students debriefing following complex situations to improve practice. The majority of preceptors (84.9%) agreed/strongly agreed with this item. The item related to students initiating professional dialogue around midwifery practice also scored a high item mean score of 4.98 with 74.6% of preceptors agreeing/strongly agreeing with this item. The lowest scoring item in this factor (mean item score 4.74) related to students recognising their attitudes, biases and values about their practice. Only 63.2% of preceptors agreed/strongly agreed with this item.

### ***Factor 3: Practice Improvements***

This five item subscale had good internal reliability (Cronbach's alpha 0.90). The factor total mean score was 23.9 (SD = 4.1) out of a possible 30. The item mean for this factor was 4.87. Two items scored a high mean of 5.06. The first item related to recognising inappropriate or non-evidence based practice and 75.5% of preceptors agreed/strongly agreed. Additionally, the majority of preceptors (77.4%) reported students sought clarification about interventions that were not appropriate or unnecessary. The lowest scoring item was identification of organisational improvements, with only 58.5% of preceptors agreeing or strongly agreeing that students demonstrated this skill in practice.

**Table 5.3: Factor summary of the CACTiM (Preceptor/Mentor version) scale**

		Item Analysis				Construct validity (factor analysis)			Internal reliability Cronbach's $\alpha$
		Number of Items	Item-total correlation range	Item sub- scale correlation range	Subscale – total correlation range	Eigenvalue	% explained variance	Loading range	
Factor 1	Partnership in Care	12	0.38-0.81	0.54-0.81	0.95	14.37	59.86	0.42-0.96	0.96
Factor 2	Reflection on Practice	7	0.38-0.87	0.45-0.87	0.88	1.11	4.62	0.35-0.88	0.90
Factor 3	Practice Improvements	5	0.38-0.77	0.57-0.77	0.87	1.70	7.08	0.65-0.95	0.93

Table 5.4: Proportion of preceptor responses on each item and item mean

Factors and items	Strongly disagree %	Disagree %	Tend to disagree %	Tend to agree %	Agree %	Strongly agree %	Mean score
<b>Factor 1 – Partnership in Care</b>							
Explores the woman's preferences of care and plans care accordingly			3.8	13.2	48.1	34.9	5.14
Sequences care and education to meet the individual needs of the woman			2.8	30.2	40.6	26.4	4.91
Suggests relevant literature and education strategies to facilitate the woman's decision making			8.5	25.5	41.5	24.5	4.82
Shares relevant evidence and clinical guidelines related to the woman's individual choices			10.4	21.7	45.3	22.6	4.80
Uses evidence to plan care according to the woman's individual circumstances		0.9	3.8	21.7	47.2	26.4	4.94
Demonstrates insight in providing individualised care to the woman			2.8	23.6	36.8	36.8	5.08
Liaises and negotiates with colleagues at different levels about processes to optimise outcomes for the woman			9.4	16.0	42.5	32.1	4.97
Consults and utilises resources (e.g. literature, guidelines, etc.) to improve care for the woman			7.5	19.8	45.3	27.4	4.92
Seeks the root cause if problems arise whilst caring for the woman			16.0	22.6	47.2	14.2	4.59
Effectively explores multiple solutions to a given situation			11.3	29.2	45.3	14.2	4.62
Demonstrates an understanding of the rationale for following (or departing from) established guidelines and policies		0.9	10.4	20.8	44.3	23.6	4.79
Where needed, negotiates a collaborative intervention plan with relevant health care providers			9.4	24.5	43.4	22.6	4.79
<b>Mean Item Score for Factor 1</b>							<b>4.86</b>



Factors and items	Strongly disagree %	Disagree %	Tend to disagree %	Tend to agree %	Agree %	Strongly agree %	Mean score
<b>Factor 2 – Reflection on Practice</b>							
Analyses own strengths and limitations in skills, knowledge and experience		0.9	1.9	25.5	44.3	27.4	4.94
Addresses own limitations in skills, knowledge and experience		0.9	4.7	22.6	43.4	28.3	4.92
Initiates professional dialogue around midwifery practice			3.8	21.7	47.2	27.4	4.98
Evaluates own practice and its effect on the woman and others	0.9	0.9	11.3	18.9	41.5	26.4	4.78
Adjusts own practice based on feedback from the woman and others		1.9	6.6	23.6	43.4	24.5	4.82
Recognises own attitudes, biases and values and their potential impact on practice	0.9	0.9	9.4	25.5	38.7	24.5	4.74
Debriefs with a professional colleague following complex situations to improve future practice			1.9	13.2	39.6	45.3	5.28
<b>Mean Item Score for Factor 2</b>							<b>4.92</b>
<b>Factor 3 Practice Improvements</b>							
Recognises non-evidence based or non- woman centred practice by self and others		0.9	4.7	18.9	38.7	36.8	5.06
Voices concerns about non-evidence based or non- woman centred practices by self and others			6.6	25.5	39.6	28.3	4.90
Identifies organisational/service improvement opportunities	0.9	0.9	12.3	27.4	39.6	18.9	4.60
Seeks clarification about interventions that appear inappropriate or unnecessary			3.8	18.5	45.3	32.1	5.06
Questions the 'unwritten rules' in midwifery practice that are not evidence- based		0.9	11.3	22.6	41.5	23.6	4.75
<b>Mean Item Score for Factor 3</b>							<b>4.87</b>

## **Discussion**

This paper reports on the development of a new tool for use by preceptors to assess midwifery students' critical thinking skills in practice. The CACTiM (Preceptor/Mentor version) was found to have good reliability and validity. Analysis revealed three factors, which comprised: 'partnership in care', 'reflection on practice', and 'practice improvements'. The CACTiM sub-scales were also tested and found to be internally reliable and theoretically and practically coherent.

The CACTiM is the first instrument specifically designed to enable preceptors to measure students' application of critical thinking in midwifery practice. The range of items attempted to reflect the multiple facets of critical thinking in practice. This tool has numerous potential applications in facilitating assessment of individual midwifery students by preceptors within the clinical curriculum; longitudinal measurement of the development of critical thinking by students throughout a midwifery education programme, and measurement of midwives' critical thinking skills in practice following graduation and commencement in practice.

The key role of a midwifery preceptor is to teach students to incorporate critical thinking when providing individualised, evidence based care to women and their families (Raisler et al., 2003). Currently the assessment of midwifery students in practice is largely focussed on assessment of clinical skills (ANMAC, 2014). The CACTiM provides an additional framework that may assist preceptors to measure students' ability to apply critical thinking to practice, identify areas of deficit, and monitor change over time.

### **Partnership in care**

The items within this factor related to critical thinking around the provision of care in partnership with women. Several items focussed on measuring students' ability to place the woman in the centre of care while respecting and facilitating her decision making. Other items pertained to students' ability to consult, collaborate and seek alternative approaches/solutions to care when problems arose. These factors are well aligned with qualities of woman centred midwifery care (Renfrew et al., 2014).

High scoring items in this factor included 'explores the woman's preferences of care and plans care accordingly' and 'demonstrates insight in providing individualised care to the woman'. This finding was reassuring as the Bachelor of Midwifery curriculum is underpinned by meta-values one of which is a woman-centred approach to care that promotes informed

choice where the woman's rights around decision making are prioritised, promoted and respected (Sidebotham et al., 2015; Bass et al., 2015).

Items that scored less than the factor mean included, 'seeks the root cause if problems arise whilst caring for the woman' and 'effectively explores multiple solutions to a given situation'. Both concepts involve high level critical thinking skills and decision making. These findings are supported by Jefford and Fahy (2015) who found a lack of decision making skills in the narratives of over half of practising midwives in their study, which may adversely affect the safety and effectiveness of midwifery practice. Further teaching strategies to exemplify problem solving skills in complex situations may be required for students, as well as continuing professional development activities for preceptor midwives.

### **Reflection on practice**

Items within this factor related to students' ability to critically reflect on their own practice and identify strengths, limitations and practice improvements. The highest item mean for the CACTiM was achieved for 'debriefs with a professional colleague following complex situations to improve future practice'. Reflection and critical thinking are encouraged in midwifery and nursing practice, where reflection on rich clinical experience facilitates critical thinking development (Kennison, 2006). The high mean on this item is not surprising considering the focus of the curriculum on reflection. Students submit three written reflective pieces each semester with a focus on identification of individual practice improvements. This ongoing emphasis on reflection appears to be subsequently demonstrated in students' clinical practice and may explain the high ratings by preceptors.

### **Practice improvements**

Items within this factor related to identification of possible practice improvements of self, others, and/or the organisation. The highest item mean in this factor related to recognising inappropriate practice, that may be non-evidence based or non-woman centred. This item was designed to measure students' ability to critically examine practice and assess appropriateness. A students' ability to apply standards to practice is also recognised as an essential component of critical thinking (Scheffer and Rubenfeld, 2000).

One of the lowest scoring items was 'identifies organisational/service improvement opportunities'. This item was designed to measure students' ability to use critical thinking to identify practice or system improvements. Challenging practices or processes can be difficult

for students as they tend to want to conform to the expectations of the organisation in an attempt to fit-in (Begley, 2001). However, the implementation of quality improvement initiatives is a vital process to continually refine existing practices and systems to promote safe care (Cronenwett et al., 2007). The introduction of an assessment item specifically designed to encourage students to identify practice improvements may be beneficial to foster their ability to bring about cultural change in the future as clinicians.

### **Implications for education, research, and practice.**

The CACTiM has utility for education, future research, and practice. Given the importance of critical thinking skills for midwifery practice, mapping and assessing critical thinking development in practice across the course of a degree programme is vital. Furthermore, a formative approach to measuring the development of critical thinking over time is important to determine the efficacy of teaching approaches and identify potential areas in need of improvement to promote students' cognitive capacities (Carter et al., 2015). It is anticipated that once a valid and reliable tool is developed, preceptors will share their assessment with students in a formative process and use the tool as a point of discussion and learning to enhance critical thinking in practice.

It is possible that some clinicians may not know the elements of critical thinking. Just as students were not aware of strategies used to develop critical thinking in curricula (Lake and McInnes 2012), some clinicians in a preceptor role may also give limited consideration to developing students' critical thinking abilities. The use of the CACTiM may be useful to clinicians in their preceptor role by providing explicit cues about evidence of students' critical thinking in practice. There may also be the potential for preceptors to use the cues to reflect on their own use of critical thinking and this process may lead to professional development opportunities for midwives in practice. Jefford and Fahy (2015) identified the need for midwives to apply cognitive processes to guide decision making in clinical practice. Use of the CACTiM tool by preceptors to assess students in practice may foster self-review about their practice.

Preceptorship plays a critical role in developing critical thinking in students (Myrick and Yonge, 2004). The tool may also provide feedback to preceptors on the effectiveness of their role in teaching and developing students' ability to assess clinical situations and respond appropriately. Students learn critical skills through observation of their preceptor who ideally 'thinks aloud' to make their thinking processes explicit (Myrick, 2002). As a

student's critical thinking skills may to some extent reflect the level of critique demonstrated by their preceptors, it is essential to provide guidance to preceptors to promote their own development and that of students.

Although the CACTiM demonstrated sound reliability and validity, further research is required. The tool needs to be validated with different cohorts of preceptors supporting students undertaking different curricula and working across different practice settings. Results of such studies would not only validate the tool, but allow for international comparisons and guide the development of curricula and teaching strategies in different countries. The extent to which preceptors need training and support to effectively use the tool also needs to be investigated.

## **Limitations**

The results of this study need to be considered in light of limitations. Although a response rate of 49% was acceptable for an anonymous survey, the findings may not reflect the views of all preceptors involved in the programme. It could be that preceptors who perceived they worked effectively with a certain student may have been more likely to respond. The sample was also relatively homogeneous with preceptors commenting on the clinical performance of students enrolled in one Australian University. Although testing indicated that the sample size was adequate, replication of this study with a larger, diverse sample of preceptors is recommended to confirm the reliability and validity of the tool.

Results may have also been influenced by recall bias. Preceptors were asked to think about the performance of a particular student and may have recalled certain aspects more positively than was really the case. Furthermore, given that the preceptors knew the survey was assessing students' critical thinking skills, the preceptor may have been inclined to choose a high performing student. A predominance of reports on high-performing students may have skewed results, highlighting the need for further research with diverse student groups.

Ideally, the CACTiM should be provided to preceptors at the commencement of the student's placement. The completed tool could then be used as a guide for feedback and a teaching tool between preceptor and student as well as a research measure of critical thinking development.

In the absence of a freely available tool to assess students' critical thinking abilities in practice, it was not possible to establish concurrent validity. Future research could compare results on the CACTiM to standardised measures of critical thinking related to the health sciences such as the Health Sciences Reasoning Test (Facione, et al., 2010) or a general measure such as the Watson-Glaser Critical Thinking Appraisal (Watson and Glaser, 1980).

The reliability of this tool may be affected by the subjectivity of the tool as it solely relies on preceptors' perceptions of students' critical thinking abilities. A multi-method approach and triangulation of data may improve validity, reliability, and insight into CT development. This may include measuring students own perceptions of their CT. Furthermore, Kennison (2006) suggests that reflection and critical thinking are intrinsically linked in nursing practice and that students' reflections are ideally placed to measure CT. A combination of these methods may improve assessment of midwifery students CT skills.

As the nature of critical thinking is complex and multidimensional, exploring students' abilities using the CACTiM may not reflect all views. Even though the items were informed from a variety of sources such as a critical review of the literature and the consensus definition of critical thinking in nursing developed by Scheffer and Rubenfeld (2000), some respondents may have different perspectives not reflected in the CACTiM.

## **Conclusion**

Assessing the development of critical thinking of undergraduate midwifery students is important. Preceptors are ideally situated to assess critical thinking skills of midwifery students' performance in practice. This initial analysis suggests the CACTiM (Preceptor/Mentor version) is a reliable and valid tool for this purpose. The tool could be utilised over time to assess development of critical thinking in practice or as a single measure. It is recognised that this tool only measures preceptors' perception of midwifery students' critical thinking in practice. Considering the complexity of critical thinking in midwifery practice robust measurement requires a multi-method approach.

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## Chapter Conclusions

Although this study established the reliability and validity of the CACTiM (Preceptor/Mentor) tool it was also recognised that a single measurement tool does not capture the complexity of critical thinking in midwifery practice. In response to the review of the literature in Chapter 1 which highlighted the distinctiveness and complexity of critical thinking in midwifery practice, and the two systematic reviews of the literature recommending a multi-method approach to measurement, a second tool was developed.

Using a self-assessment tool to measure critical thinking is common practice in the educational literature. The commercially available standardised CCTDI tool relies on self-report. The systematic review in Chapter 3, evaluating critical thinking measurement tools, found four of the sixteen tools used a self-assessment strategy. Self-assessment of cognitive skills has significant pedagogical benefits for students, including increased self-awareness, reflectivity, and promoting greater autonomy over their own learning. It was also considered that comparisons between preceptor critical thinking ratings and those of students would provide valuable reflections for students. Therefore, the next designated sequential study focussed on the development of a self-assessment tool for undergraduate students to assess their critical thinking skills in midwifery practice.

## **CHAPTER 6**

### **Critical Thinking Skills in Midwifery Practice: Development of a Self-Assessment Tool for Students**

#### **Chapter Overview**

A post-print copy of the publication forms Chapter 6 of this thesis. The references and formatting for this paper are presented in accordance with the requirements of *Midwifery*, in which this paper was published. Ethics approval was obtained for this study from Griffith University Human Ethics Committee - NRS/39/14/HREC (see Appendix A). The survey tool utilised in this study is included as Appendix M, the participant information sheet is included as Appendix N.

#### **Author contributions**

The paper is a co-authored paper. The bibliographic details of this co-authored paper, including all authors, are:

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Supervised by Professor Debra K. Creedy (Co-Principal Supervisor) and Associate Professor Mary Sidebotham (Co-Principal Supervisor) my contribution to the paper involved tool development including; review of the literature, development of draft items, facilitating expert review, and mapping of draft items. My contribution also involved recruitment of the student sample, data analysis, and preparation of the manuscript for publication including journal submission and manuscript revisions prior to publication.

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## **Abstract**

**Objective:** Develop and test a tool designed for use by pre-registration midwifery students to self-appraise their critical thinking in practice.

**Design:** A descriptive cohort design was used.

**Participants:** All students (n = 164) enrolled in a three-year Bachelor of Midwifery program in Queensland, Australia.

**Methods:** The staged model for tool development involved item generation, mapping draft items to critical thinking concepts and expert review to test content validity, pilot testing of the tool to a convenience sample of students, and psychometric testing. Students (n = 126, 76.8% response rate) provided demographic details, completed the new tool, and five questions from the Motivated Strategies for Learning Questionnaire (MSLQ) via an online platform or paper version.

**Findings:** A high content validity index score of 0.97 was achieved through expert review. Construct validity via factor analysis revealed four factors: 'seeks information', 'reflects on practice', 'facilitates shared decision making', and 'evaluates practice'. The mean total score for the tool was 124.98 (SD =12.58). Total and subscale scores correlated significantly. The scale achieved good internal reliability with a Cronbach's alpha coefficient of 0.92. Concurrent validity with the MSLQ subscale was 0.35 (p <0.001).

**Conclusion:** This study established the reliability and validity of the CACTiM – student version for use by pre-registration midwifery students to self-assess critical thinking in practice.

**Implications for practice:** Critical thinking skills are vital for safe and effective midwifery practice. Students' assessment of their critical thinking development throughout their pre-registration programme makes these skills explicit, and could guide teaching innovation to address identified deficits. The availability of a reliable and valid tool assists research into the development of critical thinking in education and practice.

## Introduction

Critical thinking involves a reflective process in making judicious purposeful judgements using cognitive processes of analysis, interpretation, evaluation, inference, explanation, and reflection (Facione, 1990; Hendricson et al., 2006). As midwives welcome increasing autonomy in their practice, their need to possess well-developed critical thinking skills also increases. Critical thinking in practice informs professional judgement and decision making, enabling midwives to provide flexible, woman centred, holistic, evidence-based care whilst incorporating women's choice (Lake and McInnes, 2012). Adding to this complexity is the ambiguity regarding 'best practice' in many practice situations (Scholes et al., 2012), and the need to contextualise any available evidence to an individual woman's circumstances.

Decision making can be viewed as key to quality professional practice (Thompson and Dowding, 2002), and critical thinking is an essential cognitive process in reaching efficacious clinical decisions. Yet, best practice teaching strategies to develop student's problem solving and critical thinking skills remain uncertain (Hendricson et al., 2006; Carter et al., 2016). Facione (1990) proposed that a coordinated approach to curricula, pedagogy, and assessment strategies needs to focus on developing the cognitive skills and habits of inquiry associated with critical thinking.

Whilst the need to develop critical thinking skills of pre-registration midwifery students is clear, the measurement of this development is not. A systematic review of the literature on tools used to measure the development of critical thinking in midwifery and nursing undergraduate students discovered an absence of tools for specific use in midwifery practice (Carter et al., 2015). A further review which evaluated the efficacy of teaching methods used to develop critical thinking skills in midwifery and nursing undergraduate students found inconsistencies (Carter et al., 2016). Of the twenty-eight studies reviewed, seventeen identified strategies that increased critical thinking, while nine studies found no increases, and two reported unexplained decreases in CT when using similar educational interventions. While these inconsistencies could be attributed to flaws in methodology and outcome measures, both reviews recommended the development of discipline-specific instruments to measure critical thinking, particularly tools that measure the application of critical thinking in midwifery practice (Carter et al., 2015; Carter et al., 2016).

Critical thinking also requires the development of critical awareness and reflectivity

(Dearnley and Meddings, 2007), which enhance learning and achievement through improved self-efficacy (Credé and Phillips, 2011). The concept that students benefit from engagement in self-assessment and monitoring is commonly recognised within the adult learning literature (Sadler, 2005). Effective self-assessment requires students to deconstruct an event, make a judgement, reflect on their understanding of the situation and evaluate appropriate responses, thereby cultivating skills required for professional practice (Hendricson et al., 2006; Mould et al., 2011).

Learning to evaluate one's practice and competence is essential for midwifery students as they prepare to become autonomous practitioners with increasing accountability for decision making (Kitson-Reynolds and Rogers, 2013). However, teaching practices in most midwifery pre-registration programs tend to focus on the attainment and assessment of theoretical knowledge and clinical skill development. Limited attention is given to strategies that facilitate and measure cognitive skill development in practice (Lake and McInnes, 2012).

Given the importance of developing and measuring critical thinking in midwifery practice, and the value of utilising self-assessment by students, the current study reports on the development and testing of a tool designed for pre-registration midwifery students to self-assess their critical thinking skills in practice.

## **Research questions**

1. To what extent is the draft tool reliable and valid for self-assessment of critical thinking in practice by pre-registration midwifery students?
2. What is the level of students' critical thinking in practice?

## **Methods**

### **Design**

A staged model was used for tool development and tested using a descriptive cohort design.

### **Setting**

The Bachelor of Midwifery program at Griffith University reflects a social emancipatory model of a transformative education philosophy. Transformational learning involves contextualised learning where students are enabled to claim and develop their own ways of knowing, critically assessing themselves and their practice (McAllister, 2005; McAllister et al., 2007).

In line with the Australian Qualifications Framework (Level 7 – Bachelor Degree) one of the core aims within the Bachelor of Midwifery program is to facilitate the development of student's cognitive and creative skills to exercise critical thinking and judgement in identifying and solving problems with intellectual independence (Australian Qualifications Framework Council, 2013).

The clinical component of the three-year Bachelor of Midwifery program, requires students to be placed at one primary site for the duration of their degree. Students complete around 1,800 hours of clinical practice, in a continuous model rather than traditional block placements. Students' clinical learning is facilitated by midwifery preceptors (working in hospitals or private midwifery practices) supported by university-employed onsite practice lecturers.

### **Participants**

Inclusion criteria were students ( $n = 164$ ) enrolled in any year of the Bachelor of Midwifery program who had completed at least one semester of clinical placement. All potential students had undertaken clinical placements ranging from 280 hours (1<sup>st</sup> year) up to 1,800 hours (3<sup>rd</sup> year). As the main purpose of this study was to test the newly developed tool it was considered important to include all students to elicit a range of practice levels and potential critical thinking abilities.

### **Sample size calculation**

Generally, in tool development research, a recommended minimum participant to item ratio of 5:1 is acceptable (Gorsuch, 1983; Hatcher, 1994), with a minimum of 100 subjects, regardless of the number of items (Gorsuch, 1983). Our sample size calculation recommended a sample of 116 in order to achieve a 95% confidence level with a 5% margin of error (Raosoft, 2004).

### **Ethical considerations**

Ethical approval was attained through the Human Research Ethics Committee of Griffith University. Students were informed about the aim of the study, and that completion of the survey implied consent. Students were also informed that participation was voluntary; and results would be reported in group aggregate form.

## **Instrument development**

We followed a staged model for tool development that involved item generation; mapping of draft items to critical thinking concepts to test content validity and expert review; pilot testing of the tool and items to a convenience sample of students; and psychometric testing (DeVellis, 2017).

## **Literature review and generation of item pool**

The generation of items occurred firstly from an extensive review of the literature to establish relevant conceptual domains and content. An examination of the National Competency Standards for the Midwife (ANMC, 2006) was also undertaken. We also developed items that reflected midwifery philosophy and practice based on a midwife-woman partnership where informed choice and shared decision making is fundamental to care (Australian College of Midwives, 2011; Renfrew et al., 2014).

## **Content validity**

A two stage process was used to establish content validity. Firstly, draft items were reviewed by two experienced midwifery researchers (PhD qualified, extensive publication record, PhD supervisors) and an experienced midwifery practitioner (more than 10 years providing midwifery continuity of care). Secondly, a process of mapping draft items to the consensus definition of critical thinking in nursing developed by Scheffer and Rubenfeld (2000) occurred. This process aimed to ensure that all core concepts of critical thinking were represented. The mapping of items was then verified by the two midwifery researchers. An example of mapping for four of the 25 items is provided in Table 6.1. The wording of items was further refined in minor ways according to feedback received. Further enhancement of item wording and development of new items occurred following mapping to ensure all domains of critical thinking were addressed.

A decision was made to use a six point Likert scale of 1 = strongly disagree to 6= strongly agree (Stage 3). The use of a six-point response option prevents equivocation (DeVellis, 2017).

## **Expert review**

Scale items were reviewed by a panel of experts to establish content validity. The panel consisted of eleven members, nine of whom were midwifery academics/practice lecturers and two clinicians undertaking doctoral studies. There is some controversy in the literature



regarding the number of experts required to undertake a review, with recommended numbers ranging between 2-20 (Gable and Wolf, 1993; Walz et al., 1991). Rather than focus on the number of experts, we chose experts with the desired expertise and diversity of knowledge (Grant and Davis 1997). As the tool aimed to measure critical thinking in midwifery practice, our experts had a variety of clinical experiences gained over a considerable time (8-31 years), as well as academic expertise (1-15 years) and understanding of critical thinking concepts.

To ensure congruity between concepts and item content domains, panel members were provided with a verbal overview of the conceptual basis for the instrument (Grant and Davis, 1997). This discussion outlined a definition of critical thinking and translation of critical thinking into midwifery practice. The panel were also briefed on the purpose of the study, and provided with instructions regarding completion of the expert review survey and the Content Validity Index (CVI). The expert panel members were asked to rate the relevance of each item in measuring critical thinking in midwifery practice on a four point Likert scale of 1 = not at all relevant to 4 = highly relevant (DeVellis 2017). Panel members also evaluated the clarity and conciseness of each item and suggest alternative wording if necessary.

Table 6.1: Example of mapping items to habit of mind and skills in consensus definition of critical thinking in nursing 1

Habits of Mind and Skills of Critical Thinking in Nursing	Examples of four items from the draft tool			
	I often instinctively know what type of care is right for a woman	If problems arise when caring for a woman I always try to seek the root cause	I question the 'unwritten rules' in midwifery practice that are not evidence-based	I can provide the rationale for following (or departing from) established guidelines and policies
Scheffer and Rubenfeld (2000).				
<b>Confidence</b>			<b>X</b>	<b>X</b>
<b>Contextual perspective</b>	<b>X</b>			<b>X</b>
<b>Creativity</b>	<b>X</b>			
<b>Flexibility</b>				
<b>Inquisitiveness</b>		<b>X</b>		
<b>Intellectual Integrity</b>				
<b>Intuition</b>	<b>X</b>	<b>X</b>		
<b>Open-mindedness</b>				
<b>Perseverance</b>		<b>X</b>	<b>X</b>	
<b>Reflection</b>		<b>X</b>		
<b>Applying Standards</b>			<b>X</b>	
<b>Discriminating</b>				<b>X</b>
<b>Information Seeking</b>				
<b>Logical Reasoning</b>		<b>X</b>	<b>X</b>	<b>X</b>
<b>Predicting</b>		<b>X</b>		<b>X</b>
<b>Transforming Knowledge</b>	<b>X</b>	<b>X</b>		<b>X</b>

## **Results of expert review**

The CVI was calculated from the percentage of total items judged to be valid by receiving a score of 3 or 4 (Grant and Davis, 1997). For a panel of 10 or more experts a CVI above 0.73 was considered valid (Lynn, 1986). In the current study, item CVI scores ranged from 0.82 to 1, with all of the 25 items achieving a CVI above 0.73, therefore no items were removed. The CVI score for the total scale (average item CVI) was 0.97, representing good content validity. All written comments related to clarity of items were analysed. Any suggested alternative wording proposed by an expert was considered by the researchers and the item revised. Following the expert review, the draft tool had 25 items within the two domains of “habits of mind” and “skills” in critical thinking, and was ready for pilot testing.

## **Construct validity**

Inclusion of other validated scales measuring similar concepts can be used to test construct validity (DeVellis, 2017). A literature search related to critical thinking identified the Motivated Strategies for Learning Questionnaire (MSLQ) (OERI/DE, 1991). The MSLQ is an 81-item self-report instrument comprising of fifteen subscales that assess both student motivation to engage with learning, and learning strategies used (Credé and Phillips, 2011). The subscales can be used collectively or singularly. We selected and administered a MSLQ subscale of five items on critical thinking with the authors' permission. These items relate to applying previous knowledge to new situations in order to solve problems, reach decisions, or make critical evaluations with respect to standards of excellence (Credé and Phillips, 2011). This sub-scale has a satisfactory Cronbach's Alpha of 0.80 (Garcia Duncan and McKeachie, 2005).

## **Survey and psychometric testing**

### **Procedure for data collection**

Paper copies of the survey and information sheet were distributed to students during tutorial sessions of clinical courses during October 2016. A link to the online version of the survey and information sheet was also posted on clinical course sites for students who did not attend the tutorial. Students were requested to complete the tool and assess their own critical thinking skills in practice. Consent was implied through completion of the survey. Completed paper surveys were placed in a sealed envelope. Students were informed that the survey was anonymous

## **Approach to analysis**

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) 24.0 (2016) personal computer version. The Cronbach's alpha coefficient was used to assess internal consistency. The tool was analysed according to inter-item correlation, and principal components analysis (PCA) with varimax rotation and exploratory factor analysis. An evaluation of each subscale extracted from the factor analysis was conducted. Total and subscale scores were calculated. Correlations between factor scores and total scale score as well as the item-subscale correlations were assessed using Pearson's correlation. Descriptive statistics were used to analyse characteristics of the sample. An alpha level of 0.05 was used for all statistical tests.

## **Findings**

### **Participant characteristics/sample**

The sample consisted of 126 (out of 164) students giving a response rate of 76.8%. The mean age of participants was 30.4 years (SD = 8.4, range 18 and 58 years). Nearly forty percent of respondents were first year students (38.1%), 34.9 % were in second year and 27% in third year. Almost thirty percent held a previous Bachelor's Degree (29.4%) and 9.5% had postgraduate qualifications in disciplines other than midwifery.

### **Findings of item analysis**

All items had positive item-total correlation coefficients (Table 6.2). Corrected item-total correlations ranged between 0.31 and 0.69, therefore no items were removed (DeVellis, 2017).

### **Findings of construct validity**

The scale demonstrated good sampling adequacy for factor analysis. The Kaiser-Meyer-Olkin (KMO) value was 0.87, exceeding the recommended value of 0.6 (Kaiser, 1974) and Bartlett's Test of Sphericity reached statistical significance (Chi-square = 1658.753,  $p < 0.001$ ) indicating patterned relationships between items and that factor analysis was appropriate.

Principal components analysis revealed the presence of six components with eigenvalues exceeding 1 explaining 66.3% of variance. Coefficients  $< 0.3$  were suppressed. All items had high communalities therefore none were excluded. However, an inspection of the screeplot

revealed four main factors which aligned with the conceptual model. Examination of the component matrix identified split loading of items in factor five and six, with the highest loading in other factors.

A repeated factor analysis specifying four factors, explained 57.5% of the variance. The Bartlett's test of sphericity ( $\chi^2 = 1658.753$   $p < 0.001$ ) showed patterned relationships between the items. The four components had eigenvalues exceeding 1, explaining 36.18%, 9.17%, 7.23% and 4.98% of the variance respectively (Table 6.2).

The four factors were named according to the underlying construct: 'seeks information' (Factor 1); 'reflects on practice' (Factor 2); 'facilitates shared decision making' (Factor 3) and 'evaluates practice' (Factor 4). For items that were split loaded, allocation decisions were made based on the highest loading factor, apart from one item which had a very close split loading and a decision was made on a conceptual basis.

### **Internal reliability**

The coefficient alpha for the total scale was 0.92, demonstrating good internal consistency (DeVellis, 2017). Cronbach's alpha coefficient for the subscales ranged from 0.73-0.88 (see Table 6.2). Following the item analysis, evaluation of construct validity and reliability the tool was named Carter Assessment of Critical Thinking in Midwifery (CACTiM) – student version.

### **CACTiM (Student version) scores**

The mean total score for the CACTiM scale was 124.98 (SD = 12.58). The mean item score was 4.99 out of 6. This high item mean indicated that overall students agreed that their practices reflected a reasonably high level of critical thinking in practice. Table 6.3 presents a summary of the mean scores and valid percentages for all items.

Table 6.2: Item, factor, and subscale analysis summary of the CACTiM (Student version) scale

Factor	Factor title	Item Analysis				Construct validity (factor analysis)			Internal reliability Cronbach's $\alpha$
		Number of Items	Corrected item total correlation	Corrected item sub-scale correlation range	Subscale – total correlation	Eigenvalue	% explained variance	Loading range	
1	Seeks information	7	0.51-0.60	0.45-0.72	0.87	9.05	36.18	0.34-0.78	0.82
2	Reflects on Practice	7	0.55-0.69	0.52-0.78	0.80	2.30	9.17	0.42-0.83	0.87
3	Facilitates shared decision making	5	0.54-0.67	0.66-0.79	0.76	1.80	7.23	-0.54- -0.85	0.88
4	Evaluates practice	6	0.31-0.65	0.34-0.55	0.81	1.24	4.98	0.43-0.69	0.73

**Table 6.3: Student responses on each item and item means**

Factors and items	Strongly Disagree n (%)	Disagree n (%)	Tend to Disagree n (%)	Tend to Agree n (%)	Agree n (%)	Strongly Agree n (%)	Item mean score (SD)
<b>Factor 1 – Seeks Information</b>							
I explore multiple solutions to a given situation			8 (6.3)	35 (27.8)	53 (42.1)	30 (23.8)	4.8 (0.9)
If problems arise when caring for the woman I always try to seek the root cause			6 (4.8)	29 (23.0)	50 (39.7)	41 (32.5)	5.0 (0.9)
I liaise and negotiate with colleagues at different levels about processes to optimise outcomes for the woman		2 (1.6)	14 (11.1)	28 (22.2)	46 (36.5)	36 (28.6)	4.8 (1.0)
I consult resources (e.g. literature, guidelines, etc.) to improve care for the woman			4 (3.2)	33 (26.2)	44 (34.9)	45 (35.7)	5.0 (0.9)
I seek clarification about interventions that appear inappropriate or unnecessary			3 (2.4)	18 (14.3)	50 (39.7)	55 (43.7)	5.3 (0.8)
Where needed, I negotiate a collaborative intervention plan with relevant health care providers	1 (0.8)	2 (1.6)	20 (15.9)	36 (28.6)	44 (34.9)	23 (18.3)	4.5 (1.1)
I question the ‘unwritten rules’ in midwifery practice that are not evidence-based	1 (0.8)	1 (0.8)	17 (13.5)	40 (31.7)	43 (34.1)	24 (19.0)	4.6 (1.0)
<b>Mean Item Score for Factor 1</b>							<b>4.85</b>
<b>Factor 2 – Reflects on Practice</b>							
I continually analyse my own strengths and limitations in skills, knowledge and experience			1 (0.8)	18 (14.3)	35 (27.8)	72 (57.1)	5.4 (0.8)
I evaluate my own practice and its effect on the woman and others			1 (0.8)	19 (15.1)	47 (37.3)	59 (46.8)	5.3 (0.8)
I address my own limitations in skills, knowledge and experience				15 (11.9)	44 (34.9)	67 (53.2)	5.4 (0.6)
I adjust my own practice based on feedback from the woman and others				10 (7.9)	51 (40.5)	65 (51.6)	5.4 (0.6)
I can recognise non-evidence based or non- woman centred practice by self and others			4 (3.2)	17 (13.5)	46 (36.5)	59 (46.8)	5.3 (0.8)
I recognise my own attitudes, biases and values and their potential impact on practice			2 (1.6)	12 (9.3)	48 (38.1)	64 (50.8)	5.4 (0.7)
I debrief with a professional colleague following complex situations to improve my practice		4 (3.2)	3 (2.4)	13 (10.3)	30 (23.8)	76 (60.3)	5.4 (0.7)
<b>Mean Item Score for Factor 2</b>							<b>5.37</b>

Factors and items	Strongly Disagree n (%)	Disagree n (%)	Tend to Disagree n (%)	Tend to Agree n (%)	Agree n (%)	Strongly Agree n (%)	Item mean score (SD)
<b>Factor 3 – Facilitates Shared Decision Making</b>							
I sequence care and education to meet the individual needs of the woman				17 (13.5)	50 (39.7)	59 (46.8)	5.3 (0.7)
I choose relevant literature and education strategies to facilitate the woman's decision making		1 (0.8)	2 (1.6)	28 (22.2)	52 (41.3)	43 (34.1)	5.06 (0.8)
I explore the woman's preferences of care and plan care accordingly				12 (9.5)	46 (36.5)	68 (54.0)	5.44 (0.7)
I share relevant evidence and clinical guidelines related to the woman's individual choices			4 (3.2)	27 (21.4)	55 (43.7)	40 (31.7)	5.0 (0.8)
I use evidence to plan care according to the woman's individual circumstances			2 (1.6)	24 (19.0)	63 (50.0)	37 (29.4)	5.1 (0.7)
<b>Mean Item Score for Factor 3</b>							<b>5.19</b>
<b>Factor 4 – Evaluates Practice</b>							
I often instinctively know what type of care is right for the woman		5 (4.0)	22 (17.5)	46 (36.5)	40 (31.7)	13 (10.3)	4.3 (1.0)
I apply knowledge from past experiences to present situations			5 (4.0)	21 (16.7)	55 (43.7)	45 (35.7)	5.1 (0.8)
I identify organisational/service improvement opportunities	1 (0.8)	2 (1.6)	21 (16.7)	37 (29.4)	49 (38.9)	16 (12.7)	4.4 (1.0)
I voice my concerns about non-evidence based or non-woman centred practices by self and others		4 (3.2)	12 (9.5)	47 (37.3)	48 (38.1)	15 (11.9)	4.5 (0.9)
I initiate professional dialogue around midwifery practice		2 (1.6)	7 (5.6)	42 (33.3)	57 (45.2)	18 (14.3)	4.7 (0.9)
I can provide the rationale for following (or departing from) established guidelines and policies	1 (0.8)	2 (1.6)	15 (11.9)	49 (38.9)	46 (36.5)	13 (10.3)	4.4 (0.9)
<b>Mean Score for Factor 4</b>							<b>4.58</b>



### **Factor 1: Seeks information**

This seven item factor had good internal reliability (Cronbach's alpha .82). The factor total mean score was 34.0 (SD = 4.6) out of a possible 42. The item mean for this factor was 4.85. An analysis of the relationship between the subscale information seeking and the CACTiM (Student version) revealed a strong positive correlation between this subscale and the total scale ( $r = .87$ ,  $p < .001$ ).

### **Factor 2: Reflects on practice**

This seven item factor had good internal reliability (Cronbach's alpha .87). The factor total mean score was 37.6 (SD = 4.1) out of a possible 42. This factor had the highest mean item score of 5.37. Correlation between this subscale and the total scale was strong ( $r = .80$ ,  $p < .001$ ).

### **Factor 3: Facilitates shared decision making**

This five item subscale had good internal reliability (Cronbach's alpha .88). The factor total mean score was 26.0 (SD = 3.1) out of a possible 30. The item mean for this factor was 5.19. A positive correlation was found between this subscale and the total scale ( $r = .76$ ,  $p < .001$ ).

### **Factor 4: Evaluates practice**

This six item subscale demonstrated lower internal reliability (Cronbach's alpha .73). Although values above 0.8 are preferred to ascertain reliability, values greater than 0.70 are an acceptable lower boundary for alpha coefficients (DeVellis, 2017, Nunnally, 1978). The factor total mean score was 27.5 (SD = 3.7) out of a possible 36. The item mean was 4.57. A strong positive relationship was demonstrated between this subscale and the total scale ( $r = .81$ ,  $p < .001$ ).

## **Motivated Strategies for Learning Questionnaire**

The mean total score for the 5 items in the MSLQ critical thinking sub-scale was 21.04 (SD = 4.21). The mean item score was 4.2. This item mean was lower than those within each CACTiM subscale. This may indicate that students do not apply critical thinking skills in their learning to the same degree they apply these skills to midwifery practice. Table 6.4 presents a summary of the mean scores and valid percentages for all items of the MSLQ.

The relationship between the MSLQ and the CACTiM (Student version) revealed a medium

positive correlation between the total scores of both scales ( $r = .32$ ,  $p < .001$ ). According to Cohen (1988) an  $r$  value between .30 and .49 indicates a medium effect.

## **Discussion**

The CACTiM (Student version) aimed to measure students' self-appraisal of their critical thinking skills in practice and was found to have good reliability and validity. Factor analysis revealed four factors which comprised of: 'seeks information', 'reflects on practice', 'facilitates shared decision making' and 'evaluates practice'. The CACTiM sub-scales were found to be internally reliable and theoretically and practically coherent.

### **Seeks information**

The items within this factor related to the gathering of data to inform clinical decisions. Five of the seven items involved collaboration with other health professionals through liaison, negotiation, consultation, clarification and questioning. These items acknowledge that midwifery care is not provided in isolation but is delivered within a collaborative framework that not only involves the woman and her family but other health professionals. The development of collaborative collegial relationships with other health professionals is an essential skill to optimise outcomes for women (ANMC, 2006; Skinner and Foureur, 2010). Successful collaboration involves open communication, cooperation, consultation and joint decision making to enable appropriate referral and ensure effective and safe care is provided (Cragin and Kennedy, 2006; NMBA, 2007). Sound collaborative practice is particularly important between midwives and obstetricians when complexities arise and a team approach to care is required (Skinner and Foureur, 2010; Downe et al., 2010). Yet tension due to differing opinions may exist and present a myriad of challenges affecting critical decisions related to care (Watson et al., 2012; Van Helmond et al., 2015). It is therefore crucial for student midwives to develop collaborative skills and respectful professional relationships to optimise care provided to women and their families.

**Table 6.4: Proportion of student responses on each item and item mean for MSLQ**

<b>Factors and items</b>	<b>Strongly Disagree n (%)</b>	<b>Disagree n (%)</b>	<b>Tend to Disagree n (%)</b>	<b>Tend to Agree n (%)</b>	<b>Agree n (%)</b>	<b>Strongly Agree n (%)</b>	<b>Mean Score (SD)</b>
<b>Motivated Strategies for Learning Questionnaire</b>							
I often find myself questioning things I hear or read in this program to decide if I find them convincing	7 (5.6)	18 (14.3)	19 (15.1)	40 (31.7)	33 (26.2)	9 (7.1)	3.8 (1.3)
When a theory, interpretation, or conclusion is presented in class or in the readings, I try to decide if there is good supporting evidence	1 (0.8)	7 (5.6)	15 (11.9)	55 (43.7)	38 (30.2)	10 (7.9)	4.21 (1.0)
I treat the course material as a starting point and try to develop my own ideas about it.	1 (0.8)	6 (4.8)	12 (9.5)	40 (31.7)	48 (38.1)	19 (15.1)	4.47 (1.1)
I try to play around with ideas of my own related to what I am learning in this program.	1 (0.8)	6 (4.8)	7 (5.6)	55 (43.7)	35 (27.8)	22 (17.5)	4.5 (1.0)
Whenever I read or hear an assertion or conclusion in this program, I think about possible alternatives.	1 (0.8)	9 (7.1)	19 (15.1)	52 (41.3)	36 (28.6)	9 (7.1)	4.11 (1.4)
<b>Mean Score for MSLQ</b>							<b>4.20</b>

One item involved the questioning of others' practices or 'unwritten rules' that often hinder evidence-based care. The use of 'unwritten rules' to guide midwifery practice is problematic. Generally, these rules have little scientific basis, are based on tradition rather than current evidence, and are often practiced by senior midwives (Hunter, 2005). Unwritten rules are founded on institutional etiquette and can quickly become the cultural norm of the organisation translated through individual preferences of the midwife (Hunter, 2005). Some midwives unquestioningly accept the unwritten rules and are often unaware their practice is out of date and ritualistic (Bluff, 2001; Cluett and Bluff, 2006). These rituals are often imposed on peers and students, and contribute to less than optimal care for women. The questioning of 'unwritten rules' and commitment to quality are vital critical thinking processes to ensure appropriate, evidence-based decisions related to midwifery care.

### **Reflects on practice**

The items within this factor represent the student's skills and abilities to reflect on, and analyse their own practice. These items assessed students' capacity to analyse their own practice, identify strengths and weaknesses and address these, consider the impact of current practices on others, and value reflection and debriefing with colleagues.

Within the consensus definition of critical thinking in nursing, reflection is considered an essential core component. Scheffer and Rubenfeld (2000) defined reflection as 'contemplation upon a subject, especially one's assumptions and thinking for the purposes of deeper understanding and self-evaluation' (p358). The items in this factor were designed to capture reflection in and on practice. Quality clinical placements provide students with a rich environment to develop critical thinking skills through reflection (Kennison, 2006). It could be argued that the development of critical thinking is not possible without reflection. Reflection promotes the likelihood of students improving their own thinking and action, and is often referred to as the highest level of metacognition within critical thinking (Facione, 2015).

Responses on 'Reflects on Practice' items scored the highest mean within the total scale. This high mean may be a direct consequence of learning and teaching strategies used in the Bachelor of Midwifery programme that focus on the development of reflective skills (Bass et al., 2016). Students are required to complete at least two written reflections per semester using a structured reflective framework. The Holistic Reflection Model has six integrated, inter-dependant stages designed to promote detailed critical reflection at a deeper personal

and holistic level (Bass et al., 2017).

### **Facilitates shared decision making**

This factor comprises of items unique to the profession of midwifery. Items relate to the ability of the midwife to explore and share evidence, clinical guidelines, and options of care with women to facilitate informed decision making. The concept of shared decision making is supported by the International Confederation of Midwives statement on Philosophy and Model Midwifery Care (ICM, 2014). Midwives are recognised as partners in care who promote the woman's self-determination, provide appropriate information and advice to facilitate participation, and enhance informed decision making (ICM, 2014). Shared decision making acknowledges the expertise that both parties bring to the discussion, including the midwife's knowledge of evidence, experience, and skills, as well as the woman's preferences, self-knowledge and experience (Young, 2012). This negotiated partnership and shared decision making adds a layer of complexity to midwifery decision making in practice.

Critical thinking can be viewed as a purposeful activity which enables effective decision making. Critical thinking involves a process of analysis, interpretation, evaluation, inference, explanation, and reflection (Facione, 1990; Hendricson et al., 2006). However, critical thinking in midwifery practice requires an additional element that incorporates the role of the midwife in facilitating shared decision making with childbearing women that then informs practice. Midwifery decision making is holistic and woman centred and requires considerable interpersonal negotiation skills and consideration of the woman's desires and choices (Davis-Floyd, 2004; Jefford et al., 2010a).

### **Evaluates practice**

Items within this factor relate to the student's ability to evaluate their own and others' practice in order to identify possible practice improvements. This factor scored the lowest mean, perhaps indicating that the items within this factor require the high critical thinking skills that develop over time. The lowest scoring item 'I often instinctively know what type of care is right for the woman' was designed to measure the critical thinking concept of intuition. Intuition is included within the nursing consensus definition of critical thinking as an 'insight sense of knowing without a conscious use of reason' (Scheffer and Rubenfeld, 2000, p358).

Incorporation of intuition within critical thinking is well suited to the midwifery paradigm which

embraces a variety of knowledges to holistically make clinical decisions and recognise the significance of childbirth as a life event (Siddiqui, 2005). Using intuition in decision making relies on an exquisite sensitivity to pattern recognition and heuristics based on prior experience (Steinhauer, 2015). When using intuition, rapid and unconscious judgments are made based on a variety of cues and past experiences (Steinhauer, 2015; Geraghty, 2015). Applying knowledge from past experiences is a recognised core component of critical thinking (Facione and Facione, 1996). The use of intuition in decision making is in the domain of an 'expert' who no longer consciously relies on formal analytical judgement processes, thereby enhancing clinical judgment and making fast decisions (Benner, 2001; Jefford et al., 2010b). Considering the high level of expertise required in intuition, the lower average mean for this item by students could be expected.

Another low scoring item within this subscale involved the identification of organisational/service improvements. This item was designed to measure students' ability to question and identify policy, practice or organisational improvements. This skill may be challenging for students as they often attempt to conform to the expectations and norms of the organisation (Begley, 2001). However, the identification of quality improvements is a vital component of safe midwifery care and a core component of critical thinking (Scheffer and Rubenfeld, 2000; Cronenwett et al., 2007). The introduction of an assessment item within curricula to encourage students to identify practice or organisation improvements may be useful to further develop these skills.

### **Implications for education, research, and practice.**

The CACTiM (Student version) is the first instrument specifically designed to enable students to appraise their critical thinking in midwifery practice. The tool has various possible uses and benefits. The items within the tool endeavour to reflect the multiple elements of critical thinking in midwifery practice. Thus, the simple act of students completing this tool affords them the opportunity to reflect on their own practice as well as providing explicit examples of critical thinking expected in midwifery practice. This examination of their own practice and increased awareness of the application of critical thinking skills in practice has the potential to not only improve critical thinking skills but also promote greater autonomy over their own learning. The elements of the tool may also be useful to guide midwifery lecturers in the design of learning and assessment opportunities that explicitly assist students' critical thinking development.

This tool could be used in the longitudinal measurement of critical thinking development throughout a midwifery education programme or as a single measure for midwifery graduates and midwives in practice. Further use of the tool could include tracking first year students' development of critical thinking through the degree. Currently, the focus of clinical assessment in most pre-registration programs is largely on the attainment and assessment of technical skill development (Lake and McInnes, 2012; ANMAC, 2014). The CACTiM (Student version) may facilitate and measure cognitive skill development in practice, identify areas of development and enable students and their lecturers to examine the transformation of these skills over time. The tool could also be used to test the effectiveness of teaching strategies and preparedness of graduates for practice.

In this study reliability and validity was established for the CACTiM (Student version) however, further research is required. The tool needs to be validated with a larger cohort of students from a variety of universities undertaking different curricula and working across different clinical environments. Further validation would facilitate comparisons within national and international contexts guiding the development of curricula and teaching strategies.

## **Limitations**

Although a response rate of 76.8% was considered adequate, students less interested/capable in critical thinking may not have participated. It may be that higher performing students felt more comfortable assessing their own critical thinking skills. It is also acknowledged that the sample was relatively homogenous with students recruited from one Australian University. Testing with large diverse samples of students is warranted. Around 30% of students already possessed a Bachelor's Degree which may have contributed to an inflated overall mean CACTiM total score. However, as the tool is specifically designed to measure critical thinking in midwifery practice, it is unknown whether critical thinking skills gained in a different degree influenced responses on this tool, and requires further investigation.

It was challenging to establish concurrent validity of this new tool due to the dearth of tools available that measure critical thinking in midwifery practice. An attempt was made to establish concurrent validity through the inclusion of 5 questions related to critical thinking from a subscale of the MSLQ. Although both the MSLQ sub-scale and the CACTiM (Student

version) are both designed to measure critical thinking the low correlation between the two scales was not surprising. The MSLQ measures students' critical thinking in their approach to learning, whereas the CACTiM scale is designed to measure the application of critical thinking skills in practice.

Although the use of tools by students to self-assess their own progress and learning is sound pedagogical practice, self-report may contribute to response bias. A more robust approach could include the collection of multiple forms of data (such as independent observation; feedback from women) to improve validity of the tool. Triangulation of data collected from this tool in conjunction with a similar tool that measures preceptors'/mentors' perceptions of students' critical thinking skills in practice is recommended. Further comparison of this data with students' accounts of their clinical practice through reflections would further improve this.

Even though a rigorous process was used to develop items, CACTiM may not fully encompass all aspects of critical thinking in midwifery practice. Further use of the tool with diverse samples is recommended.

## **Conclusion**

Critical thinking involves purposeful activity which enhances the effectiveness of decision making. Decision making in midwifery is a complex process that shapes and underpins clinical practice and influences the quality of care. Critical thinking is a fundamental skill for students to develop, facilitating their transition to competent autonomous midwifery practice. The measurement of critical thinking skill development should be embedded within midwifery curricula. Utilising a self-assessment tool can cultivate essential professional skills including critical awareness, decision making, critical thinking and enhance learning. This pilot study indicates that the CACTiM (Student version) is a reliable and valid measure of critical thinking skills in midwifery practice. This self-assessment tool could be utilised over time to measure critical thinking skill development and facilitate feedback on these skills. While the CACTiM measures students' perception of their critical thinking skills, a multimethod approach including triangulation of data would provide a more rigorous approach to measuring critical thinking in midwifery practice.



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## **Chapter Conclusions**

This study found that CACTiM (Student) was a reliable and valid tool to measure critical thinking in undergraduate midwifery students. Although self-assessment has noteworthy pedagogical benefits, it may be prone to subjectivity and response bias. To enhance the multi-method approach that includes the CACTiM (Preceptor/Mentor) and CACTiM (Student) to measure critical thinking in midwifery practice, a third measurement tool was required to provide a more objective assessment.

Through the process of exploratory factor analysis of items in the CACTiM (Student) tool, one of the factors that emerged was titled 'reflects on practice'. These items assessed students' capacity to evaluate and reflect on their own practice, identify their own strengths and limitations, and ways to address these. Intrinsic links and synergies between reflection and critical thinking were discussed in this paper, arguing that critical thinking is not possible without reflection. A decision was therefore made to develop a third tool that measures undergraduate midwifery students' application of critical thinking in reflective writing, which formed the next sequential study.

## **CHAPTER 7**

### **Critical Thinking Evaluation in Reflective Writing: Development and Testing of Carter Assessment of Critical Thinking in Midwifery (Reflection)**

#### **Chapter Overview**

A post-print copy of the publication forms Chapter 7 of this thesis. The references and formatting for this paper are presented in accordance with the requirements of *Midwifery*, in which this paper was published. Ethics approval was obtained for this study from Griffith University Human Ethics Committee - NRS/39/14/HREC (see Appendix A). The critical thinking assessment tool utilised in this study is included as Appendix P.

#### **Author contributions**

The paper is a co-authored paper. The bibliographic details of this co-authored paper, including all authors, are:

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Supervised by Professor Debra K. Creedy (Co-Principal Supervisor) and Associate Professor Mary Sidebotham (Co-Principal Supervisor) my contribution to the paper involved tool development including; review of the literature, development of draft items, mapping of draft items, and facilitation of expert review. My contribution also involved analysis of data, preparation of the manuscript for publication including journal submission and manuscript revisions prior to publication.

(Signed)

(Date) 30<sup>th</sup> October 2017

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## **Abstract**

**Objective:** Develop and test a tool designed for use by academics to evaluate pre-registration midwifery students' critical thinking skills in reflective writing.

**Design:** A descriptive cohort design was used.

**Sample:** A random sample ( $n = 100$ ) of archived student reflective writings based on a clinical event or experience during 2014 and 2015.

**Methods:** A staged model for tool development was used to develop a fifteen item scale involving item generation; mapping of draft items to critical thinking concepts and expert review to test content validity; inter-rater reliability testing; pilot testing of the tool on 100 reflective writings; and psychometric testing. Item scores were analysed for mean, range and standard deviation. Internal reliability, content and construct validity were assessed.

**Findings:** Expert review of the tool revealed a high content validity index score of 0.98. Using two independent raters to establish inter-rater reliability, good absolute agreement of 72% was achieved with a Kappa coefficient  $K = 0.43$  ( $p < 0.0001$ ). Construct validity via exploratory factor analysis revealed three factors: 'analyses context', 'reasoned inquiry', and 'self-evaluation'. The mean total score for the tool was 50.48 ( $SD = 12.86$ ). Total and subscale scores correlated significantly. The scale achieved good internal reliability with a Cronbach's alpha coefficient of .93.

**Conclusion:** This study established the reliability and validity of the CACTiM (reflection) for use by academics to evaluate midwifery students' critical thinking in reflective writing. Validation with large diverse samples is warranted.

**Implications for practice:** Reflective practice is a key learning and teaching strategy in undergraduate Bachelor of Midwifery programmes and essential for safe, competent practice. There is the potential to enhance critical thinking development by assessing reflective writing with the CACTiM (reflection) tool to provide formative and summative feedback to students and inform teaching strategies.



## Introduction

Teaching critical thinking is an essential component in any academic programme, particularly within health disciplines, such as midwifery, where clinical decision making is paramount. Critical thinking involves a disciplined, self-directed and purposeful thinking process that encompasses 'thinking about your thinking' in an effort to improve decisions and actions (Paul, 1993; Facione, 1990; Scheffer and Rubenfeld, 2000). Critical thinking has also been described as a process of reflective thinking where the focus is to determine action or change of thought (Ennis, 1987). The action following the thinking process is a crucial component of critical thinking (Paul, 1993) with critical thinking considered as the 'metaphorical bridge' between information and action (Rubenfeld and Scheffer, 2015).

To address the need for a discipline specific definition of critical thinking in nursing, a Delphi study was conducted by Scheffer and Rubenfeld (2000). The consensus definition comprised of ten habits of mind (affective components) and seven skills (cognitive components) (Scheffer and Rubenfeld, 2000). To date there has not been a consensus definition of critical thinking in midwifery.

Critical thinking is essential in making safe, evidence based and efficient clinical decisions using a process of intentional higher order thinking (Ashcraft, 2010). Best practice midwifery involves working autonomously providing continuity of care to a defined group of women (Hodnett, 2008), and midwives are increasingly taking on such roles. This increased autonomy for midwives coupled with uncertainty regarding 'best practice' in many clinical situations, require well-developed critical thinking skills to facilitate the provision of safe, woman centred and evidenced based midwifery practice (Carter et al., 2014; Lake and McInnes, 2012; Scholes et al., 2012;). Despite the recognition of the importance, teaching and cultivating critical thinking skills remains a significant challenge for nursing and midwifery education programmes (Mun, 2010).

The concept of critical thinking is intrinsically linked to reflection as both processes involve reflective thought and action. Reflective practice is an important component in the development of a self-aware, skilled, engaged autonomous midwifery practitioner (Bass et al., 2016, Gallagher et al., 2017). In his seminal work on reflection, Schön (1995) suggests that reflective practice promotes a heightened consciousness of a practitioner's implicit knowledge and learning from their experience. The act of reflection involves purposeful

thinking in the form of contemplation of thoughts, feelings and experiences related to a specific event (Kennison and Misselwitz, 2002). Schön (1995) identified a two-step process of reflection involves 'reflection-in-action' (thinking while doing), and 'reflection-on-action' (after the event thinking).

Reflective writing as a pedagogical strategy promotes 'reflection on action' where students are encouraged to review, analyse and evaluate a situation or experience. Using writing as an instrument to facilitate reflection, reflective writing assists students undertake deep learning from clinical experiences. During the process of reflective writing, students challenge and integrate their thoughts, feelings, assumptions, and experiences with theoretical content and evidence, and develop a deeper understanding of the situation, their actions and thoughts (Kennison and Misselwitz, 2002; McGuire et al., 2009; Schön, 1995; Scheffer and Rubenfeld, 2000). When purposeful reflection occurs on meaningful experiences critical thinking is cultivated (Kennison, 2003).

Reflection is a central element within the consensus definition of critical thinking in nursing (Scheffer and Rubenfeld, 2000). A rich clinical learning environment provides an ideal context to promote critical thinking skills. Students' reflection on their experiences in the clinical placement environment can develop critical thinking skills, foster self-awareness and understanding, and improve clinical practice (Naber et al., 2014; Craft, 2005; Kennison, 2006). Therefore, reflective writing is an ideal medium to evaluate and measure the development of critical thinking skills.

The development of critical thinking and reflection are endorsed and required by midwifery regulatory bodies internationally (NMBA, 2010; NMC, 2015). Yet, the efficacy of teaching strategies to develop critical thinking and the measurement of its' development remains unclear. Carter et al. (2015) found an absence of specific measurement tools used to evaluate critical thinking skill development in midwifery in their recent systematic review.

Another systematic review examining the efficacy of teaching strategies on critical thinking skills found inconsistencies between studies often when the same teaching strategy or measurement tool was utilised (Carter et al., 2015; Carter et al., 2016). One study included in the review utilised nursing students' reflective writing to improve and develop critical thinking skills (Naber and Wyatt, 2014). The reflective writing intervention was conducted over an eight-week period, but was not associated with increases in students' critical thinking

scores on the California Critical Thinking Skills Test (CCTST) and California Critical Thinking Disposition Inventory (CCTDI). It could be that eight weeks was not long enough to develop complex levels of thinking. However, it could also be that the use of standardised tools that measure formal logic and general critical thinking skills are unsuitable to measure improvement in critical thinking in reflection. The use of standardised general critical thinking tools (such as CCTST, CCTDI and the Health Service Reasoning Tool) have produced contradictory results when applied to the context of nursing and midwifery and may be inappropriate (Carter et al., 2015; Carter et al., 2016). Specific tools are required to measure critical thinking applied to midwifery practice.

Recognising that a reliable tool to evaluate reflective writing for evidence of critical thinking was lacking, Kennison (2006) developed the Critical Thinking Scale (CTS). The authors established content validity through expert view of draft items, concurrent validity through positive correlations with the CCTST, and inter-rater reliability (Kennison, 2003; Kennison, 2006). However, no internal reliability testing or factor analysis was undertaken. The items in this tool were reviewed and found to be not relevant to midwifery practice.

Given the importance of developing critical thinking skills and reflection in midwifery practice, and synergies between the two, the current study reports on the development and psychometric testing of a tool designed to measure critical thinking skills in reflective writing for pre-registration midwifery students.

## **Research questions**

1. To what extent is the draft tool reliable and valid in measuring critical thinking in midwifery students' reflective writing?
2. What is the level of midwifery students' critical thinking evident in their reflective writing?

## **Methods**

### **Design**

A staged model was used for tool development, and tested using a descriptive cohort design.

### **Setting**

The three-year degree Bachelor of Midwifery, commenced in 2010 using an educational

framework of transformational learning. Transformational learning promotes a context of learning where students are inspired to discover their own ways of knowing, and to critically evaluate and reflect on themselves and their practice (McAllister, 2005; McAllister et al., 2007). Within a woman-centred philosophy, the programme focuses on the development of reflective practice and critical thinking, with teaching, learning and assessment strategies scaffolded throughout the three years.

Students undertake approximately 1,800 hours of clinical placement in one organisation for the duration of the degree. The integrated clinical placement model requires students to undertake two to three shifts per week, enables them to consolidate learning in one organisation, and develop meaningful relationships with known preceptors and practitioners.

Midwifery students are also required to complete three structured reflections related to their clinical experiences per semester. Reflections are recorded in an online e-portfolio and feedback provided by midwifery lecturers. Feedback concentrates on (1) the development of reflective writing and skills, as evidenced by focussed and deep reflection, (2) challenging students' assumptions, and (3) providing supportive encouragement. Students utilised the Bass Model of Holistic Reflection (Bass et al., 2017), specifically designed to reflect the holistic nature of midwifery practice. The model comprises of six inter-dependent phases; self-awareness, description, reflection, influences on knowing, evaluation and learning (Bass et al., 2017). Students receive guidelines and prompts for each phase of the model, to encourage the development of reflection and transformational learning (Bass et al., 2017).

The Bass Model of Holistic Reflection assists midwifery students to progressively develop deep personal and transformative learning through the skills of reflection and reflexivity (Bass et al., 2017). A structured model was chosen, not to confine students' reflexivity, but to guide and support students to articulate their experiences as novice practitioners within a holistic framework and foster continued use of reflection as registered midwifery practitioners (Bass et al., 2017; Johns, 2002; McGrath and Higgins, 2006).

## **Sample**

The sample consisted of previously submitted, archived reflective writing submissions within an electronic portfolio by students during the 2014 and 2015 academic years. Each reflective writing piece is based on a clinical, personal or professional experience. Inclusion criteria for the current study consisted of reflective writing based on clinical events or experiences.

In order to select a random sample from the large pool of reflections available, a research assistant chose one reflection from every second student's portfolio and briefly assessed whether the reflection met the inclusion criteria. Data were collected over a two-month period in 2016.

### **Sample size calculation**

Calculation of the sample size used subject to item ratio. Costello and Osbourne (2005) suggests that for scale development, the number of items in the initial pool should be utilised, rather than the number of items retained in the final tool. The original tool contained 19 items and using a minimum participant to item ratio of 5:1, a sample size of 100 was acceptable (Gorsuch, 1983; Hatcher, 1994). Gorsuch (1983) suggests that a minimum of 100 subjects, regardless of the number of items is acceptable in tool development research.

### **Ethical considerations**

Ethical approval was given by the Human Research Ethics Committee of Griffith University, Australia. Archived student reflections were de-identified prior to assessment with the draft tool.

### **Instrument development**

A staged model of tool development as suggested by DeVellis (2017) was utilised. Stages involved: item generation through an extensive review of the literature; mapping of draft items to critical thinking concepts to test content validity, expert review to test content validity; inter-rater reliability testing; pilot testing of the tool and items on the sample of archived reflections; and psychometric testing of the tool.

### **Literature review and generation of item pool**

Item generation was initiated through an extensive review of the literature to establish relevant conceptual domains and item content. The review revealed the Critical Thinking Scale (CTS), a teacher-accessible tool designed to measure the critical thinking of baccalaureate nursing students' reflective writing (Kennison, 2006). The author gave permission to assess the relevance and applicability of the CTS to the midwifery context. After a thorough examination of items and expert review, it was determined that the scale items did not reflect the unique holistic nature of midwifery practice and decision making. However, review of tool items guided the development of new items.

Secondly, the Australian National Competency Standards for the Midwife (NMBA, 2010) were reviewed to ensure draft items aligned with the conceptual basis of contemporary midwifery practice. Thirdly, the Holistic Model of Reflection (Bass et al., 2017) and related resources (guidelines and prompts students, conceptual framework and marking rubric) were also examined to ensure items reflected the application of critical thinking concepts within reflection. Items were developed to reflect the holistic and woman-centred nature of midwifery practice, incorporating women's desires and choices and the facilitation of shared decision making which then informs practice (Carter et al., 2017; Davis-Floyd, 2004; Jefford et al., 2010).

### **Content validity**

To establish the degree each item is representative of the theoretical content domain of a construct (Nunnally and Bernstein, 1994), a two-staged approach to content validity was employed. Draft items were reviewed by two experienced midwifery researchers (PhD qualified, extensive publication record, PhD supervisors). The draft items were mapped against the consensus definitions of the habits of the mind and skills of critical thinking in nursing (Scheffer and Rubenfeld, 2000). The mapping served as a confirmatory process to ensure that the core concepts of critical thinking were reflected in the draft items. Two expert midwifery researchers verified the mapping process. Further enhancement of mapping, rewording of items and development of new items occurred following feedback.

A five point Likert scale of 1 = not at all, 2 = very limited, 3 = to some extent, 4 = to a considerable extent and 5 = to a great extent was chosen as the response format on the draft tool. A five point Likert scale ensures the response categories were meaningful. There was no concern about the need for equivocation as the validation process was being undertaken by trained personnel.

### **Expert review**

Content validity was established by a panel of experts who reviewed the item pool. The expert review panel consisted of eleven members, nine of whom were midwifery academics, one nursing academic and one clinician undertaking doctoral studies. Disparity exists in the literature in respect to the number of experts required for this process. Recommendations range between involving two to 20 experts (Gable and Wolf, 1993; Walz, et al., 1991), whereas Grant and Davis (1997) suggest the focus should be on the level and diversity of knowledge required. Using a larger pool of experts may generate more information about

the measure (Rubio et al., 2003). We chose experts with considerable breadth of academic and clinical skills and understanding of critical thinking and reflection. The mean length of time as a midwife was 23.3 years (range 9-32), with a mean of 8.9 (1.5-14 years) as an academic.

Panel members were briefed on the conceptual basis of the instrument, including discussion of critical thinking definitions and translation into midwifery practice. Panel members were instructed on how to complete the expert review survey using a four point scale of 1= not at all relevant to 4 = highly relevant and how the content validity index (CVI) would be calculated. Use of the CVI is a widely accepted practice and involves a team of experts rating each item on a scale to assess congruent with (or relevance to) the construct (Polit and Beck, 2006). Experts were also asked to comment on the clarity of items, identify any complex or ambiguous phrases, and suggest any alternative wording where appropriate.

### **Results of expert review**

The CVI was calculated from the percentage of total items with scores of 3 or 4 and hence considered to be valid (Grant and Davis, 1997). Lynn (1986) suggests for an expert panel with 10 or more expert members a CVI above 0.73 is deemed valid. In our study, at least eight of the eleven experts' rating had to be three or four for a minimum score of 0.73 for each item. The CVI scores ranged from 0.9 to 1, with a total index score of 0.98, indicating good content validity of items. Written comments by experts were analysed and considered by the researchers. In accordance with feedback the wording of six items was altered to enhance clarity and strengthen conceptual relevance. The expert review panel suggested that four items, although relevant to critical thinking may not always be included in reflective writing, and were removed. The draft tool contained 15 items designed to measure critical thinking in reflective writing.

### **Inter-rater reliability**

To assess the degree to which raters' scores correspond with each other (DeVellis, 2017) a research assistant and two of the researchers discussed in detail; the definition of critical thinking and application in midwifery practice; the conceptual framework of the tool; and meaning of each item. The tool was then used by the research assistant and one of the researchers to assess one reflective writing piece. Application of the tool was discussed. Formal inter-rater reliability was then performed for five reflective writings by the two raters, scores for each item applied to each written piece were then compared. Good absolute

agreement, where both raters gave the same rating for each item, was achieved at 72%. The Kappa coefficient indicated moderate agreement with  $K = 0.43$  ( $p < 0.0001$ ).

## **Piloting and psychometric testing of tool**

### **Procedure for data collection**

Student's reflective writing submissions were accessed through the online e-portfolio. Reflective pieces that met the inclusion criteria were assessed by a trained assessor and data were entered directly into a SPSS database.

### **Approach to analysis**

The Statistical Package for the Social Sciences (SPSS) 24.0 (2016) personal computer version was utilised to analyse data. Internal consistency was assessed using Cronbach's alpha coefficient. Analysis and testing of the draft tool included calculation of inter-item correlation, and principal components analysis (PCA) with varimax rotation and exploratory factor analysis. The eigenvalues and scree plot were used to determine the number of factors to retain. Each subscale was evaluated, total and subscale scores were calculated and correlated using Pearson's correlation. An alpha level of 0.05 was used.

## **Findings**

### **Sample of reflective writing**

The sample consisted of archived reflective writings (between 2014 and 2015) where students had reflected on a clinical event. All reflective writings were de-identified prior to examination. Of the randomly chosen pieces, 19% were written by students in first year, 46% in second year and 35% in 3<sup>rd</sup> year of the programme.

### **Findings of item analysis**

On examination of the fifteen items, positive item-total correlations coefficients were found (Table 7.1). Internal consistency using corrected item-total correlations ranged between 0.54 and 0.77. Accordingly, no further items were removed (DeVellis, 2017).

### **Findings of construct validity**

The suitability of data for factor analysis was assessed revealing a Kaiser-Meyer-Olkin (KMO) value of 0.89, well above the recommended value of 0.6 (Kaiser, 1974), with the Bartlett's Test of Sphericity reaching statistical significance (Chi-square = 1242.207,  $p$



<0.001).

Principal components analysis determined the factor structure of the scale. Using and eigenvalue value cut-off as 1.0, there were three factors that explained a cumulative variance of 72.9%. An inspection of the screeplot revealed a clear break after the third component and confirmed retaining three factors (Table 7.2). Coefficients < 0.3 were suppressed. All items had high communalities, ranging from 0.52 and 0.86 and retained.

The three factors were named according to conceptual intent and construct: 'analyses context' (Factor 1); 'reasoned inquiry' (Factor 2); and 'self-evaluation' (Factor 3). Three items were cross loaded across two factors, this occurs when an item loads at .32 or higher on two or more factors (Costello and Osborne, 2005). These items were allocated to the factor with the highest loading and/or congruent from a conceptual and practical perspective.

### **Internal reliability**

The scale demonstrated good internal consistency with a Cronbach alpha coefficient of 0.93, with values great than 0.7 being ideal (DeVellis, 2017). The Cronbach's alpha coefficient for each subscale ranged between 0.77 and 0.91 (see Table 7.1). Following confirmation of the internal reliability and construct validity of the tool it was named Carter Assessment of Critical Thinking in Midwifery (Reflection) (CACTiM- Reflection).

**Table 7.1: Item, factor, and subscale analysis summary of the CACTiM (Reflection) scale**

Factor	Factor title	Item Analysis				Construct validity (factor analysis)			Internal reliability Cronbach's $\alpha$
		Number of Items	Corrected item total correlation	Corrected item sub-scale correlation range	Subscale – total correlation	Eigenvalue	% explained variance	Loading range	
1	Explores context	6	0.61-0.77	0.72-0.82	0.89	8.12	54.13	0.62-0.92	0.91
2	Reasoned inquiry	6	0.63-0.76	0.62-0.84	0.90	1.74	11.57	-0.92-0.53	0.90
3	Self-evaluation	3	0.55-0.75	0.57-0.67	0.79	1.08	7.20	0.35- -0.70	0.78

### **CACTiM (Reflection) scores**

The mean total score for the CACTiM (reflection) scale was 50.48 (SD 12.86) out of a possible 75. The mean item score was 3.37 out of 5. Higher scores were interpreted to indicate higher levels of critical thinking. Table 7.2 presents a summary of mean scores and valid percentages for all items.

#### **Factor 1: Explores context**

This six-item subscale demonstrated good internal reliability with a (Cronbach's alpha of .91). The factor total mean score was 21.5 (SD = 5.49) out of a possible 30. The item mean for this factor was 3.6. A strong positive correlation was found between this subscale and the total CACTiM (Reflection) scale ( $r = .89, p < .001$ ).

#### **Factor 2: Reasoned inquiry**

This six-item subscale also demonstrated good internal reliability with a Cronbach's alpha of .90. The factor total mean score was 18.8 (SD = 6.7) out of a possible 30. The item mean for this factor was 3.1, being the lowest mean of the three factors. Correlation between this factor's subscale score and the total scale indicated a strong correlation ( $r = .90, p < .001$ ).

#### **Factor 3: Self-evaluation**

This three-item subscale demonstrated adequate internal reliability (Cronbach's alpha .78), which may be explained by the lower number of items (Cronbach, 1951, Voss et al., 2000). The factor total mean score of was 10.2 (SD = 2.5) out of a possible 15. The item mean for this factor was 3.4. A positive correlation was found between this subscale and the total scale ( $r = .79, p < .001$ ).

**Table 7.2: Rater responses on each item and item means**

<b>Factors and items</b>	<b>Not at all %</b>	<b>Very Limited % n =100</b>	<b>To some extent %</b>	<b>To a considerable extent %</b>	<b>To a great extent %</b>	<b>Item mean Score (SD)</b>
<b>Factor 1 – Explores context</b>						
1. Identifies the significance of the topic or situation being reflected on		5	34	39	22	3.8 (0.8)
2. Demonstrates insight into the need to provide individualised care to the woman	6	13	20	24	37	3.7 (1.3)
3. Investigates the root cause of problems that arose in the situation or explains enabling factors that lead to a positive outcome	2	8	41	29	20	3.6 (1.0)
4. Examines perspectives of woman and others involved in situation	4	11	27	25	33	3.7 (1.2)
5. Recognises the impact of own attitudes, biases and values pertinent to the situation on the care provided	9	12	32	32	15	3.3 (1.1)
6. Evaluates own practice and its effect on the woman and others	8	11	31	31	19	3.4 (1.2)
<b>Mean Item Score for Factor 1</b>						<b>3.6</b>

Factors and items	Not at all %	Very Limited % n =100	To some extent %	To a considerable extent %	To a great extent %	Item mean Score (SD)
<b>Factor 2 – Reasoned inquiry</b>						
7. Identifies and examines appropriateness of clinical procedures and practice	2	6	40	36	16	3.6 (0.9)
8. Accurately applies the literature pertinent to situation	19	10	29	19	23	3.2 (1.4)
9. Critically analyses the quality of the literature and its' relevance to the individual woman's situation	41	7	19	14	19	2.6 (1.6)
10. Explores alternative approaches to the situation	12	12	36	20	20	3.2 (1.2)
11. Justifies suggested alternatives	13	14	33	22	18	3.2 (1.3)
12. Evidence of woman's preferences central to suggested alternatives	33	8	16	17	26	3.0 (1.6)
<b>Mean Item Score for Factor 2</b>						<b>3.1</b>
<b>Factor 3 – Self-evaluation</b>						
13. Analyses strengths and limitations in skills, knowledge and experience	4	9	38	39	10	3.4 (0.9)
14. Addresses limitations in skills, knowledge and experience	7	9	39	37	8	3.3 (1.0)
15. Appropriately identifies required improvements to own practice pertinent to this situation	4	13	32	34	17	3.5 (1.0)
<b>Mean Item Score for Factor 3</b>						<b>3.4</b>

## **Discussion**

The CACTiM (Reflection) aimed to measure midwifery students' critical thinking skills within reflective writing and through psychometric testing, was found to have good reliability and validity. Factor analysis revealed three factors that comprised of: exploring context, evaluating practice and self-evaluation. The CACTiM (reflection) sub-scales also demonstrated internal reliability and were theoretically and practically coherent.

Although higher scores were deemed to reflect higher levels of critical thinking, cut-off scores for levels of critical thinking have not been established. Further testing of the tool with a larger and more diverse population will allow categorisation of critical thinking levels according to scores achieved.

### **Explores context**

The items in this factor relate to the gathering of information to explore the context of the situation, fostering critical thinking and informing clinical decision making. This process in critical thinking is defined within the consensus definition of critical thinking in nursing as contextual perspective, where the clinician considers the whole situation including relationships, background and environment (Scheffer and Rubenfeld, 2000). This concept is also evident within the literature where it is described as consideration of the wider social context (Thompson and Thompson, 2008). This factor achieved the highest mean factor score within the scale and items reflect the extent to which students to look beneath the surface, identifying factors influencing the situation (Thompson and Thompson, 2008).

Item one of this factor, relates to identification of the significance of the situation and obtained the highest individual item mean score. Consideration of the significance of the situation and its importance is a core component within the Bass Holistic Model of Reflection to facilitate deep critical reflection which is taught to students throughout the programme (Bass et al., 2017). Reflective writing entries may reflect students' familiarity with this concept and may account for its high score in this study.

Two items within this factor involve consideration of the woman's individual needs and examining the perspectives of the woman within this situation. Both of these items examine the student's ability to incorporate the principles of woman centred care and the central role of the woman in shared decision making. Woman centred care is central to midwifery care provision where the midwife facilitates the woman's choices, enhancing informed decision

making and in control of every aspect of her care (ICM, 2014; Brady et al., 2016) and hence is an important concept within both midwifery reflection and critical thinking.

### **Reasoned inquiry**

The items within this factor relate to students' ability to examine the appropriateness of clinical practice, and explore information, evidence and the woman's preference to inform future practice. Development of skills in inquiry promotes ownership of learning, enhancing student's engagement and self-regulation (McKeachie and Svinicki, 2006). Essentially, critical thinking is a tool of inquiry (Facione, 1990) which encourages exploration and discovery rather than rote based learning or rule based decision making. In addition, learning from reflection cultivates an open minded and inquiry approach to professional practice (Thompson and Pascal, 2012). The process of reasoning is also a core aspect of critical thinking involving the examination of evidence and formulation of conclusions (Cottrell, 2011). Clinical reasoning skills are essential for the autonomous midwifery practitioner to provide quality care (Jefford, 2014).

The application and critique of the literature and consideration of the woman's preferences were three items assessed within this factor. Assessment of the reflections demonstrated an overall ability of students to apply the relevant evidence to the situation with a mean item score of 3.2 for item eight. However, there was inadequate critical analysis of the quality of the literature and assessment of its' relevance to the individual woman's situation with item nine having the lowest mean item score of 2.6. This may indicate a need for greater emphasis on the development of this skill in the curricula. Several factors make the application of evidence complex in midwifery. Although evidence to support practice is rapidly expanding there remains uncertainty regarding 'best practice' in many clinical situations (Scholes et al., 2012). There has been a recent proliferation of clinical guidelines, providing clinicians with a step by step process to care. However, in an analysis of the 'Green top-guidelines' (produced by the Royal College of Obstetricians and Gynaecologists) only 9-12% of the guidelines were based on the best quality evidence (Prusova, et al., 2014). While some guidelines may promote best-practice, the individual woman's circumstances need to be considered to contextualise the evidence, along with the woman's choice and preferences for care (Ménage, 2016). Decision making in maternity care needs to be based on women's autonomy and facilitate informed choice (Delany, 2008).

## **Self-evaluation**

Items within this factor relate to the student's ability to analyse their skills, knowledge and experience and plan to address any identified limitations, as well as identifying required improvements in practice. Using a mirror type reflective process to ensure that professional knowledge is being utilised holistically; actions are consistent with a woman centred and midwifery values based framework; and opportunities for professional growth and development are considered, is referred to as reflexive practice (Thompson and Pascal, 2012). This type of reflexive practice facilitates continual learning, growth and development in response to clinical practice. The process of self-evaluation through reflection facilitates critical thinking through evaluation of self, present thinking and practice patterns, and planning transformation and improvements in practice (Rubenfeld and Scheffer, 2015). This ability to adapt, modify or change practice or behaviours demonstrates flexibility in thinking and is a core component of critical thinking (Scheffer and Rubenfeld, 2000).

## **Implications for education, research, and practice.**

The CACTiM (Reflection) is the first instrument specifically designed to evaluate critical thinking application in midwifery students' reflective writing. The tool has numerous applications within midwifery education and practice context. The items within the tool endeavour to represent the elements of critical thinking in reflective writing. Making these elements explicit to students' and midwives may enhance their understanding on the application of critical thinking and in turn enhance these skills. The tool could be used in a singular context to provide formative feedback to students on their critical thinking in reflective writing highlighting areas for development.

This tool is ideally suited for longitudinal measurement of critical thinking development over time within formative and summative approaches. The potential of this tool is significant due to its' objective nature, relying on academics to undertake assessment, and unlike a self-assessment or preceptor completed tool, avoids socially desirable responses. This tool may be used across different midwifery programmes or curricula regardless of the content or process used for student reflective writing. The tool could also be used for midwifery graduates and midwives in practice encouraging deeper reflection on events, and enhancing clinical decision making. The CACTiM (Reflection) tool could also be used to test the effectiveness of teaching strategies and guide the development of learning and assessment strategies that support students' critical thinking development.



This study established the reliability and validity of the CACTiM (Reflection) however, additional research is recommended to further validate the tool with a larger sample from a variety of universities using different reflection processes and models. Further testing of the tool would allow comparison of critical thinking development and assist the revision and development of curricula and teaching strategies.

## **Limitations**

Although the sample size was considered acceptable for the testing of this tool, the findings may not represent the range of levels of critical thinking by midwifery students across this programme. It is also recognised that the sample was somewhat homogenous with reflections assessed from students from one Australian University. Further testing of this tool with a larger and more heterogeneous sample is recommended.

A moderate level of inter-rater reliability was established in this study. Further testing of inter-rater reliability is recommended across a variety of environments. Although we believe this tool is transferrable and could be used within any model of reflection, its' use on other models of reflection is warranted to test inter-rater reliability and applicability.

Although items were developed through a vigorous process to establish content validity, the CACTiM (reflection) may not capture all aspects of the complex and multidimensional nature of critical thinking in midwifery practice. Further testing of the tool with diverse samples is recommended to assess this.

The reflective writings analysed were formative assessments and therefore not graded. This may have affected the level of critical thinking demonstrated. Although extensive feedback is provided to students following each reflective writing submission it is recognised that students often devalue assessment where a grade is not attached (Kennison and Misselwitz, 2002), prioritise learning tasks and expend little effort when reflections are not graded (Hahemann, 1986).

Ideally the CACTiM (Reflection) should be utilised at several key points throughout the programme to map development, used as a guide for student feedback, and inform teaching practice.

## **Conclusion**

Critical thinking in midwifery is a complex concept that is challenging to teach, measure and practice, yet is essential in autonomous midwifery practice to ensure woman centred quality midwifery and best practice clinical decision making. In this study, the CACTiM (reflection) was used to measure critical thinking in reflective writings. Meaningful relationships and synergies were established between reflection and critical thinking in midwifery. Reflective writing provides an ideal medium to assess students' critical thinking skills where students unpack challenging and complex practice situations. This pilot study suggests that the CACTiM (reflection) is a reliable and valid measure of critical thinking skills in reflective writing. It is recommended that this tool is utilised over time to measure the development of critical thinking skills in reflection and facilitate feedback to students. To capture the complex nature of critical thinking skills in midwifery and measure the application of these skills in reflection and midwifery practice, a multimethod approach is advocated.

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## **Chapter Conclusions**

This study ascertained the reliability and validity of CACTiM (Reflection). Three rigorous, reliable and valid tools that measure critical thinking in and on midwifery practice for undergraduate students are now available. To further support the recommended multi-method approach to measurement, it was considered important to establish concurrent validity of the three tools. The final sequential study therefore examined the concurrent validity of the three newly developed tools.

## **CHAPTER 8**

### **Measuring Critical Thinking in Pre-Registration Midwifery Students: A Multi-Method Approach**

#### **Chapter Overview**

This chapter comprises of a submitted paper for publication which is currently under review. The references and formatting for this paper are presented in accordance with the requirements of *Nurse Education Today*, where this paper was submitted. Ethics approval was obtained for this study from Griffith University Human Ethics Committee - NRS/39/14/HREC (see Appendix A).

#### **Author contributions**

This paper was submitted for publication in *Nurse Educator Today* in August 2017 and we are awaiting the review outcome. The bibliographic details of this co-authored paper, including all authors, are:

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Supervised by Professor Debra K. Creedy (Co-Principal Supervisor) and Associate Professor Mary Sidebotham (Co-Principal Supervisor), my contribution to the paper involved conception and design of the research project including; review of the literature, data analysis and interpretation, and preparation of the manuscript for publication including journal submission.

(Signed)

(Date) 30<sup>th</sup> October 2017

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## Abstract

**Objective:** Test the concurrent validity of three newly developed tools (student self-rating, preceptor rating, and reflective writing) that aim to measure critical thinking in midwifery practice.

**Design:** A descriptive matched cohort design was used.

**Setting:** An Australian research intensive university offering a three year Bachelor of Midwifery programme.

**Sample:** Fifty-five undergraduate midwifery students.

**Methods:** Students assessed their ability to apply critical thinking in midwifery practice using a 25 item tool and a 5-item subscale in Motivated Strategies for Learning Questionnaire. Clinical preceptors completed a 24 item tool assessing students' application of critical thinking in practice. Reflective writing by students was assessed by midwifery academics using a 15 item tool. Internal reliability, and concurrent validity were assessed. Correlations, t-tests, multiple regression and confidence levels were calculated for the three scales and associations with student characteristics.

**Results:** The three scales achieved good internal reliability with a Cronbach's alpha coefficient between 0.93-0.97. Matched total scores for the three critical thinking scales were moderately correlated; student/preceptor ( $r = .36, p < 0.01$ ); student/reflective writing ( $r = .38, p < 0.01$ ); preceptor/reflective writing ( $r = .30, p < 0.05$ ). All critical thinking mean scores were higher for students with a previous degree, but only significant for reflective writing ( $t(53) = -2.35, p = 0.023$ ). Preceptor ratings were predictive of GPA ( $\beta = .50, p < .001, CI = .10$  to  $.30$ ). Students' self-rating scores were predictive of year level ( $\beta = .32, p < .05, CI = .00$  to  $.03$ ).

**Conclusion:** The student, preceptor, and reflective writing tools were found to be reliable and valid measures of critical thinking. The three tools can be used individually or in combination to provide students with various sources of feedback to improve their critical thinking in practice. The tools allow formative measurement of critical thinking over time. Further testing of the tools with larger, diverse samples is recommended.

## Introduction

The provision of midwifery care is unique, multifaceted and complex and hence requires high level technical and cognitive abilities. There is increasing recognition that midwifery care leads to optimisation of outcomes for women and newborns (Renfrew et al., 2014; ten-Hoope et al., 2014). To achieve these optimal outcomes, midwives are required to provide evidence-based, safe, and individualised care in partnership with women (Mènage, 2016a; Jefford et al., 2010). Hence, midwives need well developed cognitive skills to apply critical thinking in decision making using intellectual independence. However, there is limited literature focussing on thinking processes in midwifery practice (Mong-Chue, 2000).

Critical thinking involves in-depth and higher order thinking that facilitates knowledge development, contextual decision making and problem solving skills, and analyses situations from different perspectives (Facione and Facione, 1996). Contextually appropriate decision making is key to the provision of high quality and safe midwifery care (Jefford, 2012), and critical thinking is a crucial cognitive skill in reaching sound professional judgements.

Midwifery decision making is holistic and made in partnership with women, requiring significant interpersonal skills, whilst acknowledging and valuing the woman's autonomy to make informed choices (Davis-Floyd, 2004; Mènage, 2016b; Jefford et al., 2011). Decisions need to be based on the best available evidence, however, while evidence, and the production of clinical guidelines, protocols and care pathways are proliferating, uncertainty remains regarding 'best practice' in many scenarios (Scholes et al., 2012). In addition, not all clinical guidelines or protocols are based on the best available evidence, and may be out-of-date (Mènage, 2016b; Prusova et al., 2014). Similarly, there may be institutional barriers to the overt use of best practice guidelines, potentially limiting the midwife's capacity to use those guidelines to inform decision making (Toohill et al., 2017).

In order to provide safe quality care, midwives need to critically appraise all of the evidence available and assess the quality and relevance to the woman and her situation. Whilst available evidence and clinical guidelines are important resources, they need to be considered in conjunction with the woman's preferences, values and beliefs as well as the midwife's intuitive knowledge. Intuitive decision making is commonly used by highly experienced midwives who rely on pattern recognition and heuristics based on prior

experience (Steinhauer, 2015). In addition, a key part of midwifery decision making is self-awareness, where the midwife reflects on their own knowledge and skills and identifies gaps, and alternative approaches or expertise needed (Ménage, 2016b).

The development and measurement of critical thinking skills in undergraduate midwifery students is vital to ensure they are able to apply critical thinking to practice and decision making. Measurement of this cognitive skill can highlight areas for development and provide academics with feedback on the efficacy of their teaching practices. Currently the measurement of critical thinking in nursing and midwifery is inconsistent or neglected (Walsh and Seldomridge, 2006). Critical thinking tools used for midwifery students need to encompass the uniqueness of midwifery decision making, be meaningful, purposeful and ultimately promote improvement in practice.

## **Background/Literature**

The most commonly used measures to evaluate critical thinking abilities are standardised, commercially available tools such as the California Critical Thinking Skills Test (CCTST), California Critical Thinking Disposition Inventory (CCTDI), Health Sciences Reasoning Test (HSRT) and Watson-Glaser Critical Thinking Appraisal (WGCTA). These tools focus on the measurement of formal logic and general thinking skills, utilising a multiple-choice format. In a recent systematic review evaluating tools used to measure critical thinking development in nursing and midwifery undergraduate students, of the 34 studies reviewed 21 utilised one of these standardised tools (Carter et al., 2015). The review authors found variation of reported reliability across studies using the same measure, placing doubt about the reliability of these tools when used with nursing and midwifery students. In a further systematic review of the literature evaluating the efficacy of teaching methods used to develop critical thinking skills in nursing and midwifery undergraduate students, inconsistent results were found when testing similar interventions with these tools (Carter et al., 2016a).

Several authors have attempted to develop discipline-specific tools to measure critical thinking in nursing, but a review of these tools revealed limited reporting of reliability and psychometric testing (Carter et al., 2015). No discipline specific tools that measure critical thinking in midwifery practice were found at that time.

Several authors expressed concern about the absence of discipline specific tools that capture the complexity, richness and multidimensional nature of critical thinking in nursing

and midwifery practice (Carter et al., 2015; Jacob et al., 2017; Paul, 2014; Zuriguel-Pérez et al., 2015; Zuriguel-Pérez et al., 2017). This complexity of critical thinking is even more paramount in midwifery, where midwives are recognised as partners in care which is holistic, woman centred, and promotes shared decision making (Carter et al., 2017a; Davis-Floyd, 2004; Jefford et al., 2011).

The application of critical thinking in nursing and midwifery practice is complex, and multiple lenses are required to capture its' depth and breadth (Carter et al., 2015; Raymond-Seniuk and Profetto-McGrath 2011; Rubenfeld and Scheffer, 2015). The use of multiple reliable and valid measures and triangulation of data would more likely capture the complex and multi-faceted nature of critical thinking in midwifery. Valid and reliable tools are needed to measure the development and refinement of students' critical thinking in practice. The current study reports on the reliability and concurrent validity of three new tools designed to measure critical thinking skills in pre-registration midwifery students.

## **Methods**

### **Design**

A descriptive, matched, cohort design was used.

### **Setting**

The Bachelor of Midwifery programme at Griffith University in Australia has a strong woman-centred, values-based philosophy. The programme is delivered within a transformative educational framework. Aligned with the Australian Qualifications Framework, two of the core aims of the Bachelor of Midwifery programme are to produce graduates who have highly developed critical thinking skills, and are critically reflective and reflexive practitioners (Australian Qualifications Framework Council, 2013). Teaching, learning and assessment strategies in relation to critical thinking development are embedded and scaffolded throughout the three-year degree.

Students complete up to 1,800 clinical placement hours primarily at one site (hospital or private midwifery practice) for the duration of their degree. Students undertake two to three shifts per week in an integrated clinical placement model which facilitates the consolidation of learning in one organisation, and enables the development of meaningful relationships with midwifery staff and preceptors. The preceptor role involves the facilitation, monitoring, support and assessment of students' learning and progress during clinical placement.

Midwifery preceptors are supported by university-employed onsite practice lecturers.

Students produce three structured pieces of reflective writing per semester related to clinical events. The reflective writing pieces are uploaded by the student into an online e-portfolio and midwifery lecturers provide feedback. Students use the Bass Model of Holistic Reflection (Bass et al., 2017), which encompasses six inter-dependent phases; self-awareness, description, reflection, influences on knowing, evaluation and learning to guide their reflective writing. To encourage the development of reflection and transformational learning, students are provided with guidelines and prompts for each phase of the model (Bass et al., 2017).

### **Sample/participants**

The sample consisted of students enrolled in the Bachelor of Midwifery programme who had completed at least one semester of clinical placement and completed the self-rating tool (n = 85).

### **Measures**

Development and initial testing of the student self-rating tool (Carter et al., 2017a), preceptor rating (Carter et al., 2016b) and reflective writing (Carter et al., 2017b) have been described elsewhere. In summary, tool development followed the staged model recommended by DeVellis (2017). During the tool development, items were tested for conceptual coherence, and mapped against the consensus definition of critical thinking in nursing developed by Scheffer and Rubenfeld (2000). Content validity for each tool was established using a judgement-quantification review process by an expert panel. Items with a Content Validity Index score of < 0.7 were deleted. Each tool was administered to a convenience sample and psychometric testing was performed to establish construct validity and reliability. A brief description of each tool is outlined below.

#### **Student self-rating tool**

The student self-rating tool was designed for pre-registration students to self-assess their critical thinking skills in midwifery practice. The 25 items require responses on a 6 point Likert scale of 1 = strongly disagree to 6 = strongly agree. The total possible maximum score is 150. Examples of items include, 'I question the 'unwritten rules' in midwifery practice that are not evidence-based' and 'I choose relevant literature and education strategies to facilitate the woman's decision making'.

Psychometric testing of the student self-rating tool indicated good internal reliability with a Cronbach's alpha coefficient of 0.92 (Carter et al., 2017a). Exploratory factor analysis revealed four factors which were named according to the underlying construct: 'seeks information'; 'reflects on practice', 'facilitates shared decision making' and 'evaluates practice'. Cronbach's alpha coefficients for the factors ranged from 0.73-0.88, (Carter et al., 2017a).

### **Motivated strategies for learning questionnaire**

Construct validity of the student self-rating tool was tested using a five-item subscale of the Motivated Strategies for Learning Questionnaire (MSLQ) (OERI/DE, 1991). The MSLQ has been extensively tested and validated, has a reported Cronbach's alpha of 0.80, and subscales can be used collectively or singularly (Credé and Phillips, 2011; Garcia Duncan and McKeachie, 2005). The five-item subscale aims to assess students' critical approach to learning. Examples of items include, 'I often find myself questioning things I hear or read in this programme to decide if I find them convincing'; and 'I treat the course material as a starting point and try to develop my own ideas about it'.

### **Preceptor rating tool**

The preceptor rating tool was designed for use by preceptors (mentors) to measure the extent to which undergraduate midwifery students apply critical thinking in the practice context. The scale contains 24 items on a six point Likert scale, of 1 = strongly disagree to 6 = strongly agree. The total possible maximum score is 144. Examples of items include, 'Uses evidence to plan care according to the woman's individual circumstances', and 'Effectively explores multiple solutions to a given situation'.

Testing with a convenience sample indicated good internal reliability with a Cronbach's alpha coefficient of 0.97 (Carter et al., 2016b). Exploratory factor analysis revealed three factors which were named according to the underlying construct: 'partnership in care'; 'reflection on practice'; and 'practice improvements'. Cronbach's alpha coefficients for the factors ranged from 0.90-0.96.

### **Reflective writing tool**

The reflective writing tool measures the extent to which students' think critically in their reflective writing. The 15-item scale, intended for use by academics, uses a five point Likert scale of 1 = not at all to 5 = to a great extent. The total maximum possible score is 75.

Testing the tool on 100 pieces of reflective writing indicated good internal reliability with a Cronbach's alpha coefficient of .93 (Carter et al., 2017b). Two independent raters established good inter-rater reliability, with a Kappa coefficient  $K = 0.43$  ( $p < 0.0001$ ) (Carter et al., 2017b). Exploratory factor analysis revealed three factors: 'analyses context', 'reasoned inquiry', and 'self-evaluation', with Cronbach's alpha coefficients ranging from 0.77-0.91 for these subscales. Examples of items include, 'Critically analyses the quality of the literature and its' relevance to the individual woman's situation' and 'Explores alternative approaches to the situation'.

## **Procedure**

As part of an initial pilot study, 85 students completed the student-rated survey and MSLQ, which included demographic data such as sex, age, year level, previous qualifications, and current Grade Point Average (GPA). During the same time period, 106 clinicians completed the preceptor rating tool on students' application of critical thinking in practice (Carter et al., 2016b); and 100 pieces of reflective writing by students were analysed (Carter et al., 2017b). Reflective writing pieces were submitted during July – November 2014. Completion of student and preceptor tools occurred in November – December 2014.

The measurement of critical thinking development, where the three critical thinking tools were completed for one student, could be matched for 55 students. Matching could occur because names were provided by both the preceptor (to identify the student they were assessing) and the student themselves (to receive feedback on their critical thinking development). Students and preceptors were informed that for research purposes their responses would be anonymised using a code and results would be reported in a group aggregate form. Archived pieces of reflective writing by students were matched to student and preceptor surveys, coded, and de-identified prior to analysis.

## **Ethical considerations**

Ethical approval for the study was granted by the Human Research Ethics Committee of Griffith University.

## **Approach to analysis**

The Statistical Package for the Social Sciences (SPSS) 24.0 (2016) personal computer version was utilised to analyse data. Descriptive statistics were used to analyse characteristics of the sample and survey responses. Internal consistency of each scale and

factors was assessed using Cronbach's alpha coefficient. Total and factor scores were calculated. Pearson's correlation and t-tests were used. Multiple regression analysis was conducted to identify the impact of critical reflection on academic outcomes (GPA and year level). Confidence intervals were calculated. An alpha level of 0.05 was used for all statistical tests.

## **Data/Results**

### **Participant characteristics/sample**

Matched data were available for 55 (64.7%) students from the cohort of 85, who completed the student survey. All students were female with an average age of 30.75 (SD = 7.038, range 20-55 years). Approximately half (50.9%, n = 28) of the students were in year three and the remainder (49.1%, n = 27) were in year two. Around fifty per cent (50.9%, n = 28) of students had completed a previous Bachelor's Degree, with 7.3% (n = 4) having completed post-graduate qualifications in disciplines other than midwifery. Students had a relatively high GPA with an average of 5.41 (SD = 7.04, range 4.17-6.94) out of a possible 7. A grade of 4 generally indicates a passing grade.

### **Student self-rating tool results**

The mean total score for the student self-rating scale was 129.33 (SD = 10.905) with a range of 104-147. The mean item score was 5.17 out of 6. This high item mean indicated that students considered they applied a reasonably high level of critical thinking in their midwifery practice. Table 8.1 presents a summary of the total and subscale means. The coefficient alpha for the total scale was 0.93, demonstrating good internal consistency (DeVellis, 2017). Cronbach's alpha coefficient for the subscales ranged from 0.75-0.90 (see Table 8.1).

### **Preceptor rating tool results**

The mean total score for the preceptor scale was 118.91 (SD = 16.77) with a range of 80-144. The mean item score was 4.96 out of 6. Although still high, this mean indicated that preceptors rated students' ability to apply critical thinking in midwifery practice slightly lower than students themselves. Table 8.1 presents a summary of total and subscale means. The alpha coefficient for the total scale was 0.97, demonstrating good internal consistency (DeVellis, 2017). Cronbach's alpha coefficient for the subscales ranged from 0.92-0.96 (see Table 8.1).



## Reflective writing tool results

The mean total score for the reflective writing scale was 50.36 (SD = 13.70) with a range of 21-72. The mean item score was 3.6 out of 5. This mean is slightly higher than found in the original pilot of the tool (Carter et al., 2017b). Table 8.1 presents a summary of the total and subscale means. The alpha coefficient for the total scale was 0.93, demonstrating good internal consistency ( DeVellis, 2017). Cronbach's alpha coefficient for the subscales ranged from 0.85-0.91 (see Table 8.1).

**Table 8.1: Internal Reliability of 3 tools**

	Factor Names	Factor Cronbach's $\alpha$	Scale Cronbach's $\alpha$	Mean scores for each subscale	Total mean score (possible max score)
<b>Student self-rating</b>	Seeks information	0.83	0.93	5.11	129.33 (150)
	Reflects on practice	0.77		5.16	
	Facilitates shared decision making	0.90		5.41	
	Evaluates practice	0.75		5.01	
<b>MSLQ</b>	Critical Thinking	0.80	0.80	4.6	22.83 (30)
<b>Preceptor rating</b>	Partnership in care	0.96	0.97	4.92	118.91 (144)
	Reflection on practice	0.94		4.98	
	Practice improvements	0.92		5.0	
<b>Reflective writing</b>	Explores context	0.91	0.93	3.6	50.36 (75)
	Reasoned inquiry	0.88		3.0	
	Self-evaluation	0.85		3.5	

## Concurrent validity

To examine concurrent validity, the relationship between the mean scores of the student and preceptor rating tool was investigated using Pearson product-moment correlation

coefficient. There was a moderate correlation found between these two scales ( $r = .36$ ,  $p < 0.01$ ). Cohen (1988) suggests an  $r$  value between .30 and .49 is indicative of a medium effect. Student and reflective writing scores revealed a moderate correlation ( $r = .38$ ,  $p < 0.01$ ). Finally, preceptor and reflective writing scores also revealed a moderate correlation ( $r = .30$ ,  $p < 0.05$ ). See Table 8.2.

MSLQ and student self-rating scores were investigated using Pearson product-moment correlation coefficient. A moderate correlation was found between these two scales ( $r = .38$ ,  $p < 0.01$ ). Further testing also revealed moderate correlations between MSLQ and preceptor tool scores ( $r = .35$ ,  $p < 0.01$ ). The correlation between the MSLQ and reflective writing tool was small but not significant ( $r = .29$ ,  $p = .078$ ). See Table 8.2.

### **Associations between critical thinking scores and student characteristics**

Pearson's product-moment correlation coefficient identified a large correlation between preceptor scores and GPA ( $r = .51$ ,  $p < 0.01$ ). A small correlation was also found between reflective writing scores and GPA ( $r = .26$ ,  $p = 0.05$ ). No relationship was found between student self-rating scores and GPA. See Table 8.2.

Multiple regression analysis assessed the extent to which student, preceptor, and reflective writing scale scores predicted students' GPA. Preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, multicollinearity and homoscedasticity. A significant regression equation was found, ( $F(3, 51) = 6.63$ ,  $p = .001$ , adjusted  $R^2 = .27$ ). Only preceptor ratings were found to be predictive of GPA ( $\beta = .50$ ,  $p < .001$ ,  $CI = .10$  to  $.30$ ). See Table 8.3.

Moderate correlations were found between both student scores and year level ( $r = .30$ ,  $p < 0.05$ ) and preceptor scores and year level ( $r = .30$ ,  $p < 0.05$ ). No correlation was found between reflective writing scores and year level. See Table 8.2.

Multiple regression analysis assessed the extent to which individual student, preceptor, and reflective writing scale scores predicted students' year level. Preliminary analyses indicated no violation of the assumptions of normality, linearity, multicollinearity and homoscedasticity. A significant regression equation was found ( $F(3, 51) = 3.31$ ,  $p < .05$ , adjusted  $R^2 = .11$ ). Only student scores were found to be predictive of year level ( $\beta = .32$ ,  $p < .05$ ,  $CI = .00$  to  $.03$ ). See Table 8.4.

An independent samples t-test found that students who had completed a previous degree had higher mean critical thinking scores on each tool. However, this increase was significant only for reflective writing scores for students who possessed a previous degree ( $M = 54.41$ ,  $SD = 11.26$ ) compared to those who did not ( $M = 45.96$ ,  $SD = 15.49$ ) ( $t(53) = -2.35$ ,  $p = 0.023$ , two tailed). The magnitude of mean difference (mean difference = 8.45, 95% CI, -15.68 to -1.22) was moderate (eta squared = .09). Cohen (1988) suggests an eta squared value between .06 and .14 is indicative of a moderate effect. See Table 8.5.

**Table 8.2: Correlations between tools and student characteristics**

	<i>r</i> value	p
Student self-rating / Preceptor rating	0.36	0.007**
Student self-rating / Reflective writing	0.38	0.004**
Preceptor rating / Reflective writing	0.30	0.03*
Student self-rating / MSLQ	0.38	0.004**
Preceptor rating / MSLQ	0.35	0.009**
Reflective writing / MSLQ	0.34	0.078
Student self-rating / GPA	0.130	0.35
Preceptor rating / GPA	0.51	0.000**
Reflective writing / GPA	0.26	0.05*
Student self-rating / Year level	0.30	0.03*
Preceptor rating / Year level	0.30	0.03*
Reflective writing / Year level	-0.31	0.82

\*significant at the 0.05 level \*\*significant at the 0.01 level

**Table 8.3: Regression of critical thinking scores on GPA**

	GPA			95% confidence intervals for <i>Beta</i>	
	<i>Adjusted R<sup>2</sup></i>	<i>Beta</i>	<i>p</i>	<i>Lower Bound</i>	<i>Upper Bound</i>
<b>Student scores</b>	0.27	-1.1	0.417	-0.25	0.10
<b>Preceptor scores</b>		0.50	0.000**	0.10	0.30
<b>Reflective writing scores</b>		0.16	0.229	-0.05	0.26

\*significant at the 0.05 level \*\*significant at the 0.01 level

**Table 8.4: Regression of critical thinking scores and year level**

	Year level			95% confidence intervals for <i>Beta</i>	
	<i>Adjusted R<sup>2</sup></i>	<i>Beta</i>	<i>p</i>	<i>Lower Bound</i>	<i>Upper Bound</i>
<b>Student scores</b>	0.11	0.32	0.031**	0.00	0.03
<b>Preceptor scores</b>		0.21	0.142	-0.00	0.01
<b>Reflective writing scores</b>		-0.23	0.105	-0.02	0.00

\*significant at the 0.05 level \*\*significant at the 0.01 level

**Table 8.5: T-tests of previous qualifications and critical thinking scores**

Scale	Group						95% CI for Mean Difference			
	Previous Degree			No previous degree						
	M	SD	n	M	SD	n				
Student scores	131.93	10.34	32	126.26	10.89	23	-11.51,0.15	-1.95	0.056	53
Preceptor scores	121.22	16.95	32	112.35	18.02	23	-18.41,0.67`	-1.87	0.068	53
Reflective writing scores	54.41	11.26	32	45.96	15.49	23	-15.68,-1.22	-2.35	0.023*	53

\* p < .05.

## Discussion

The three tools (student self-rating, preceptor rating and reflective writing) and subscales were found to have good reliability and validity. Concurrent validity which estimates the individual performance on different tests at the same time (DeVellis, 2017), was established producing moderate correlations between all scales.

Positive correlations were also found between the MSLQ subscale and the preceptor and student tools. The items within this MSLQ subscale relate to the ways students apply previous knowledge to new situations in problem solving, make decisions, or make critical evaluations in their approach to learning (Credé and Phillips, 2011). The MSLQ is a widely utilised and validated tool. Comparing the new critical thinking tools with the MSLQ helped to establish concurrent validity.

A large correlation was found between GPA and the preceptor scores, with a small correlation found with the reflective writing scores. A number of studies examining nursing students' critical thinking scores also found a positive correlation between GPA and critical thinking scores when using standardised measurement tools such as the CCTST (Bowles, 2000; Kennison, 2006) and the HSRT (Pitt et al., 2015). The current findings are encouraging and indicate that preceptors' assessment of students' critical thinking in practice accurately reflects their academic performance.

Student year level and student and preceptor critical thinking scores were positively related, with student scores predictive of year level. This finding is not surprising, indicating that students' critical thinking developed as they progressed through the degree programme. However, the poor correlation between year level and reflective writing scores was unexpected, as it was assumed that with appropriate feedback on regular reflections, these skills would improve. This finding may indicate that greater depth and breadth of feedback is required. However, it is acknowledged that the reflective writing pieces analysed were formative assessments and not graded which may have affected students' prioritisation and effort expended on this task (Carter et al., 2017b). Findings related to year level also need to be considered with caution due to the small sample and inclusion of only two year groups (2<sup>nd</sup> and 3<sup>rd</sup> year). Testing with a larger, more diverse sample is recommended. It would also be useful to test the reflective writing tool on graded assessment and evaluate the difference in critical thinking scores.

Positive correlations were found between reflective writing scores and previous qualifications. This finding may be explained by the likelihood that students were exposed to the concepts of reflection in their previous studies and familiar with the format, writing style and level of critical reflection required. Indeed, the use of reflection as a teaching and assessment strategy is frequently noted in the broader education and health professional education literature (Mann et al., 2009).

The concurrent use of the three tools provides a multifaceted measurement of students' critical thinking in midwifery practice. This multi-method approach provides feedback to the student from three different sources (self, preceptor and faculty). Through self-assessment, students have opportunities to reflect on their own practice and learn more about critical thinking in midwifery practice because the items provide explicit examples of good practice. The preceptor tool can also facilitate formative feedback to students if used as a point of discussion and identification of strategies to enhance critical thinking in practice. The reflective writing tool provides students with objective formative feedback on their critical thinking from teaching staff as they deconstruct challenging and complex clinical scenarios.

Best midwifery practice is characterised by the use of quality evidence, combined with and balanced by women's preferences and choices, along with expert judgement based on well-developed critical thinking skills (Fullerton and Thompson, 2005). Midwifery critical thinking and decision making also encompasses the use intuitive knowledge (Steinhauer, 2015), along with reflection and self-awareness (Ménage, 2016b).

The measurement of critical thinking skills is an important step in improving decision making abilities. A multi-method approach to measurement of critical thinking aligns with the complexity of midwifery care and decision making. Items within the three scales encompass the depth and breadth of the unique aspects of midwifery practice including: facilitating shared decision making; critical analysis of the research literature; intuitive decision making, self-awareness and reflection on practice.

## **Limitations**

This study aimed to validate three different tools to assess the development of midwifery students' critical thinking skills. Although matching of participants' responses is a strength, a relatively small sample was used. The sample was also homogenous being recruited from a single programme at one University. Sampling bias is also likely because participants



could be described as “high achieving” given the high proportion with a prior degree, their relatively high GPAs, and their willingness to complete the student scale. The reported results may differ from those of students who did not wish to participate. The scales are new and need to be tested further with large diverse samples of undergraduate midwifery students. Although concurrent validity was established through a comparison of the three scales with the MSLQ, this work should be repeated with larger diverse samples.

## **Conclusion**

The application of critical thinking in midwifery practice is important to direct decision making and facilitate high quality and safe midwifery care. Tools that measure the development of critical thinking in midwifery students need to encompass the unique facets and context of midwifery care. The tools should promote scaffolded learning through the provision of targeted feedback to students highlighting areas for further development. In this study, three newly developed tools (student-rating, preceptor rating and reflective writing) were tested for concurrent validity and reliability. This study suggests that the three tools are reliable and valid measures of critical thinking skills in pre-registration midwifery students. To capture the complexity of critical thinking in midwifery practice, and provide feedback from several sources, a multi-method approach is recommended using the three tools. These three tools can be routinely implemented into undergraduate midwifery programmes and used in the longitudinal measurement of critical thinking development throughout midwifery education programmes. The tools could also be used to measure critical thinking of midwifery graduates and midwives in practice. Further testing of these tools with large, more diverse samples is recommended.

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## **CHAPTER 9**

### **Conclusions and Recommendations**

This thesis presented the findings of six interlinked studies focussing on the evaluation and measurement of critical thinking in midwifery practice for undergraduate midwifery students. The application of critical thinking in midwifery practice is crucial to inform effective clinical decision making and facilitate high quality, evidence based and safe midwifery care. Yet, very few studies have explored or measured the cognitive skill of critical thinking in midwifery practice. In the few studies available, critical thinking was loosely defined and poorly operationalised. The studies in this thesis were presented as published or unpublished papers. This final chapter will, discuss the unique contribution of this research, synthesise the results of these studies into a conceptual framework and set of conclusions, outline limitations, and present recommendations for practice, education and research.

#### **Strengths and Major Contributions of the Research**

This program of work contributes a series of empirical studies focussing on cognitive skill development in midwifery practice. The outputs of this work aim to contribute to the scholarly literature around critical thinking in midwifery; and promote dialogue around the concepts of critical thinking in midwifery and its' measurement.

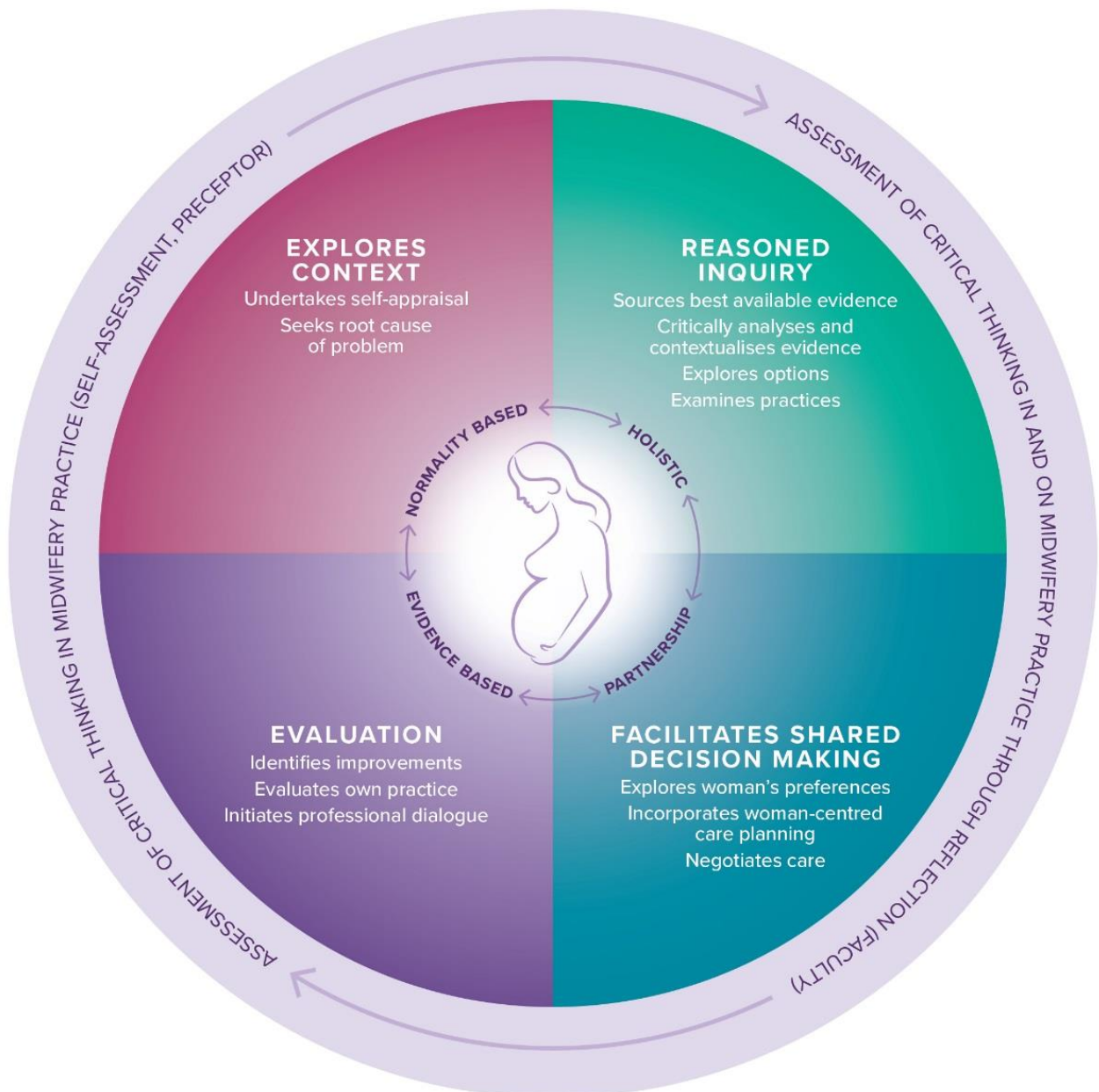
The three tools developed within this body of work to measure critical thinking in midwifery practice are freely available and easily applied in both clinical practice and the classroom. The tools provide another dimension in the assessment of clinical practice that incorporates the application of cognitive skills, as well as clinical skill development. The items within each tool provide explicit examples of critical thinking in midwifery practice, prompting students, preceptors and lecturers to reflect on these tangible examples and use them to improve their own practice and provide feedback to students.

#### **Conceptual Framework**

The purpose of this body of work was to evaluate and measure critical thinking skills in midwifery practice for undergraduate midwifery students. The elements and concepts that shape critical thinking in midwifery practice emerged from (1) the review of literature on critical thinking and midwifery, (2) reviews evaluating current available tools, (3) development of survey items and expert review of these, and (4) testing of the three tools.

These processes informed the development of a conceptual model for critical thinking in midwifery practice. This model presents a new understanding of critical thinking in midwifery practice and provides opportunities for future research to test this model and related concepts.

Figure 2: Conceptual Model of Critical Thinking in Midwifery Practice



## **Conceptual model of critical thinking in midwifery practice**

The conceptual model of critical thinking in midwifery practice is embedded within a woman centred philosophy of care. Woman centred care focusses on the individual woman's needs, preferences and expectations rather than the needs of the organisation or caregiver, acknowledging the woman's right for self-determination, choice and control (NMBA, 2010). Foundations of the overarching philosophical framework that support this conceptual model of critical thinking in midwifery practice are:

- Pregnancy and birth are normal physiological events;
- Midwifery care and decision making are based on the best available evidence;
- Midwifery care involves the development of a partnership relationship between the woman and midwife of equal power and mutual respect; and
- Midwifery care is holistic and individualised.

This conceptual model involves four phases and twelve elements which reflect items of the three CACTiM tools. The phases within this conceptual model are fluid and not restricted by sequencing in any particular order.

### ***Phase 1: Explores Context***

- *Undertakes self-appraisal*

This element involves identification of any gaps and skills related to the clinical situation through self-appraisal of knowledge and skills. It also involves reflection by the student on their values and beliefs and consideration of the impact of these on the care provided. This self-evaluation may lead to consideration of a different approach to care or consultation and referral to access additional expertise. This stage of self-appraisal may also prompt the student to undertake professional development or further learning to address any identified gaps.

- *Seeks root cause of a problem*

This step involves deeper cognitive thinking and rather than simply responding to current cues or problems, aims to seek and address the cause. It also recognises the significance of the clinical situation.

## ***Phase 2: Reasoned Inquiry***

- *Sources best available evidence*

This element may include a search of the literature, prioritising high level evidence and/or seeking relevant clinical guidelines or policies.

- *Critically analyses and contextualises evidence*

This element involves consideration of the evidence pertaining to the woman's individual situation, incorporating her preferences. It also involves contextualising evidence and/or policies to determine their appropriate application or variances required.

- *Explores options*

This element involves the exploration of multiple options and alternatives to a given situation. This exploration may involve the use of intuition and/or previous experiences through identification and clustering of a variety of cues using pattern recognition.

- *Examines practices*

This element encourages further inquiry and examination of observed practices to determine if they are evidence based and/or woman centred. This includes recognition of unnecessary interventions or institutional 'unwritten rules' that do not optimise woman-centred care.

## ***Phase 3: Facilitates Shared Decision Making***

- *Explores woman's preferences*

This element may involve a general discussion regarding the woman's preferences for care or a more specific conversation related to the current episode/event in practice.

- *Incorporates woman-centred care planning*

Care planning is centred around the woman and incorporates her preferences and needs. This involves individualising the sequencing of care and the nature of care provided. It also involves sharing and discussing contextualised evidence and information with the woman.

- *Negotiates care*

This element involves developing collaborative collegial relationships with other health



professionals to ensure the woman receives the most appropriate care that meets her needs. This may include advocating for the woman's choices or negotiating appropriate evidence based care.

#### ***Phase 4: Evaluation***

- *Identifies improvements*

This step in critical thinking involves being proactive and addressing any deficits in policies/guidelines, practices or the environment that hinder care. This element involves greater depth of critical thinking as it is not only concerned with the present situation but considers improvements for care in the future.

- *Evaluates own practice*

This element involves self-reflection and consideration following the event on the care provided and outcomes. It also involves seeking feedback from others, including the woman, preceptor or others involved in the care. This reflection may identify particular aspects of the student's practice or care provided that could be improved.

- *Initiates professional dialogue*

This dialogue is focussed on evaluation of practice and may involve discussion with other colleagues around clinical care to generate more knowledge (this may occur prior, during or following the event). Alternatively, it may involve specific debriefing related to involvement in a complex situation.

#### ***Measurement and Assessment***

To capture the complexity of critical thinking in midwifery practice a multi-method approach to measurement is required. This approach facilitates feedback from a variety of sources and provides holistic real-world assessment on the application of critical thinking skills in practice. The feedback on a student's ability to apply critical thinking in midwifery practice is facilitated through self-assessment (by the student) and from the student's preceptor. Evaluation of the application of critical thinking on and in midwifery practice is enabled through faculty assessment of reflective writing on practice.

## Conclusions

This program of work has produced several conclusions about the development and measurement of critical thinking in midwifery practice.

- 1. Well-developed critical thinking skills are crucial in the provision of safe, autonomous, evidence based midwifery care.**

As the autonomy of midwives increases so does their need to enact independent professional judgement and clinical decision making. Highly developed critical thinking skills are required to navigate and inform complex decision making in midwifery. Midwifery decision making involves balancing the philosophical underpinnings of midwifery care, with contextualised evidence and honouring the woman's choices.

- 2. Critical thinking in midwifery practice is distinct, complex and requires discipline specific measurement tools.**

Midwifery specific critical thinking measurement tools are required to capture the breadth and depth of critical thinking applied to midwifery practice. Discipline specific tools can provide explicit examples of critical thinking in practice, facilitating meaningful and purposeful engagement, and providing feedback to students to assist development of this cognitive skill and ultimately improve their practice.

- 3. Active constructive-based learning strategies have a positive impact on critical thinking development.**

Promising results were found within the systematic review of the literature in Chapter 4 related to critical thinking development and the use of active teaching strategies such as, problem based learning, concept mapping and simulation. Added to this list of strategies/interventions is root cause analysis which was used successfully in Study 1. These teaching methodologies utilise constructivist principles where students are encouraged to use analysis and reasoning to solve clinically based problems. The efficacy of these strategies requires further validation with the use of discipline specific measurement tools, focusing on the application of critical thinking in practice.

**4. The CACTiM (Preceptor/Mentor) is a valid and reliable measurement tool for preceptors to assess undergraduate midwifery students' critical thinking skills in practice.**

Piloting and psychometric testing of the newly developed CACTiM (Preceptor/Mentor) tool indicated acceptable levels of reliability and validity. Testing of concurrent validity found CACTiM (Preceptor/Mentor) scores were predictive of students' GPA, indicating that preceptors' assessment of students' critical thinking in practice accurately reflects their academic performance. The tool items provide explicit examples of critical thinking in midwifery practice for use by preceptors to guide feedback to students. These items may also be useful for preceptors to reflect on their own practice and identify possible practice improvements or professional development needs.

**5. The CACTiM (Student) is a valid and reliable self- assessment tool for students to evaluate their own critical thinking skills in midwifery practice.**

The pilot study and testing of the CACTiM (Student) tool indicated acceptable levels of reliability and validity for the measurement of critical thinking skills in midwifery practice. A medium correlation was found between the CACTiM (Student) and MSLQ, further establishing concurrent validity. The utilisation of a self-assessment tool can cultivate self-awareness through the simple act of providing students with explicit examples of critical thinking expected in midwifery practice, requiring them to reflect on their own practice and make a self-assessment according to each item. Self-assessment also has the capacity to promote greater autonomy in the student's own learning.

**6. The CACTiM (Reflection) is a valid and reliable measurement tool for use by faculty to assess the application of critical thinking skills in and on midwifery practice in reflective writing.**

Reliability and validity of the CACTiM (Reflection) tool was established through a pilot study assessing 100 students' reflective writing. Meaningful and significant relationships were established between reflection and critical thinking in midwifery. Reflective writing provides an ideal medium to assess students' critical thinking skills, and provides an objective form of measurement and feedback from faculty. This tool is practical and simple to implement,

with reflection being a commonly utilised through formative or summative assessment within most undergraduate midwifery programs.

## **Limitations**

The limitations of each study have been previously outlined and discussed within the published papers presented in each chapter. Specific limitations that relate to the body of work as a whole need to also be acknowledged and considered when forming inferences from the results of this thesis. These limitations relate to the sample, setting and process of tool development.

The samples for all the research studies were relatively homogenous, being from one Bachelor of Midwifery program at one Australian University, which may have affected results. Administering the tools with students from different programs may reveal different results. While there is some cultural diversity in the student population, the extent to which the tools are relevant in different cultures that do not foster independent critical thinking, such as some Asian or Middle Eastern countries, is unknown. Testing of the newly developed tools with larger, diverse samples of preceptors and students is recommended to confirm reliability as well as content and construct validity of the tools.

Although the sample sizes were adequate for study 3 and 4 when piloting and testing the CACTiM (Preceptor/Mentor) and CACTiM (Student) tools, the results may be not representative of all students and preceptors. It may be that a disproportionate number of high achieving students, who felt more comfortable assessing their critical thinking skills participated in the study, resulting in inflated mean scores. Due to the method of survey distribution for the CACTiM (Preceptor/Mentor), where preceptors were asked to complete the tool for a student they have recently supervised, preceptors may have tended to choose a student with whom they worked effectively. This may have also resulted in inflated mean scores. Embedding these tools as routine measures in midwifery curricula, would give a more accurate view of critical thinking development across a whole student cohort and program.

Self-assessment of critical thinking skills is a commonly used strategy within the educational literature and considered to be sound pedagogical practice. The process of students evaluating their own progress and learning cultivates self-awareness and reflection, and promotes greater autonomy over the student's own learning. However, the use of self-report

alone may contribute to response bias. The final correlation study found that students tended to overrate their critical thinking skills compared to preceptors' assessments. This finding needs further testing and supports the use of triangulation of data from the three tools to accurately measure critical thinking in midwifery practice.

A comprehensive process was undertaken to develop items for the three CACTiM tools. Processes involved; (1) critical review of the literature and examination of items within other critical thinking measurement tools, (2) review of Australian National Competency Standards for the Midwife (NMBA, 2010) to ensure alignment with the conceptual basis of contemporary midwifery practice, (3) mapping draft items to the consensus definition of critical thinking in nursing (Scheffer & Rubenfeld, 2000), and (4) expert review. However, due to the complex and multidimensional nature of critical thinking in midwifery practice, and the lack of available literature to inform item development, the items within the three CACTiM tools may not fully encompass all aspects of critical thinking in midwifery practice. Item content of the tools will require ongoing review to ensure they reflect critical thinking in contemporary midwifery practice.

An extensive judgement-quantitation review process by a panel of experts was undertaken involving evaluation and provision of feedback on all items in each of the three tools. However, the tested items may not be relevant or well understood in different contexts, curricula or international settings. Further research is necessary to determine the applicability of the tools in different contexts and settings.

## **Recommendations**

To capture the richness, complexity and depth of critical thinking in midwifery practice it is recommended that a multi-method approach to measurement is adopted. It is recommended that the concurrent use of the three newly developed CACTiM tools (Student, Preceptor/Mentor and Reflection) are embedded routinely into undergraduate midwifery programs to measure critical thinking development.

### ***Practice recommendations***

It is recommended that the three CACTiM tools are utilised to assess critical thinking in midwifery practice for undergraduate midwifery students. Completion of these tools in practice may foster identification of students' strengths, deficits and/or required professional development, ultimately leading to improvements in practice. It is also recommended that

the tools be piloted and tested for use with midwifery graduates and experienced midwives in practice, to provide feedback on current practice, encourage deeper reflection, and enhance clinical decision making.

### ***Education recommendations***

The items within the three tools endeavour to represent the elements of critical thinking in and on practice. It is recommended that these items are made available to midwifery students, preceptors and faculty staff. Making these elements explicit to students and preceptors will help to delineate the expectations and understandings of critical thinking in midwifery practice, and in turn foster development of these skills. The elements of the tools could also be used by midwifery lecturers to guide the design of learning and assessment opportunities that explicitly assist students' critical thinking development.

The significance of critical thinking skills for midwifery practice is well established. It is recommended that critical thinking development is mapped and assessed across the course of a degree program. This longitudinal measurement will allow students, preceptors and faculty to examine and map the transformation of students' cognitive capacities over time. The tools should be used to promote scaffolded learning through the provision of targeted feedback to students, highlighting areas for further development.

A formative approach to measuring the development of critical thinking over time is recommended to determine the efficacy of teaching approaches and preparedness of graduates for practice. Any of the three CACTiM tools could be used individually or in combination as a pre post test to evaluate the effectiveness of teaching strategies on critical thinking abilities. Any identified deficits through this testing could guide future teaching innovation.

This program of work commenced with a study investigating the impact of an innovative assessment item on the development of students' critical thinking abilities. Now that three robust tools are available to measure critical thinking skill in midwifery practice, it is recommended that this study is repeated using these tools with a pre post test methodology to determine the effect of the root cause analysis assessment on critical thinking.

## ***Research recommendations***

In addition to the areas of further research already outlined, it is recommended that further validation of the three CACTiM tools is undertaken with a larger, more diverse sample. This would assist to validate the tools within different curricula, different practice settings, and with different cohorts of preceptors and students. Results of a larger, diverse sample would also allow for international comparisons and guide the revision and development of curricula and teaching strategies in different countries.

Further testing of concurrent validity of the three tools with a larger, diverse sample will also provide validation of the multi-method approach to critical thinking measurement. It is recommended that this further testing explores links with other domains of student performance to test discriminatory validity. This may include comparisons between CACTiM critical thinking scores and other student performance indicators such as decision making abilities, clinical competence and progression through the degree program. It is also recommended that comparisons are also explored between CACTiM critical thinking scores and academic performance in specific assessment items designed to increase critical thinking (for example, root cause analysis assessment as in Study 1).

Furthermore, a framework has been presented as a conceptual summary of this body of work. Further testing of this framework is required to ensure all aspects of critical thinking are included and represented. It is also recommended that further testing is undertaken exploring the items within the tools and whether these are explicit and comprehensible to students, preceptors, and faculty across different contexts, settings, and academic programs.

## **Summary**

This thesis provides new empirical evidence related to critical thinking in midwifery practice. Three tools that measure critical thinking in undergraduate midwifery students have been developed, piloted and psychometrically tested. The tools were found to be reliable and valid. Predictive relationships were found between CACTiM (Preceptor/Mentor) and GPA, CACTiM (Student) and year level, and CACTiM (Reflection) and previous tertiary qualification.

Priority recommendations for practice, education and research have been outlined and require action and implementation. Importantly, midwives, midwifery students, educational

and health institutions need to prioritise critical thinking skill development and recognise the impact of these skills on clinical decision making and the provision of woman-centred high quality midwifery care.

Collectively, the results from this body of work provides opportunities for further measurement, mapping, comparisons and research into critical thinking in midwifery practice. Three reliable, valid and robust tools that are meaningful and purposeful in measuring critical thinking in midwifery practice are now freely available and ready to implement in any undergraduate midwifery program.



## References

- Nursing and Midwifery Board of Australia. (2010). *National Competency Standards for the Midwife*. Retrieved from <http://www.nursingmidwiferyboard.gov.au/Codes-Guidelines-Statements/Professional-standards.aspx>.
- Scheffer, B. K., & Rubenfeld, M. G. (2000). A consensus statement on critical thinking in nursing. *Journal of Nursing Education*, 39(8), 352-359.

## Appendix A

### Human Research Ethics Approval

Human Research Ethics Approval for all studies in this body of work was obtained from Griffith University Human Research Ethics Committee. The studies did not intend or result in harm for participants. Had any emotional or psychological issues or responses been elicited participants were to be referred to counselling services offered by Griffith University professional counsellors. Participants were informed they could withdraw from any of the studies at any time or not answer every question on the surveys and this withdrawal would not affect their studies (if they were a student) or their relationship with Griffith University (if they were a preceptor or midwifery industry partner).

Students involved in the studies were reassured that participation in the study would not affect their enrolment or results in the Bachelor of Midwifery program in any way. Students were also informed that results surveys were not part of their formal academic assessment within the Bachelor of Midwifery program.

Specific ethical considerations of each study have been outlined within the relevant chapter.

Study 1: Pilot study to test the effect of root cause analysis in developing midwifery students' critical thinking abilities; received formal ethics approval from the Griffith University Human Research Ethics Committee GU Ref No: NRS/47/12/HREC. The table below outlines the approvals and variations in relation to this protocol.

Date	Details
26/11/2012	Ethical approval granted for this study
9/5/2013	Variation approved to include SEC (Student Evaluation of the Course) and SET (Student Evaluation of Teaching) data.
15/7/2013	Variation approval to add Professor Debra K. Creedy as Primary Supervisor.
13/3/2014	Variation approved to extend ethical approval clearance from 18/12/2013 to 31/7/2015.

Ethical approval for Studies 3, 4, and 5: Development and testing of three tools that measure critical thinking in midwifery practice for undergraduate midwifery students, and Study 6: Validation analysis of three tools matched cohort, was obtained from Griffith University Human Research Ethics Committee GU Ref No: NRS/39/14/HREC. The table below outlines the approvals and variations in relation to this protocol.

<b>Date</b>	<b>Details</b>
23/10/2014	Ethical approval granted for this study
7/11/2014	Variation approved for minor changes to survey tools in response to expert review feedback

## Appendix B

### Student Survey Tool – Root Cause Analysis Assessment

Dear Students,

In one of your recent courses within the Bachelor of Midwifery Program 3506NRS you completed an assessment involving a group presentation on risk management. We now would like to hear your views on this assessment item.

To protect your privacy, this form will be anonymous. You will not put your name on this form and you will return it in the reply paid envelope. You are encouraged to participate in this survey and complete in full and return by **Monday 3<sup>rd</sup> December 2012**. By returning the survey you are indicating that you have received information about this research project and you agree to participate.

There are no right or wrong answers, so please choose responses that best suit you.

First we would like to ask a few questions about you. This information will be combined across all the survey forms and no individual will be able to be identified from the final report.

1. Please tick your age category:

under 22

☐

22-25

☐

26-35

☐

36-45

☐

46-55

☐

over 55

☐

2. Prior to this degree what was the **highest** level of education you had attained?

Did not complete  
senior high school

☐

Senior  
high school

☐

TAFE  
qualification

☐

Degree

☐

Masters

☐

To answer the below questions, tick the box which most closely matches how much you agree/disagree with the statement.

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
<b>Acceptability</b>					
1. This assessment item engaged me in learning					
2. I enjoyed researching and preparing this assessment item					
3. The critical incident our group worked on was similar to those faced in the clinical environment					
4. This is an appropriate assessment for this course					
5. I would recommend this assessment item continue within this course					
<b>Educational Impact</b>					
6. This assessment item was beneficial to my learning					
7. This assessment item developed my critical thinking skills					
8. This assessment item developed my decision making skills					
9. This assessment item consolidated my learning from this course and within the Bachelor of Midwifery Program					
10. This assessment item challenged my thinking					
11. This assessment item encouraged me to examine the whole clinical situation rather than the tasks at hand					
<b>Preparation as a Midwife</b>					
12. This assessment item improved my confidence in managing complex cases					
13. This assessment item has encouraged me to be more accountable in my practice as a midwife					
14. This assessment has developed my skills in collaborative practice					
15. I am more aware of the causes of critical incidents following the completion of this assessment item					

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
16. I believe I am less likely to make clinical errors following completion of this assessment item					
17. I feel more prepared as a midwife following completion of this assessment					

1. What did you enjoy most about this assessment item?

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2. What did you enjoy the least about this assessment item?

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3. What did you learn from this assessment item?

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4. How could this assessment item be improved?

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Thank you for completing this survey.

Please place the survey in the reply paid envelope and return to Research Assistant Jo Kinnane by  
**Monday 3<sup>rd</sup> December 2012.**

Amanda Carter, Midwifery Lecturer

## Appendix C

### Participant information Sheet – Student: Root Cause Analysis Assessment

<b>Chief Investigator</b> Ms Amanda Carter Midwifery Lecturer School of Nursing & Midwifery Logan Campus Griffith University Ph 33821535 M 0421230466 a.carter@griffith.edu.au	<b>Additional Investigators</b>  Dr Mary Sidebotham Senior Lecturer Program Director Bachelor of Midwifery School of Nursing and Midwifery, Logan Campus, Griffith University Ph 338 21378 M 0434932303 m.sidebotham@griffith.edu.au  Dr Jennifer Fenwick Professor of Midwifery Griffith University Clinical Chair Gold Coast Hospital Logan Campus, Griffith University M 0410479985 j.fenwick@griffith.edu.au  Dr Jenny Gamble Professor of Midwifery and Deputy Head: School of Nursing and Midwifery Logan campus, Griffith University Ph 33821083 M 0404080518 j.gamble@griffith.edu.au
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#### What is the purpose of the study?

The purpose of this study is to examine the effectiveness of an innovative assessment item designed to evaluate student's ability to apply critical thinking within a clinical framework. The goal of this assessment item is to foster independent learning and equip students with the skills to situate their learning in the 'real world' of practice. This study is part of a larger program of work addressing the Student Life Cycle objectives of advancing the student experience and outcomes within Griffith Health.

#### Why have I been invited to take part?

You have been invited to take part in this study because you are a student in the Bachelor of Midwifery program who completed the required assessment in your third year of the program.

#### Do I have to take part?

No. It is up to you to decide whether or not to take part. If you do, you will be given this information sheet to keep. Your consent will be indicated by the return of the completed questionnaire. You are still free to withdraw at any time and without giving a reason. Your decision whether or not to participate in the study will not affect your enrolment in your Bachelor of Midwifery program in any way.



### **What will happen to me if I take part?**

You will be asked to complete the survey included with this information form. Some of the questions will require you to select an answer. Other questions will require a short written response. Survey forms will be coded to enable a research assistant to track responses. You are then asked to return the survey to the Research Assistant in the reply-paid envelope included or as an email attachment (Word Document) by the date specified, if sent as an email attachment, the message will be deleted once the survey has been printed. You are not known to the Research Assistant and your responses will be anonymous.

### **What are the possible benefits of taking part?**

There will be no direct benefit to you in taking part in this study. We hope however that the information generated may indirectly benefit you by improving the preparation of graduate midwives in the future and improve maternity outcomes. The information you provide may also help to identify important issues for other student midwives who may benefit from similar assessment and learning strategies. In this way you will contribute to the development of meaningful strategies for engaging future student midwives in learning activities that enhance confidence and maximise preparedness for practice.

### **What are the possible disadvantages and risks of taking part?**

You may feel uncomfortable commenting on some questions, however, this is your opportunity to express your feelings about this particular assessment and any issues you believe need to be voiced in this area. While we do not expect the survey to raise any concerns for you, if it does illicit any emotional or psychological issues or responses, we can refer you to the counselling services offered by Griffith University professional counsellors.

### **Will my taking part in the study be kept confidential?**

Yes. All the information about your participation in this study will be kept confidential. Results of the study will be published in professional journals as a summary of the whole group and contain no identifiable information about you.

### **Contact Details:**

If you would like to discuss this study in more detail before agreeing to take part please contact; Amanda Carter via email [a.carter@griffith.edu.au](mailto:a.carter@griffith.edu.au) or telephone on 33821535 or 0421230466

### **What will happen to the results of the research study?**

The results of the study will be presented to all staff within the Griffith Health Group. The results will also be disseminated to our industry partners to inform them of the continued commitment towards

improving quality in the Bachelor of Midwifery program. The results will also be submitted for publication to a peer reviewed professional journal and submitted for presentation at professional conferences. All content will be de-identified before dissemination of results. Should you wish to obtain feedback regarding the results of the study you are invited to contact the research team. It is anticipated that the project will be completed by June 2013 and results will be available at that time.

### **Who has reviewed the study?**

Griffith University conducts research in accordance with the National Statement on Ethical Conduct in Human Research. This study has been approved by one of the Human Research Ethics committees of Griffith University in accordance with the National Health and Medical Research Council's guidelines. If you would like to speak to an officer of the University not involved in the study, you may contact the Manager, Research Ethics on 3735 5585 or [research-ethics@griffith.edu.au](mailto:research-ethics@griffith.edu.au).

### **Privacy Statement**

The conduct of this research involves the collection, access and/or use of your identified personal information. The information collected is confidential and will not be disclosed to third parties without your consent, except to meet government, legal or other regulatory authority requirements. A de-identified copy of this data may be used for other research purposes. However, your anonymity will at all times be safeguarded. For further information consult the University's Privacy Plan at <http://www.griffith.edu.au/privacy-plan> or telephone (07) 3735 5585.

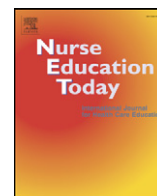
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**Nurse Education Today**

journal homepage: [www.elsevier.com/nedt](http://www.elsevier.com/nedt)



## Using root cause analysis to promote critical thinking in final year Bachelor of Midwifery students



Amanda G. Carter <sup>a,\*</sup>, Mary Sidebotham <sup>a</sup>, Debra K. Creedy <sup>b</sup>, Jennifer Fenwick <sup>c</sup>, Jenny Gamble <sup>b</sup>

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## Appendix E

### Industry Partner Survey Tool – Root Cause Analysis Assessment

Dear Industry Partner,

In a final course within the 3<sup>rd</sup> year of the Bachelor of Midwifery Program (3506NRS – Transition to Midwifery Practice) students completed an assessment item which involved a group presentation on risk management. Students were asked to use risk management and clinical governance principles to explore a variety of critical incidents. You are requested to complete this survey after viewing two of the archived student presentations, as well as reviewing written information about the assessment item including a written description of requirements as supplied to the students, learning objectives and marking criteria. **You are asked not to assess or judge the students' work or performance.** Please **focus on the assessment itself**.

To protect your privacy, this form will be anonymous. You will not put your name on this form and you will return it at the completion of this session. You are encouraged to participate in this survey and complete in full.

There are no right or wrong answers, so please choose responses that most closely reflect your opinion.

First we would like to ask a few questions about you. This information will be combined across all the survey forms and no individual will be able to be identified from the final report.

1. Please tick your age category:

Under 25	26-35	36-45	46-55	Over 55
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. What was is **highest** level of education you have attained?

TAFE	Certificate	Bachelor's Degree	Graduate Diploma	Masters	Doctorate
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. How long have you been registered as a midwife?

Under 5 years	5-10 years	11-15 years	16-20 years	Over 20 years
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. What position do you currently hold?

Midwifery Educator	<input type="checkbox"/>
Midwifery Unit Manager	<input type="checkbox"/>
Clinical Midwifery Consultant	<input type="checkbox"/>
Midwifery Director	<input type="checkbox"/>

To answer the questions below, tick the box which most closely matches how much you agree/disagree with the statement.

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Acceptability					
1. This assessment item engaged the students in learning					
2. This assessment item would be interesting for students to research and prepare					
3. The critical incidents provided are similar to those faced in the clinical environment					
4. This is an appropriate assessment for final year Bachelor of Midwifery students					
5. I would recommend this assessment item continue within this course					
Educational Impact					
6. This assessment item enhances student learning					
7. This assessment item encourages students' critical thinking skills					
8. This assessment item develops a students' decision making skills					
9. This assessment item enhances students' ability to assess complex needs					
10. This assessment item challenges student's thinking					
11. This assessment item encouraged students to examine the whole clinical situation rather than the tasks at hand					
12. This assessment item measures the relevant course objectives					
Preparation as a Midwife					
13. Students will be more confident and able to make appropriate clinical decisions in complex situations after successfully completing this assessment					

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
14. Students will gain an enhanced understanding of midwives' accountability after successful completion of this assessment					
15. This assessment item develops students' appreciation of the value and extent of other roles within the wider health care team					
16. This assessment item promotes the development of skills in collaborative practice					
17. Students will be more aware of the causes of critical incidents following the completion of this assessment item					
18. Students are less likely to make clinical errors following completion of this assessment item					
19. Teaching students to use risk management and clinical governance principles in this way assists them in meeting the ANMC Competencies					
20. This assessment item assists prepare student midwives for midwifery practice					

1. Please explain the positive aspects of this assessment item

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2. Please state what could be improved regarding this assessment item

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3. What do you believe the most important students learning outcomes will be from this assessment item?

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4. Is there anything else you would like to add?

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Thank you for completing this survey.

Please place your completed survey in the envelope provided and return to the facilitator of your session.

Amanda Carter, Midwifery Lecturer

## Appendix F

### Participant information Sheet- Industry Partner: Root Cause Analysis Assessment

#### Chief Investigator

Ms Amanda Carter  
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School of Nursing & Midwifery  
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Logan campus Griffith University  
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M 0404080518  
j.gamble@griffith.edu.au

Dr Jennifer Fenwick  
Professor of Midwifery Griffith University  
Clinical Chair Gold Coast Hospital, Logan Campus  
Griffith University  
M 0410479985  
j.fenwick@griffith.edu.au

#### What is the purpose of the study?

The purpose of this study is to examine the effectiveness of an innovative assessment item designed to evaluate students' ability to apply critical thinking within a clinical framework. The goal of this assessment item is to foster independent learning and equip students with the skills to situate their learning in the 'real world' of practice. This study is part of a larger program of work addressing the Student Life Cycle objectives of advancing the student experience and outcomes within Griffith Health.



**Why have I been invited to take part?**

You have been invited to take part in this study because you are a recognised midwifery expert and a significant Industry Partner of Griffith University where the assessment was utilised with third year students in the Bachelor of Midwifery program.

**Do I have to take part?**

No. It is up to you to decide whether or not to take part. If you do, you will be given this information sheet to keep and be asked to sign a consent form. You are still free to withdraw at any time and without giving a reason. Your decision whether or not to participate in the study will not affect your relationship with Griffith University in any way.

**What will happen to me if I take part?**

You will be asked to attend a session at an agreed site and time. A brief introduction will be provided by a Midwifery Lecturer and any questions you have will be answered. You will be provided with information about the assessment item including a written description of requirements as supplied to the students, learning objectives and marking criteria. You will then be asked to watch archived recordings of student assessments. At the completion of the viewing, you will be asked to complete a questionnaire, about the assessment item. You will not be asked to comment on students' performance, only on the assessment item. Some of the questions will require you to select a single answer. Other questions will require a short written response.

**What are the possible benefits of taking part?**

There will be no direct benefit to you in taking part in this study. We hope however that the information generated may indirectly benefit you by improving the preparation of graduate midwives in the future and thus improve maternity outcomes. The information you provide may also help to identify important issues for future student midwives who may benefit from similar assessment and learning strategies. In this way you will contribute to the development of meaningful strategies for engaging future student midwives in learning activities that enhance confidence and maximise preparedness for practice.

**What are the possible disadvantages and risks of taking part?**

This is your opportunity to express your feelings about assessment, preparedness for practice, and related issues that you believe need to be voiced in this area. While we do not expect the research to raise any concerns for you, if it does illicit any emotional or psychological issues or responses, we can refer you to the counselling services offered by Griffith University Professional Counsellors.

**Will my taking part in the study be kept confidential?**

Yes. All the information about your participation in this study will be kept confidential. Results of the study will be published in professional journals as a summary of the whole group and contain no identifiable information about you.

**Contact Details:**

If you would like to discuss this study in more detail before agreeing to take part please contact;

Amanda Carter via email [a.carter@griffith.edu.au](mailto:a.carter@griffith.edu.au) or telephone on 33821535 or 0421230466

**What will happen to the results of the research study?**

The results of the study will be presented to all staff within the Griffith Health Group. Dissemination of results to all our industry partners as an integral part of this study will demonstrate our continuing commitment to improving the quality of the Bachelor of Midwifery program. Study results will also be submitted for publication to a peer reviewed professional journal and for presentation at professional conferences. All content will be de-identified before dissemination of results. You are invited to contact the research team for feedback regarding the results of the study. It is anticipated that the project will be completed in June 2013.

**Who has reviewed the study?**

Griffith University conducts research in accordance with the National Statement on Ethical Conduct in Human Research. This study has been approved by one of the Human Research Ethics committees of Griffith University in accordance with the National Health and Medical Research Council's guidelines. If you would like to speak to an officer of the University not involved in the study, you may contact the Manager, Research Ethics on 3735 5585 or [research-ethics@griffith.edu.au](mailto:research-ethics@griffith.edu.au).

**Privacy Statement**

The conduct of this research involves the collection, access and/or use of your identified personal information. The information collected is confidential and will not be disclosed to third parties without your consent, except to meet government, legal or other regulatory authority requirements. A de-identified copy of this data may be used for other research purposes. However, your anonymity will at all times be safeguarded. For further information consult the University's Privacy Plan at <http://www.griffith.edu.au/privacy-plan> or telephone (07) 3735 5585.

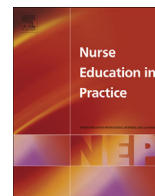
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Midwifery education in practice

### Strengthening partnerships: The involvement of health care providers in the evaluation of authentic assessment within midwifery undergraduate education



Amanda G. Carter <sup>a,\*</sup>, Mary Sidebotham <sup>a</sup>, Debra K. Creedy <sup>b</sup>, Jennifer Fenwick <sup>c</sup>,  
Jenny Gamble <sup>b</sup>

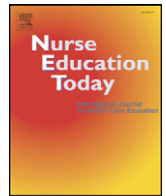
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Nurse Education Today

journal homepage: [www.elsevier.com/nedt](http://www.elsevier.com/nedt)



Review

## Evaluation of tools used to measure critical thinking development in nursing and midwifery undergraduate students: A systematic review



Amanda G. Carter <sup>a,\*</sup>, Debra K. Creedy <sup>b</sup>, Mary Sidebotham <sup>a</sup>

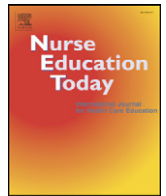
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**Nurse Education Today**

journal homepage: [www.elsevier.com/nedt](http://www.elsevier.com/nedt)



Review

## Efficacy of teaching methods used to develop critical thinking in nursing and midwifery undergraduate students: A systematic review of the literature



Amanda G. Carter<sup>a,\*</sup>, Debra K. Creedy<sup>b</sup>, Mary Sidebotham<sup>a</sup>

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## Appendix J

### Evaluating Critical thinking skills in Bachelor of Midwifery Students – Preceptor Survey

#### Demographic questions

First we would like to ask a few questions about you. This information will be combined across all the results and no individual will be able to be identified from the final report.

3. Please indicate your gender: Female ☐ Male ☐

4. Please state your age in years \_\_\_\_\_

5. What was is **highest** level of education you have attained?

TAFE	Certificate	Bachelor's Degree	Graduate Diploma	Masters	Doctorate
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. How many years have you been registered as a midwife? \_\_\_\_\_

7. What is your current midwifery position? \_\_\_\_\_

Please choose a 2<sup>nd</sup> or 3<sup>rd</sup> year midwifery student whom you have supervised in the current semester.

**Name of Student** \_\_\_\_\_

(This will be removed once the survey is matched and coded)

**Please rate the midwifery student, on each item indicating your level of agreement with the following statements on a scale of 1 = strongly disagree to 6 = strongly agree**

Criteria	Strongly Disagree	Disagree	Tend to Disagree	Tend to Agree	Agree	Strongly Agree
1. Explores the woman's preferences of care and plans care accordingly						
2. Sequences care and education to meet the individual needs of the woman						
3. Suggests relevant literature and education strategies to facilitate the woman's decision making						
4. Shares relevant evidence and clinical guidelines related to the woman's individual choices						
5. Uses evidence to plan care according to the woman's individual circumstances						
6. Demonstrates insight in providing individualised care to the woman						
7. Liaises and negotiates with colleagues at different levels about processes to optimise outcomes for the woman						

Criteria	Strongly Disagree	Disagree	Tend to Disagree	Tend to Agree	Agree	Strongly Agree
8. Consults and utilises resources (e.g. literature, guidelines, etc.) to improve care for the woman						
9. Seeks the root cause if problems arise whilst caring for the woman						
10. Effectively explores multiple solutions to a given situation						
11. Seeks clarifies about interventions that appear inappropriate or unnecessary						
12. Where needed, negotiates a collaborative intervention plan with relevant health care providers						
13. Demonstrates an understanding of the rationale for following (or departing from) established guidelines and policies						
14. Recognises non-evidence based or non-woman centred practice by self and others						
15. Voices concerns about non-evidence based or non-woman centred practices by self and others						
16. Identifies organisational/service improvement opportunities						
17. Questions the 'unwritten rules' in midwifery practice that are not evidence- based						
18. Analyses own strengths and limitations in skills, knowledge and experience						
19. Addresses own limitations in skills, knowledge and experience						
20. Initiates professional dialogue around midwifery practice						
21. Evaluates own practice and its effect on the woman and others						
22. Adjusts own practice based on feedback from the woman and others						
23. Recognises own attitudes, biases and values and their potential impact on practice						
24. Debriefs with a professional colleague following complex situations to improve future practice						

**Many thanks for your time in completing this survey**

## Appendix K

### Participant information Sheet – Preceptor

#### Evaluating Critical thinking skills in Bachelor of Midwifery Students

Student Researcher	Chief Investigator	Additional Investigator
<p>Ms Amanda Carter Midwifery Lecturer School of Nursing &amp; Midwifery Logan Campus, Griffith University Ph: 33821535 M 0421230466 <a href="mailto:a.carter@griffith.edu.au">a.carter@griffith.edu.au</a></p>	<p>Professor Debra K Creedy Professor of Perinatal Mental Health Griffith Health Institute Griffith University Ph 338 21024 M: 0407555105 d.creedy@griffith.edu.au</p>	<p>Dr Mary Sidebotham Senior Lecturer , Program Director Master of Primary Maternity Care School of Nursing and Midwifery, Logan Campus, Griffith University Ph 338 21378, M 0434932303 m.sidebotham@griffith.edu.au</p>

#### What is the purpose of the study?

The purpose of this study is to examine student's critical thinking abilities and the development of these skills within the Bachelor of Midwifery Program. One of the aims of the Bachelor of Midwifery Program is development of critical thinking skills that enhance clinical decision making, reflection on practice and appraisal of the literature and clinical guidelines in practice. This study is part of a larger program of work addressing the Griffith Health Student Life Cycle objectives of advancing the student experience and outcomes. It is also part of a PhD study being undertaken by Amanda Carter.

#### Why have I been invited to take part?

You have been invited to take part in this study because you have been identified as a practice partner who supervises Griffith Bachelor of Midwifery students in practice.

#### Do I have to take part?

No. It is up to you to decide whether or not to take part. Your consent will be indicated by completion of the survey. Your decision whether or not to participate in the study will not affect your relationship with Griffith University in any way. You can choose to withdraw at any time or not answer every question if you wish without inquiry.

#### What will happen to me if I take part?

You will be asked to complete a survey assessing the critical thinking skills in practice of a midwifery student whom you have been supervised on clinical placement recently. The results of this survey are not used as part of the student's formal academic assessment within the Bachelor of Midwifery program.



### **What are the possible benefits of taking part?**

There will be no direct benefit to you in taking part in this study. Research has shown that critical thinking is imperative to developing autonomous midwifery practice. The information you provide may also help to identify gaps in students' critical thinking abilities and develop strategies to address these. In this way you will contribute to the development of meaningful strategies for engaging current and future student midwives in learning activities that enhance critical thinking and maximise their preparedness for practice.

### **What are the possible disadvantages and risks of taking part?**

The survey should take approximately 10 minutes to complete, and therefore requires a time commitment from you. While we do not expect the survey to raise any concerns for you, if it does elicit any emotional or psychological issues or responses, we can refer you to the counselling services offered by Griffith University professional counsellors.

### **Will my taking part in the study be kept confidential?**

Yes. All the information about your participation in this study will be kept confidential. You will be asked to include the name of the student you are evaluating on the survey. To test the reliability of this newly developed tool your responses will be matched with responses from the student who has completed a self-assessment survey tool and then de-identified. The researcher will only receive de-identified data and will not know the identity of the participants or be able to match their responses. Results of the study will be published in professional journals as a summary of the whole group and contain no identifiable information about you or the students.

### **Contact Details:**

If you would like to discuss this study in more detail before agreeing to take part please contact; Amanda Carter via email [a.carter@griffith.edu.au](mailto:a.carter@griffith.edu.au) telephone (07) 3382 1535.

### **What will happen to the results of the research study?**

Results of the study will be shared within Griffith University at relevant teaching forums. The results will also be submitted for publication to peer reviewed professional journals and submitted for presentation at professional conferences. All content will be de-identified before dissemination of results and only group data will be used. Should you wish to obtain feedback regarding the results of the study you are invited to contact the research team at any time for a summary.

### **Who has reviewed the study?**

Griffith University conducts research in accordance with the National Statement on Ethical Conduct in Human Research. This study has been approved by one of the Human Research Ethics

committees of Griffith University in accordance with the National Health and Medical Research Council's guidelines. If you would like to speak to an officer of the University not involved in the study, you may contact the Manager, Research Ethics on (07) 3735 4375 or [research-ethics@griffith.edu.au](mailto:research-ethics@griffith.edu.au).

### **Privacy Statement**

The conduct of this research involves the collection, access and/or use of your identified personal information. The information collected is confidential and will not be disclosed to third parties without your consent, except to meet government, legal or other regulatory authority requirements. A de-identified copy of this data may be used for other research purposes. However, your anonymity will at all times be safeguarded. For further information consult the University's Privacy Plan at <http://www.griffith.edu.au/privacy-plan> or telephone (07) 3735 4375.

**THANK YOU FOR YOUR TIME**



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**Midwifery**

journal homepage: [www.elsevier.com/midw](http://www.elsevier.com/midw)



## Development and psychometric testing of the Carter Assessment of Critical Thinking in Midwifery (Preceptor/Mentor version)



Amanda G. Carter, RM, BHealthSc, MMid (Program Director, Bachelor of Midwifery)<sup>a,\*</sup>,  
Debra K. Creedy, RN, PhD (Professor of Perinatal Mental Health)<sup>b</sup>,  
Mary Sidebotham, RM, PhD (Director Primary Maternity Care Program)<sup>a</sup>

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## Appendix M

### Evaluating Critical thinking skills in Bachelor of Midwifery Students – Student Survey

#### Demographic questions

First we would like to ask a few questions about you. This information will be combined across all the results and no individual will be able to be identified from the final report.

1. Please state your age in years \_\_\_\_\_

2. As of December 2016 what year of the Bachelor of Midwifery will you have completed?

1<sup>st</sup> Year

2<sup>nd</sup> Year

3<sup>rd</sup> Year

☐
☐
☐

3. What is the **highest** level of education you have previously attained?

High  
School

TAFE

Bachelor's  
Degree

Graduate  
Diploma

Masters

Doctorate

☐
☐
☐
☐
☐
☐

***Please indicate your level of agreement (with an X in one box only) with the following statements regarding your own practice as a midwifery student***

Criteria	Strongly Disagree 1	Disagree 2	Tend to Disagree 3	Tend to Agree 4	Agree 5	Strongly Agree 6
1. I often find myself questioning things I hear or read in this program to decide if I find them convincing						
2. When a theory, interpretation, or conclusion is presented in class or in the readings, I try to decide if there is good supporting evidence						
3. I treat the course material as a starting point and try to develop my own ideas about it.						
4. I try to play around with ideas of my own related to what I am learning in this program.						
5. Whenever I read or hear an assertion or conclusion in this program, I think about possible alternatives.						
6. I explore the woman's preferences of care and plan care accordingly						
7. I sequence care and education to meet the individual needs of the woman						

Criteria	Strongly Disagree 1	Disagree 2	Tend to Disagree 3	Tend to Agree 4	Agree 5	Strongly Agree 6
8. I choose relevant literature and education strategies to facilitate the woman's decision making						
9. I share relevant evidence and clinical guidelines related to the woman's individual choices						
10. I use evidence to plan care according to the woman's individual circumstances						
11. I often instinctively know what type of care is right for the woman						
12. I liaise and negotiate with colleagues at different levels about processes to optimise outcomes for the woman						
13. I consult resources (e.g. literature, guidelines, etc.) to improve care for the woman						
14. If problems arise when caring for the woman I try to seek the root cause						
15. I explore multiple solutions to a given situation						
16. I seek clarification about clinical procedures or practice that appears inappropriate or unnecessary						
17. Where needed, I negotiate a collaborative intervention plan with relevant health care providers						
18. I can provide the rationale for following (or departing from) established guidelines and policies						
19. I apply knowledge from past experiences to present situations						
20. I continually analyse my own strengths and limitations in skills, knowledge and experience						
21. I address my limitations in skills, knowledge and experience						
22. I can recognise non-evidence based or non- woman centred practice by self and others						
23. I voice my concerns about non-evidence based or non-woman centred practices by self and others						
24. I identify organisational/service improvement opportunities						

Criteria	Strongly Disagree 1	Disagree 2	Tend to Disagree 3	Tend to Agree 4	Agree 5	Strongly Agree 6
25. I question the 'unwritten rules' in midwifery practice that are not evidence-based						
26. I initiate professional dialogue around midwifery practice						
27. I evaluate my practice and its effect on the woman and others						
28. I adjust my practice based on feedback from the woman and others						
29. I recognise my attitudes, biases and values and their potential impact on practice						
30. I debrief with a professional colleague following complex situations to improve my future practice						

**Many thanks for your time in completing this survey your assistance is greatly appreciated.**

## Appendix N

### Participant information Sheet - Students

#### Evaluating Critical thinking skills in Bachelor of Midwifery Students

Student Researcher	Chief Investigator	Additional
<p>Ms Amanda Carter Midwifery Lecturer School of Nursing &amp; Midwifery Logan Campus, Griffith University Ph: 33821535 M 0421230466 <a href="mailto:a.carter@griffith.edu.au">a.carter@griffith.edu.au</a></p>	<p><b>Investigator</b> Professor Debra K Creedy Professor of Perinatal Mental Health Griffith Health Institute Griffith University Ph 338 21024 M: 0407555105 <a href="mailto:d.creedy@griffith.edu.au">d.creedy@griffith.edu.au</a></p>	<p>Dr Mary Sidebotham Senior Lecturer , Program Director Master of Primary Maternity Care School of Nursing and Midwifery, Logan Campus, Griffith University Ph 338 21378, M 0434932303 <a href="mailto:m.sidebotham@griffith.edu.au">m.sidebotham@griffith.edu.au</a></p>

#### What is the purpose of the study?

The purpose of this study is to examine student's critical thinking abilities and the development of these skills within the Bachelor of Midwifery Program. The Bachelor of Midwifery Program aims to develop critical thinking skills that enhance clinical decision making, reflection on practice and appraisal of the literature and clinical guidelines for practice. This study is part of a larger program of work addressing the Griffith Health Student Life Cycle objectives of advancing the student experience and outcomes. It is also part of a PhD study being undertaken by Amanda Carter.

#### Why have I been invited to take part?

You have been invited to take part in this study because you are a student in the Bachelor of Midwifery program.

#### Do I have to take part?

No. It is up to you to decide whether or not to take part. Your consent will be indicated by completion of the questionnaire. Your decision whether or not to participate in the study will not affect your enrolment or results in your Bachelor of Midwifery program in any way. You can choose to withdraw at any time or not answer every question if you wish without inquiry. The results of this survey are not part of your formal academic assessment within the Bachelor of Midwifery program.

#### What will happen to me if I take part?

You will be asked to complete a self-assessment survey about the application of critical thinking skills to your learning and midwifery practice.

### **What are the possible benefits of taking part?**

Taking part in this project will give you a better understanding of your critical thinking abilities. Research has shown that critical thinking is imperative to developing autonomous midwifery practice. Your participation may enable you to identify areas for improvement and impact on your approach to practice. The study will also provide group data on students' critical thinking abilities and inform the development of focussed teaching methods that will help other students. In this way you will contribute to the development of effective learning activities that enhance students' critical thinking and maximise their preparedness for practice.

### **What are the possible disadvantages and risks of taking part?**

The survey should take approximately 10 minutes to complete, and therefore requires a time commitment from you. While we do not expect the survey to raise any concerns for you, if it does elicit any emotional or psychological issues or responses, we can refer you to the counselling services offered by Griffith University professional counsellors.

### **Will my taking part in the study be kept confidential?**

Yes. All the information about your participation in this study will be kept confidential. You will not be required to include your name on the survey and therefore your responses will be anonymous. Results of the study will be published in professional journals as a summary of the whole group and contain no identifiable information about you.

### **Contact Details:**

If you would like to discuss this study in more detail before agreeing to take part please contact; Amanda Carter via email [a.carter@griffith.edu.au](mailto:a.carter@griffith.edu.au) telephone (07) 3382 1535.

### **What will happen to the results of the research study?**

Results of the study will be shared within Griffith University at relevant teaching forums. The results will also be disseminated to our industry partners to inform them of Griffith University's continued commitment towards improving quality in the Bachelor of Midwifery program. The results will also be submitted for publication to a peer reviewed professional journals and submitted for presentation at professional conferences. All content will be de-identified before dissemination of results and only group data will be reported. Should you wish to obtain feedback regarding the results of the study you are invited to contact the research team at any time for a summary of the findings.

### **Who has reviewed the study?**

Griffith University conducts research in accordance with the National Statement on Ethical Conduct in Human Research. This study has been approved by one of the Human Research Ethics



committees of Griffith University in accordance with the National Health and Medical Research Council's guidelines. If you would like to speak to an officer of the University not involved in the study, you may contact the Manager, Research Ethics on (07) 3735 4375 or [research-ethics@griffith.edu.au](mailto:research-ethics@griffith.edu.au).

### **Privacy Statement**

The conduct of this research involves the collection, access and/or use of your identified personal information. The information collected is confidential and will not be disclosed to third parties without your consent, except to meet government, legal or other regulatory authority requirements. A de-identified copy of this data may be used for other research purposes. However, your anonymity will at all times be safeguarded. For further information consult the University's Privacy Plan at <http://www.griffith.edu.au/privacy-plan> or telephone (07) 3735 4375.

**THANK YOU FOR YOUR TIME**



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## Critical thinking skills in midwifery practice: Development of a self-assessment tool for students



Amanda G. Carter, RM, BHealthSc, MMid<sup>a,\*</sup>, Debra K. Creedy, RN, PhD Professor of Perinatal Mental Health<sup>b</sup>, Mary Sidebotham, RM, PhD<sup>a</sup>

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## Appendix P

### Assessment of Critical Thinking in Reflective Writing for Midwifery Students

**Student's Name:** \_\_\_\_\_

(This will be removed once the survey is matched and coded)

**Please rate the students' reflective writings based on the following scale:**

Criteria	Not at all 1	Very limited 2	To some extent 3	To a considerable extent 4	To a great extent 5
1. Identifies the significance of the topic or situation being reflected on					
2. Demonstrates insight into the need to provide individualised care to the woman					
3. Investigates the root cause of problems that arose in the situation or explains enabling factors that lead to a positive outcome					
4. Identifies and examines appropriateness of clinical procedures and practice					
5. Examines perspectives of woman and others involved in situation					
6. Accurately applies the literature pertinent to situation					
7. Critically analyses the quality of the literature and its' relevance to the individual woman's situation					
8. Explores alternative approaches to the situation					
9. Justifies suggested alternatives					
10. Evidence of woman's preferences central to suggested alternatives					
11. Recognises the impact of own attitudes, biases and values pertinent to the situation on the care provided					
12. Analyses strengths and limitations in skills, knowledge and experience					
13. Addresses limitations in skills, knowledge and experience					
14. Evaluates own practice and its effect on the woman and others					
15. Appropriately identifies required improvements to own practice pertinent to this situation					

**Name of Assessor:** \_\_\_\_\_

**Appendix Q:** Critical thinking evaluation in reflective writing: Development and testing of Carter Assessment of Critical Thinking in Midwifery (Reflection) (published format).

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**Critical thinking evaluation in reflective writing: Development and testing of Carter Assessment of Critical Thinking in Midwifery (Reflection)**



Amanda G. Carter, RM BHealthSc MMid Program Director, Bachelor of Midwifery<sup>a,\*</sup>,  
Debra K. Creedy, RN PhD Professor of Perinatal Mental Health<sup>b</sup>, Mary Sidebotham, RM  
PhD Associate Professor of Midwifery, Director Primary Maternity Care Programs<sup>a</sup>

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