THE LEARNING STYLE

AND

CRITICAL THINKING ABILITIES

WITHIN

NURSING SPECIALTIES

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Declaration of originality

This thesis contains no material that has been accepted for any other degree in any university. To the best of my knowledge and belief, this thesis contains no material previously published or written by any other person, except where due reference is given in the text.

Signature:

Abbreviations and glossary

Abilities – Having the capabilities to do something. It is up to the individual to whether they use these abilities or not.

Convenience sample – The most readily available persons as subjects into a study.

Cohort - A group of persons with a common characteristic.

Critical thinking – Primarily, critical thinking is reasonable and reflective thinking which is focused upon deciding what to believe or do. Also required are certain abilities, dispositions, strategies and tactics.

Disposition – Motivation and justification for the use of critical thinking abilities, that also define one’s frame of mind.
Experiential Learning Theory – Continually views the learner as being able to continually modify concepts through experience as a way of adapting to the environment. This is displayed in the way an individual can reflect on what they have done, and then be able to adapt or modify their knowledge and skill from that experience to utilize as a basis for understanding in new situations.

Inservice session – An informal educational update.

Intuition - Is a non-linear decision making process that occurs as a rapid, effortless, non-conscious process involving a sound, rational, and relevant knowledge base developed through experience.

Learning – A process combining both behavioral and cognitive theories through learner’s experience, perception, cognition, and behavior.

Learning mode – Kolb’s two-dimensional model incorporates four different learning modes situated at each end of the two dimensions. They are Concrete Experience, Abstract Conceptualization, Active Experimentation, and Reflective Observation. They each have particular learner characteristics that dominate in learning situations.

Learning style - A learning style is the particular way in which an individual organizes experience to acquire and retain knowledge. The two learning dimensions of Kolb’s model form four quadrants. Each of these are representative
of an individual learning style. The styles are Accommodator, Diverger, Assimilator, and Converger.

**Learning Style Inventory** - Kolb's LSI (1976) is a brief, self-descriptive inventory designed to measure learning style constructs. Calculation of individual learning modes and learning styles is performed utilizing Kolb's learning style model.

**Learning Style Model** - Kolb's model incorporates learning theory, individual development, and personality types seen as a continuous life-long process. Kolb's model incorporates problem solving into this process that causes an iterative process to the enhancement of learning.

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Abstract

This study was designed to investigate the relationship between learning styles and critical thinking ability of Critical Care and Gerontic nurses. The focus of nursing care differs between specialties, hence the multiple areas of content knowledge required by the nurse to draw on, differs also. Due to the differences between specialties it was hypothesized that different learning styles would exist between different work environments. It was also hypothesized that learners with Kolb’s Diverger learning style would possess the abilities and dispositions for critical thinking. Kolb’s Learning Style Inventory (1976) was used to assess respondents’ learning styles, and the Cornell Critical Thinking Test (Level Z) to assess critical thinking abilities. Of two hundred and twenty Melbourne based nurses approached, fifty-six respondents participated in the study. No relationship between learning style and critical thinking was found. The majority of respondents (80%) displayed Concrete learning styles, with the Critical Care cohort predominantly displaying an Accommodator type learning style, and the Gerontic cohort displaying predominantly a Divergent learning style. Critical Care respondents displayed a marginally higher, yet very similar, level of critical thinking compared with Gerontic cohorts. The similar result in both cohorts lend support to the presence of critical thinking within the nursing process. The overall level of critical thinking was not as high as expected, raising doubts about the degree of nurturing critical thinking in the academic and clinical setting. Kolb’s model of learning was partially supported in reference to the positioning of the modes in the two-dimensional learning style model. Abstract Conceptualization was opposite Concrete Experience on the first learning dimension, and Active Experimentation
was found opposite Reflective Observation on the second dimension. However Kolb’s unique scaling of the learning style grid made analysis within the study extremely difficult. Age related negatively with critical thinking, lending some support to Cattell’s (1971) work on intellectual development, and raising questions about the relationship of critical thinking and fluid intelligence.
INTRODUCTION

The increasing complexity of the Australian health-care setting and of health complaints has contributed to greater nurse specialization in the attempt to improve the quality of care delivery to the general public. Rapid expansion of medical technology and a growing elderly population has further contributed. Nearly 90% of older people have a chronic illness (Eliopoulos, 1995). The diversity of needs has increased; and increasingly complex diagnostic and therapeutic client management has increased the acuity of health-care delivery.

The development of nursing specialties has occurred not only due to professional development imperatives but also through the need to ensure that the client accesses the facilities and skills they need. There have been no clear criteria for specialty development. The specialties within the hospital setting tend to mirror hospital organizational structure and the medical model. Therefore many nursing specialties focus on components of the body via medical and surgical perspectives, such as orthopaedics, gynaecology, renal and coronary, and oncology (Cheah & Moon, 1993).

Other specialties utilize the disease model focusing on specific conditions and pathological outcomes, incorporating diabetes, AIDS, and stomal care. Critical Care and Intensive Care nursing relate to the patient/client physical state; paediatric and geriatric nursing adopt an age-based approach (Cheah & Moon, 1993).
Nursing specialization through the possession of a more specific knowledge and skill base has assisted to focus and individualize client requirements.

Caring for a client involves on-going decision making with any decision being informed by one or more areas of content knowledge. The focus of nursing can change between specialties. In one context the nurse is required to respond to a potentially critical and unwanted deterioration of a client's physical health, as experienced in the Critical Care area. In another the maintenance of health and well being and in providing a dignified death is the focus, as experienced in the Gerontic area of nursing.

The extent to which the focus of nursing care differs depends upon the nurses' need to draw on multiple areas of knowledge. Where a client's physical health has a greater potential to decline rapidly such as in a Critical Care Unit, the nurse may be called upon to utilize a broader range of knowledge. This is in comparison to areas in which decisions to do with maintenance of life and providing a dignified and accepted death are required, as in a Gerontic Unit.

Basic to effective work in both contexts are nurse knowledge and the extent to which nurses have been able to integrate specialist knowledge with decision-making. One aspect of knowledge, experience and decision making is the presence of intuition in nursing care. Intuition and its presence in the nursing profession has been increasingly investigated in the nursing literature over recent years (Correnti, 1992; Miller & Rew, 1989; Constance, 1987; Rew & Barrow, 1987; Rew, 1987;
Young, 1987; Benner & Tanner, 1987; Benner, 1984; Dreyfus & Dreyfus, 1986; Murray, 1994; Paul & Heaslip, 1995; King & Appleton, 1997; Easen & Wilcockson, 1996).

It is purposed that specific to a nursing specialty is the content knowledge required to work efficiently and competently in that particular specialty, therefore making the learning style of specialist nurses specific to their work environment. The generic traits of decision making in nursing, and the use of intuition in experienced nurses that has also led to the study focusing on the examination of relationships that may exist between learning styles and critical thinking abilities of Critical Care and Gerontic nurses. It is also of interest to examine if there are differences between specialties and also within these specialties in an attempt to further understand these two constructs.

**Experiential Learning Theory**

The majority of the literature examining nurses’ learning styles utilize an integrated model of learning designed by David Kolb (1976). Kolb’s model incorporates learning theory, individual development, and personality types within the context of a continuous life-long process. The Experiential Learning theory has its origins in social psychology, philosophy, and cognitive psychology. Hence the model views learning through experience in a holistic and integrative perspective which combines perception, behavior, and cognition. In attempting to integrate the behavioral and cognitive theories of learning, Kolb differentiated his theory from other learning theories. He did this by emphasizing the importance experience has
in the learning process, especially emphasizing one’s immediate concrete experience as a focal point of learning (Richter, 1992).

Kolb’s theory owes much to the work of Dewey, Lewin and Piaget. Kolb’s view of learning as a cyclic process is partially derived from the Lewinian model of learning which viewed learning in a four-stage cycle. This included reflection and observation, concrete experience, formation of generalizations and abstract concepts, and testing conceptual implications within new situations (Richter, 1992).

Kolb’s model drew on Lewin’s views of the integration of theory and practice. This involved observation and reflection of concrete experiences, questioning the validity and implications of concepts made during the learning process. Feedback is also important in integrating theory into practice by influencing the social learning and problem-solving process through generating new information to assess the divergence from expected outcomes.

Dewey’s Model of Learning is very similar to that of Lewin. However it emphasizes the developmental nature of learning into the continuous maturation of a higher level of understanding. Dewey believes a blind impulse can lead to observation, knowledge development, and then the generation of a judgment that leads onto the formation of a new impulse in a continuous cycle.

Piaget’s Model of Learning and Cognitive Development, similar to that of Lewin and Dewey, views learning as a cyclic interaction between the individual and the
environment. The developmental stages of learning studied by Piaget led him to believe that cognitive development from childhood to adulthood progressed from a concrete, egocentric view of the world to an abstract and an internally reflective mode of understanding. Piaget viewed learning as a progression from imitating concepts or schemas of one’s environment (accommodating) to a process in which events and experiences from one’s environment become abstract concepts and schemas brought about through reflection and understanding (assimilation). Piaget viewed learning as a balanced interaction of both accommodation and assimilation (Biggs & Moore, 1993; Richter, 1992).

As well as the emphasis on the developmental nature of learning, Kolb also integrates the work of other theorists such as Erikson, Rogers, Jung and Maslow into his conceptualization of the learning process of adults. These socioemotional, cognitive and psychological development models provided Kolb with a holistic framework for describing adult developmental processes and their relationship with learning.

Other influences include more liberal educators who encouraged the exploration of the personal, experiential meaning of abstract concepts.

As such, these views serve to highlight the central role of the dialectic between abstract concepts and subjective personal experience in educational/political conflicts between the right, which places priority on maintenance of the social order, and the left, which values more highly individual freedom and expression (Kolb, 1984, p. 16).
Learning

The origins of Kolb’s model help to explain his definition of learning. Learning is seen to combine both behavioral and cognitive theories through the learner’s experience, perception, cognition, and behavior.

Learning is viewed as process orientated rather than a behavioral outcome, as behavioral outcomes may not always accompany learning. Rather than expecting learning to be shown through measuring the ‘facts’ that a person has stored in their memory, Experiential Learning Theory views the learner as being continually able to modify concepts through experience as a way of adapting to the environment. This continuous ability to process and modify concepts is displayed in the way an individual can reflect on what they have done, and then be able to adapt or modify their knowledge and skill from that experience to utilize as a basis of understanding in new situations.

Kolb’s model also views the process of learning as resulting from conflict resolution within the environment. Kolb’s view was supported by the work of Lewin, Dewey, and Piaget, who emphasize two opposing forces. Lewin’s model displays the conflict between concrete experience and abstract concepts. Dewey’s framework incorporates the ‘impulse’ that initiates the cycle and the reaction that gives desire to its direction as the major dialectic. Piaget’s model refers to the two processes of accommodation and assimilation.

Due to the existence of these dialectical forces within the learning process, Kolb incorporated two dimensions in his model. Within this two dimensional model
(Figure 1) the first dimension represents the abstract conceptualization of events at one end and concrete experience at the other. The second dimension has active experimentation at one extreme and reflective observation at the other. To utilize the four types of abilities effectively the learner must be able to move within these two dimensions.

Figure 1. Kolb’s Learning Style Type Grid

Note. Adapted from Kolb (1985, p. 36).
Kolb believed that effective learners need to be able to draw upon four modes of learning abilities; concrete experience abilities (CE), reflective observation abilities (RO), abstract conceptualization abilities (AC), and active experimentation abilities (AE).

That is, they must be able to involve themselves openly and totally without bias in new experiences (CE). By viewing a multitude of perspectives they must be able to reflect on and observe their experiences (RO). They must be able to create concepts by integrating their observations into sound theories (AC), and be able to utilize these theories for decision making and problem solving (AE) (Kolb, 1976).

When a learner cannot effectively choose which particular learning abilities they may need for a given learning situation, they may begin to develop a dominant mode of preferred abilities to use with most learning situations.

Kolb’s model incorporates problem solving into the learning process that causes an iterative circular process to the enhancement of learning. Miller and Malcolm (1990) hypothesized that if students’ learning styles were assessed, learning activities that further reinforce strengths or that develop weaker phases could be planned systematically to maximize thinking and problem-solving abilities. Kolb (1976) believes that entry into the problem-solving process occurs at the phase in which the person is the most comfortable and skilled. Therefore to initiate problem solving and learning processes early, learners must be aware of how they direct their learning to achieve optimal results.
Learning Style

A learning style is the particular way in which an individual organizes experience to acquire and retain knowledge. Kolb (1976) defines learning style as the way individuals organize information and experience from a combination of the four basic learning modes. Learning style is accentuated through education and experience. Kolb also believes learning is influenced by heredity, previous experiences, and present everyday demands (environmental press).

The enhancement of one's motivation to learn can also occur if an individual's learning style is compatible with the mode of educational delivery. This encourages the learner to understand, and solve problems in different ways.

Attitudes and interests are also related to learning styles as these variables influence the degree of attention in any learning situation (Richter, 1992). People may tend to prefer one learning style to another; this may limit learning potential. Therefore, people should be made aware of the need to broaden their styles and be encouraged to utilize learning environments that may not immediately suit their preferred learning style.

Kolb's Learning Modes

According to Kolb, the learner will emphasize one aspect of each of the two dimensions (AC-CE; AE-RO), which once combined will yield the individual's learning style.
High scores on Concrete Experience depict a receptive, experience oriented approach to learning heavily reliant on feeling-based judgments. The learner tends to be feeling rather than thinking orientated, and more concerned with the complexity and uniqueness of present reality than with theories and generalizations. High CE learners are people orientated, are open-minded and easily adapt to change, with learning being enhanced through involvement and benefiting from feedback and discussion.

Learners with a high score on Reflective Observation frequently use observation and a reflective approach to learning. In this stage of the learning cycle people can view ideas and situations multi-dimensionally, yet focus on the mastering of a concept rather than in its possible practical application. They form their opinions largely relying on their own thoughts and feelings after much deliberation and thoughtful judgement. However they may not necessarily take any action on these opinions. Unprejudiced observers, they learn best in lectures - which makes them detached learners.

Learners with a high score on Abstract Conceptualization will display a logical and scientific approach to problem solving or other learning situations. They are deductive/thinking learners rather than emotive/feeling learners. Learning is enhanced in impersonal learning situations rather than with people orientated group work/discussions, and are more orientated to things and symbols rather than people.
Learners with a high score on Active Experimentation place a higher emphasis on the practical and experimental application of a concept. They do not place importance on achieving a reflective understanding or regarding the absolute truth, but rather on what will work to get the situation resolved. Learning occurs best by hands-on activity, participating in laboratories, projects and small group discussion. Learners rating high on AE are risk takers and, often being extroverted, will influence people and events through their actions.

Calculation of Kolb’s Learning Style Types

The two learning dimensions form four quadrants. Each of these are representative of an individual learning style. These are shown in Figure 1; each individual learning style described in Kolb’s model is representative of a combination of the four basic modes mentioned above. The learning style types proposed by Kolb are the Accommodator, Diverger, Assimilator, and the Converger. When a learner completes Kolb’s Learning Style Inventory (LSI, 1976) they will frequently tend towards one or two particular learning styles.

Learning Style Type Grid

After completing the LSI, scores from the four learning modes are used to calculate two combination scores. Concrete Experience is subtracted from Abstract Conceptualization to yield the first dimension (AC-CE), and Reflective Observation is subtracted from Active Experimentation to yield the second dimension (AE-RO).
A positive score on the AC-CE dimension would indicate that the individual has an abstract approach to learning, and a negative score indicates the individual has a more concrete approach to learning. If the individual’s score on the AE-RO dimension is positive, they are more active learners, and a negative score indicates they are more reflective in their learning.

**Kolb’s Learning Style Types**

The four learning styles have specific learner characteristics. Accommodators learn best with attributes originating from Concrete Experience and Active Experimentation. They are interactive learners, who are good at carrying out experiments, taking risks and getting involved. They do not like to rely on their own analytic ability and will disregard any theory that does not fit the ‘facts’ presented to them. Problem solving occurs in a trial and error manner, and often act on ‘gut’ feelings rather than logical analysis. They are quite at ease with people’s company in the learning situation, although they can be perceived as intolerant or pushy.

The Divergent learning style combines the learning attributes of Concrete Experience and Reflective Observation. Divergent learners widely utilize their imagination; they can inspect concrete situations from many different view points. As learners they would prefer to observe rather than be active in the learning situation, and gather information to help view implications of obscure situations. They tend to be aware of meanings and values of their learning situation and how that impinges upon others. This awareness and their imagination helps them to perform well at ‘brainstorming’, in generating a broad range of ideas which would
often be an enjoyable learning tool for them. Learners in this dimension are interested in people, are open minded, and are sensitive to others' feelings and values.

Assimilators' learning style combines the learning attributes of Abstract Conceptualization and Reflective Observation, which has the opposite dominant learning characteristics to Accommodators' learning style. Inductive reasoning and creating theoretical models are a dominant characteristic of this style. These people excel in grasping a wide range of observations and information and uniting it with a concise and logical explanation. They are good at testing theories and ideas, organizing information, designing experiments, building conceptual models, and analyzing quantitatively. These individuals are more focused on ideas, concepts, and logic than on people. These types of learners believe more in the importance of a theory's logical soundness than in its practical significance.

The Convergent learners' dominant attributes originate from modes of Abstract Conceptualization and of Active Experimentation. Dominant characteristics of this style involve problem solving, decision making and the practical utilization of ideas. Their knowledge is organized to focus on specific problems through hypothetical-deductive reasoning. Convergers are quite detached from social and interpersonal issues, preferring to deal with technical tasks rather than people.
Kolb’s Learning Style and the Nursing Profession

Vast differences exist in people’s learning styles. Kolb’s theory attempts to encompass these individual differences by recognizing them as an important aspect in an individual’s ability to be attentive, motivated and to evolve as a learner. Through the four modes - Concrete Experience, Abstract Conceptualization, Active Experimentation, and Reflective Observation - he proposes a holistic learning theory incorporating behavioral, cognitive, and perceptual aspects of learning with experience.

Kolb’s model is widely used amongst nursing researchers when investigating learning styles. However, generally a rationale for use of the model has not been presented. Nursing education and nursing care is structured to ensure that the client is viewed in a holistic manner, encompassing physical illness or attributes, psychological, emotional, social, and spiritual wellbeing. The nursing profession is therefore aware that a client or individual is more than uni-dimensional. This perspective has links with Kolb’s model, which also views the individual learner in a holistic manner.

Kolb’s model examines aspects of learning incorporated in nurse education, hence making it appear to be an appropriate tool to assess nurses’ learning styles. Kolb’s model can examine learning involving experience-based, reflective, people-orientated, analytical, experimental, and logical approaches. Nursing education incorporates both theoretical and practical experience. Nursing students are given the chance to learn through structured lectures and learn via experiential, action,
and visual experiences. They must demonstrate safe practice in the clinical situation through both university-based laboratories and practical sessions before commencing in health institutions for direct client care. Hence Kolb’s model appears extremely well suited to the examination of nurses’ learning styles.

Kolb’s Learning Style Inventory has been used widely in nursing studies involving both registered and student nurses. Findings tend to indicate that nurses hold predominantly concrete type learning styles, with the majority being Divergent in learning style.

Haislelt, Hughes, Atkinson, and Williams (1993) found that 74% of a sample of 100 nursing students were Concrete learners, with 38% of the sample being Accommodators, and 36% being Divergers. Laschinger (1986), from a sample of 68 nurses, found 62.5% held Concrete styles, with 33.9% Divergers and 28.6% Accommodators’. Laschinger and Boss (1984) found 64.5% of their sample of 268 nursing students had Concrete learning styles, with 33.6% of the sample being Divergers and 31% being Accommodators. An abstract from Murphy (1988) stated that of 199 registered nurses, most tended to be field dependent, viewed themselves in the Reflective Observation mode of learning, and had primarily abstract and active learning styles. It is not clear which version of the LSI was used in this study. However an abstract from Staton-Cross (1988) states that the majority of the 202 student nurses studied were Concrete learners with Accommodator and Divergent learning styles.
Ridley, Laschinger, and Goldenberd (1995) examined the learning style of nursing students and found a greater proportion of concrete learning styles compared to abstract learning styles (76% concrete and 24% abstract). Divergent learners represented 40% of the learning styles with Accommodator type learners 36%; Assimilative and Convergent learners each represented 12% of the sample.

Wells and Higgs (1990) investigated the learning styles of baccalaureate nursing students and found two predominant learning styles; Abstract Random and Concrete Sequential. This was using Gregorc's Style Delineator. Gregorc proposes a phenomenological view of learning. The learning styles put forward by Gregorc are classified into four categories: Abstract Sequential, and Abstract Random; Concrete Sequential, and Concrete Random. An Abstract Random learner is both emotional and imaginative. Learning proceeds in a random and non-linear fashion. Personal relationships are also important to learners in this style of learning (Wells and Higgs, 1990). Kolb's Diverger is very similar to this style with regards to their imagination and their emotional and caring character. A learner with the Concrete Sequential style is methodological and structured in their learning and they would prefer a progressive approach when dealing with new concepts. This style is very similar to Kolb's Accommodator. Allowing for the differences between these two models, it is still interesting to note that there are the two learning style similarities which predominate within the sample.
Critical Thinking

Critical thinking has been defined as "...reasonable and reflective thinking that is focused upon deciding what to believe or do" (Norris & Ennis, 1990, p. 3). This entails level-headedness in reasoning and reaching conclusions, consciously seeking out valid reasons from selves and others, staying consciously directed, and evaluating statements and actions to ensure the best and optimum result is reached.

Norris and Ennis (1990) have developed a pictorial representation of critical thinking (Figure 2). It implies the interaction of multiple factors within the process of critical thinking, not necessarily in a linear pathway as shown by the figure, but proceeding in a multitude of directions which can stop, restart and retrace.

Figure 2. A pictorial representation of critical thinking.

Note. Adapted from Norris and Ennis (1990, p. 6).
The representation shows the process that is involved in solving a problem by coming to a decision about a belief or action. This process is influenced by the context in which it is placed, interaction with the world and with other people. The 'basic support box', in which all prior knowledge, conclusions, and information from others and the individual is stored, is thought of as the starting point of critical thinking. This previous knowledge is the basis from which the building of ideas and concepts occur in the 'inference box'. The 'inference box' is what holds the three basic types of inference to help come to the final decision. These boxes are pointed to show the flow in logical inference involved in the process. The 'disposition box' and the arrows leaving it represent the need for critical thinking dispositions to be dispersed throughout the whole critical thinking process. The 'clarity box' and its arrows, of equal significance to that of critical thinking, show the need for clarity throughout the process of critical thinking.

To be able to think critically, particular abilities and dispositions are required. These include the use of reflection; the ability to judge the soundness of information and inferences drawn from information. It also includes being open minded and able to produce rational information and inferences; the ability to interact effectively with other people; to be imaginative; and also maintain clarity (Norris & Ennis, 1990).

The section below details the dispositions and abilities defining critical thinking as adapted from Norris and Ennis (1990).
The dispositions of Critical thinkers include:

1. Seeking statement of the thesis or question;
2. Seeking reasons;
3. Trying to be well informed;
4. Using credible sources and mention them;
5. Taking into account the total situation;
6. Keeping their thinking relevant to the main point;
7. Keeping in mind the original or most basic concern;
8. Looking for alternatives;
9. Being open-minded and
   • seriously consider points of view other than their own;
   • reason from starting points with which they disagree without letting
     the disagreement interfere with their reasoning;
   • withhold judgment when the evidence and reasons are insufficient;
10. Taking a position and changing a position when the evidence and reasons
    are sufficient to do so;
11. Seeking as much precision as the subject permits;
12. Dealing in an orderly manner with the parts of a complex whole;
13. Employing their critical thinking abilities;
14. Being sensitive to the feelings, level of knowledge, and degree of
    sophistication of others.
The abilities of critical thinking include:

- Elementary Clarification
  1. Focusing on a question
  2. Analyzing arguments
  3. Asking and answering questions that clarify and challenge

- Basic Support
  4. Judging the credibility of a source
  5. Making and judging observations

- Inference
  6. Making and judging deductions
  7. Making and judging induction's
  8. Making and judging value judgments

- Advanced Clarification
  9. Defining terms and judging definitions
  10. Identifying assumptions

- Strategies and Tactics
  11. Deciding on an action
  12. Interacting with others

The American Philosophical Association (1990, cited in Facione, Facione, & Sanchez, 1994) has also defined the critical thinker:
The ideal critical thinker is habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit (p. 345).

Norris and Ennis' (1990) philosophically derived definition also suggests that critical thinking is a product of the interaction of a set of dispositions toward critical thinking, with a set of abilities for critical thinking. Critical thinking potential is hence reliant on the interaction between an inherent disposition and the environment in which it is nurtured.

The role of intelligence within critical thinking can be viewed through the work of Sternberg (1986). He emphasizes the importance of inductive reasoning, deductive reasoning, and comprehension skills within critical thinking. Dull (1964) linked the skills of background knowledge, a wide vocabulary, good language and perception skills with becoming adept at critical thinking. General intelligence, educational level, and verbal aptitude have also been shown to be related to critical thinking (Brabeck, 1981).

Westbrook and Sellers (1967) found a "substantial" relationship between critical thinking ability and mental ability measured by "conventional" intelligence tests. Critical thinking was measured by the Watson-Glaser Critical Thinking Appraisal, a philosophically-derived critical thinking test which overlaps conceptually with the Cornell Critical Thinking Test. Westbrook and Sellers (1967) found a correlation of 0.53 between the raw scores of the Watson-Glaser Critical Thinking
and the Henmon-Nelson Tests of Mental Ability (Revised Edition) intelligence quotients. Westbrook and Sellers (1967) reported correlations between the Watson-Glaser Critical Thinking Appraisal and intelligence measures ranging from 0.55 to 0.75 with the median at 0.68.

Verbal ability has been thought to account for a high proportion of common variance in measures of critical thinking (Landis & Michael, 1981). Follman, Johnson, Lowe, and Miller (1972) found verbal ability possibly accounted for eighty percent of true score variance in measurements of critical thinking (cited Landis & Michael, 1981). The philosophically based critical thinking tests have been classified as highly verbally loaded (Sternberg, 1986), which may account for any relationship between verbal ability and critical thinking.

The age at which an individual’s intellectual development is advanced enough to perform critical thinking is still unclear. Piagetian theorists view is that with adequate incentives, formal reasoning processes commence at fourteen or fifteen years of age. Lawson and Renner (1974) suggest that few adolescents actually use formal reasoning powers. Another view is that formal thought develops gradually and is often incomplete. However because of diverse backgrounds and differential development, not all students can use these reasoning skills. Some individuals can think critically in one specific area but not in others (Cierziak, 1985).

However Brabeck (1981), who tested 119 students from high school seniors to graduate students, did not find a relationship between educational level and critical thinking ability. Brabeck found no single educational level group completely
accounted for the differences between high and low critical thinking. They did however discover that reflective judgment increased with educational level and that critical thinking is an aspect of reflective judgment development. Notwithstanding these findings, it must be mentioned that presumably the majority of subjects involved in this study were of an age by which formal operations had been achieved. Therefore from this perspective, there may not have been sufficient variation in sample to identify any relationship between intellectual development and critical thinking. This is an interesting point in terms of Cattell’s work.

Cattell’s (1971) theory of intelligence incorporates the existence of the two types of intelligence, fluid and crystallized, that evolve over time, altering with age/experience. At birth both brain structure, along with fluid intelligence is in its most pure state. This declines with normal aging – thought to be after the last wave of nerve cell myelination which is thought to occur between the age of 18 to 25 years - as brain cells die and are not replaced (Biggs & Moore, 1993). This process is hastened by drug use, alcohol being the most prevalent within our society; chemicals, such as aluminum; and reduced oxygen supply, such as smoking and snoring (Biggs & Moore, 1993). Fluid intelligence gives an individual the potential for insight into complex relationships, independent of cultural or sensory influences. One’s fluid ability incorporates “...all the relatively culture-free performances in abstraction and relation education...” (Cattell, 1971, p.8).

An individual’s crystallized intelligence develops as a result of the interaction of fluid intelligence in higher-level cultural skills that the individual is exposed to over the years. It is mostly developed through acculturation and especially with
schooling and is trainable into old age. Crystallized intelligence incorporates among others the well-known primary abilities, such as spatial, numerical, verbal, and mechanical aptitudes (Cattell, 1971). It is the form of intelligence involved in every-day decision-making.

Cattell (1971) found one’s Crystallized intelligence altered in times of cultural change as these abilities are deeply culturally embedded. However fluid intelligence is constant within a population and will remain so over periods of considerable cultural change (Cattell, 1971). The development of both crystallized and fluid intelligence occurs at an equally proportional rate until the age of fifteen years. After this time the growth rate for both types of intelligence dramatically decreases. However a differentiation of growth rates occur between the two types. Crystallized intelligence stabilizes and gradually increases up to and over the age of sixty-five, whereas fluid intelligence gradually decreases to the age of sixty and then plateaus (Figure 3).

Figure 3. Fluid and crystallized intelligence across age.

Note. Adapted from Cattell (1971, p. 12).
Critical thinking abilities could originate within fluid intelligence. Critical thinking abilities are something that exist within every normally functioning individual, being present at birth. However they cannot be fully developed until intellectual maturity is reached; which would be when an individual's dispositions should also be enhanced. On the basis of Cattell and Piaget's work, critical thinking would not be possible until fifteen years of age when more abstract thought is achieved. On the assumption that the nurturing of critical thinking abilities occurs through crystallized intelligence, critical thinking should increase with age after the age of fifteen. If however critical thinking abilities are not further developed and taught, it could be presumed that the ability to think critically would decrease with age along with fluid intelligence.

Critical thinking has been difficult to measure, as an individual's environment and their expertise with the topic affect it (Sternberg, 1986). The environment in which an individual functions can vary and hence their performance will as well. It must also be recognized that personal and situational constraints often impinge upon our working up to full capacity therefore affecting critical thinking abilities. There are numerous potential limitations that ordinarily hinder the utilization of our full competence. Some of these include limited information, limited time, limited working memory capacity, and limited motivation (Sternberg, 1986). An individual's expertise within a topic will influence how well they can think critically to encompass all aspects of the problem.
Critical Thinking and the Nursing Profession

Discussion of critical thinking has been prominent within the nursing literature in recent years, primarily in the context of examining critical thinking within the ‘nursing process’, and justifying its position in the nursing curriculum and clinical setting (Haislett, et al., 1993; Farley Pardue, 1987; Miller & Malcolm, 1990; Jones & Brown, 1991; Berger, 1984; Ford & Profetto-McGrath, 1994; Schank, 1990; Kataoka-Yahiro & Soylor, 1994; Case, 1994). Critical thinking is viewed as an integral part of the nursing process. The Australian healthcare environment is currently exposed to under-staffing, increasing work and technological demands. Notwithstanding, it remains the responsibility of nurses to ensure the safe and competent management of clients. This is achieved through the nurse being able to think critically and creatively by possessing knowledge of nursing, science, medicine, and the humanities to ensure optimal client results.

A critical thinker as outlined above, typifies the characteristics of Kolb’s Divergent learner. It is the Divergent learning style that predominates in nursing research.

Due to the similarities between the characteristics of a Divergent learning style and those of critical thinking, it could be inferred that nurses with Divergent learning styles would also be proficient in critical thinking. This thesis has been structured to investigate if this relationship does exist.

Specialty Nurses

The increasing complexity of Australian health care over the past 30 years has resulted in a growth in the degree of specialization within the nursing profession.
Sophisticated equipment and interventions aimed at providing the complex health needs of patients are demanded. Health care administration expects nurses to provide cost-effective and quality patient care (Chuk, 1997). The rapid developmental changes can often place added demands and pressures on nurses who without specialist knowledge and skills would not be able to provide for their clients' needs efficiently and effectively.

To avoid the delivery of inefficient, ineffective, and poorly managed care, specialization can assist nurses to refine their nursing skills as they continue to work in the one specialty area to meet client needs. As stated by Benner (1984), "...clinical expertise turns out to be highly influenced by experience with similar patient populations" (p. 179). Hamric and Spross (1989) also suggest that two forces, societal and professional, shape nursing specialization. Societal forces influencing nursing specialization include expansion in the depth and complexity of knowledge and technology, and financial constraints placed on health institutions. Professional forces include nurses participating in new areas of research, nurses who are willing to apply necessary change in order to improve the quality of client care through a more in depth understanding of a specialty area. Other professional forces include the profession's desire to advance in a more clinical direction, and to increase the complexity of nursing services to keep up with current health care trends. These professional forces have brought about the specialist postgraduate qualifications for nurses such as Midwifery, Critical Care, Oncology, Gerontology, and Community nursing to name a few, and in the generation of specialty organizations.
Nursing specialization has been defined by the ‘National Nursing Organizations’ meetings (NNO, a twice-yearly meeting of 40 representatives of Australian nursing organizations who discuss issues related to specialization and credentialling). with the ten defining characteristics tabulated below (Table 1).

**Table 1: Designation of Australian nursing specialties.**

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The specialty defines itself as nursing and subscribes to the overall purposes, functions and ethical standards of nursing.</td>
</tr>
<tr>
<td>2</td>
<td>The specialty is a defined area of nursing practice, which requires the application of specially focused knowledge and skills.</td>
</tr>
<tr>
<td>3</td>
<td>There is both a need and a demand for the specialty area.</td>
</tr>
<tr>
<td>4</td>
<td>The focus of a specialty is a defined population or a defined area of activity, which provides a major support service within the discipline, and practice of nursing.</td>
</tr>
<tr>
<td>5</td>
<td>The specialty is based on a core body of nursing knowledge which is being continually expanded and refined by research. Mechanisms exist for supporting, reviewing and disseminating research.</td>
</tr>
<tr>
<td>6</td>
<td>The specialty subscribes to, or has established, practice standards commensurate with those of the nursing profession.</td>
</tr>
<tr>
<td>7</td>
<td>The specialty adheres to Australian requirements for nurse registration.</td>
</tr>
<tr>
<td>8</td>
<td>Specialty expertise is gained through various combinations of formal education programs, experience in the practice area and continuing education. Educational program preparation and administration must include appropriate nursing representation.</td>
</tr>
<tr>
<td>9</td>
<td>The specialty has or is developing a credentialling process consistent with the Australian Nurse Specialist Credentialling Framework. Sufficient human and financial resources are available to support this process.</td>
</tr>
<tr>
<td>10</td>
<td>Practitioners are organized and represented within a specialty association.</td>
</tr>
</tbody>
</table>

Note. Adapted from Bailey (1996, p. 131).
The two specialties involved within this study are Critical Care and Gerontic nursing. Both are classified as specialties; both are important to the health needs of the community; and both are characterized by lack of research involving learning styles and critical thinking abilities.

**Gerontic nursing**

The term Gerontic nursing will be used throughout the thesis when referring to this particular specialty. It should not be confused with geriatric nursing, which focuses on the illness and diseases of the elderly, or Gerontologic nursing which uses a broad scientific base to formulate care of the aged. Gerontic nursing involves the nursing of older persons, encompassing both the illness and scientific principles the person incurs. It also encompasses the art and intuition of caring for and maintaining the health of the elderly (Ebersole & Hess, 1985).

Gerontic nursing is the process of assisting the elderly to understand aging and separate the effects of aging from disease; to control the aging process through hygienic practices and life-styles that promote health, vigor, and attractive old age; and to manage some of the pathogenic conditions that accompany aging when the principles of healthful living have been disregarded (Ebersole & Hess, 1985, p. 4).

The work of a Gerontic nurse may occur in a variety of settings. For example it may be within the community, family setting, nursing homes, or acute care settings. It is within these settings where nurses’ expertise, knowledge, and caring
abilities are used to aid the aged person in the direction of optimum health function.

Nursing homes will gradually show changes in resident dependency/acute due to the fact that patients are being sent to these facilities sicker than in the past. The residents will become more frail, disabled, and dependent on total nursing care with many elderly not fully recovering from all their illnesses (Cheah & Moon, 1993). Palliative care may be the desired outcome for many elderly residents in nursing homes, especially if they are experiencing unrelied physical and emotional pain.

Therefore the attributes required by a Gerontic nurse include a knowledge specific to the physiological, psychological and social needs of the elderly; of social policy legislation; understanding of a range of mental and physical complaints; and qualities involving understanding, observation, and communication. Communication skills are largely important when working with the elderly, as elderly people tend to live with their ailments rather than complain about them. Cheah and Moon (1993) believe that Gerontic nurses need to possess observation skills that they possibly would not normally use in other specialist areas.

Although only a very small fraction of registered nurses are working within geriatric facilities this does not mean that only a few nurses are working with the elderly. Within the acute hospital setting, clients over 65 years of age fill the majority of medical-surgical beds (Eliopoulos, 1995). However when clients are within acute care facilities, their care is integrated into focus primarily on their illness. For example, if a client was admitted with a bone fracture, the initial focus
upon admission would be on orthopaedic rather than Gerontic issues. It is possible that the physiological, psychological and social needs of the elderly take less priority than immediate illness early on in their care within the acute care setting. This is due to prioritization of their health needs, attending to the most urgent needs first.

There are standards for Gerontological/Geriatric/Gerontic nursing practice organized according to a problem-solving nursing process. “It is clear that elderly care nursing possesses a number of traits which enable it to be identified as a specialism in both the sociological sense and that prevailing within nursing” (Cheah & Moon, 1993, p.1615).

**Critical Care Nursing**

Critical Care nursing has now evolved into one of the largest nursing specialty groups within Australia. It is highly technical and requires extensive theoretical knowledge as well as clinical experience.

Within Australia there is a diverse range of critical care settings. Some more specific aspects of Critical Care nursing practice vary from unit to unit, depending on unit size, specialty and resources (Competency Standards for Specialist Critical Care Nurses, 1996, Confederation of Australian Critical Care Nurses). However it has been found that there are generic competencies within the specialty of Critical Care.
Regardless of the type of unit a Critical Care nurse works in, their role still remains a very intense and demanding one. Due to a client's instability in their critical state the Critical Care nurse must have a variety of advanced nursing skills to ensure that safe and competent care is given.

The Critical Care nurse must have an enhanced knowledge of advanced physiology and pathophysiology, possess quick problem solving abilities to be able to work efficiently and precisely for a variety of client care situations. They must competently operate and efficiently manage a range of sophisticated biomedical life-support systems such as ventilators or cardiac-assist devices, and ensure the client's safety through advanced clinical assessment, monitoring and intervention.

The Critical Care nurse must attempt to seek the rationality for all clinical interpretations and skillfully respond to all clinical cues (Hudak, Gallo, & Benz, 1990). The Critical Care nurse must possess a sound understanding of ethical and legal issues, acting as the client's advocate as required and demonstrating accountability for their actions. These requirements imply that a Critical Care nurse must demonstrate advanced problem-solving and communication skills, utilizing these effectively in managing and coordinating the health care of complex situations within the Critical Care environment.

One of the hallmarks of specialty status is the development of Critical Care nurse standards. These were set by the Confederation of Australian Critical Care Nurses Inc. in 1996, after a lengthy research project involving national Critical Care representatives. The project exemplified the richness and complexity of specialist
practice, reinforcing the belief that specialist practice requires the possession of highly integrated skill, knowledge and humanistic values.

The Critical Care nurse's abilities are viewed within three levels: the novice, specialist, and expert. Not all nurses will be at the same level, and these competencies provide a framework for nurses within the area to aim towards. The competencies were set to define the Specialist critical care nurse level.

Attributes of specialist level Critical Care nurses included:

- Manages the sickest patient to industry standards consistently
- Is respected by peers and others
- Is a role model
- Utilizes a sound knowledge base in application and integration of knowledge to practice
- Responds to a continually changing environment
- Utilizes research in practice
- Supports less experienced staff
- Displays an awareness of the needs of the whole unit
- Is professionally active
- Demonstrates effective communication skills
- Demonstrates a high level of assessment skills
- Interprets complex situations
- Acts as a coordinator of care.

(Bailey, 1996, p. 128)
Why these two specialties, Critical Care and Gerontic nursing?

There has been a substantial amount of literature published that examines the learning styles and critical thinking abilities of student nurses.

To date there has been limited research into the learning styles of registered nurses, in particular Critical Care nurses, and none published involving Gerontic nurses. Research by Goldrick, Gruendemann, and Larson (1993) has examined the learning styles of Critical Care, Operating room, and Infection Control nurses, and found there to be no significant differences in learning styles among the specialty groups. Sherbinski (1994) examined the learning styles of nurse anaesthesia students, where results identified the Assimilator style to be the most predominant learning style and the Divergent style occurring the most infrequently. Due to the paucity of literature in this area, this study intends to identify, using Kolb’s theoretical framework, the different learning styles that exist within Critical Care and Gerontic nursing specialties.

The different pressures and requirements characteristic of the two specialties imply the need for different types of learning styles. To assist in enhancing the learning experience these particular learning styles must be identified and catered for in both the clinical and educational setting.

There has also been a large amount of literature published in recent years examining critical thinking in the nursing process, and in justifying its position in the nursing curriculum and clinical setting (Farley Pardue, 1987; Miller &
Malcolm, 1990; Jones & Brown, 1991; Berger, 1984; Ford & Profetto-McGrath, 1994; Schank, 1990; Kataoka-Yahiro & Saylor, 1994; Case, 1994.). Given the quite different competencies required across these two specialties, it is of interest to determine the degree to which this influences the critical thinking abilities within different work environments.

It is important to identify particular learning styles in order for the profession to ensure that professional development at the ward or classroom level is being presented in a mode more likely to produce effective learning. Similarly, the same applies for critical thinking. Once the level of critical thinking ability of the specialist nurse is known, the starting point for further development of these abilities can be identified.

Questions

- Are Critical Care and Gerontic nurses representative of the nursing populations studied previously with regards to learning styles abilities?
- Do nurses in the Critical Care area exhibit different learning styles from nurses within the Gerontic area?
- Does one specialty exhibit more critical thinking abilities than the other?
- Are there any particular learning styles that correlate with high critical thinking abilities?
This project will examine the learning styles and critical thinking abilities of specialist Critical Care and Gerontic nurses in an attempt to identify any differences that exist between and within these different nursing specialties.

**Formal hypotheses**

1. Critical Care nurses are more likely than Gerontic nurses to display a Divergent learning style.

2. Critical Care nurses are more likely than Gerontic nurses to display a higher critical thinking ability.

3. Specialist nurses categorized as a ‘Divergent’ learning style display higher critical thinking abilities than those who are characterized by other learning styles.
METHOD

Subjects were obtained by a convenience sample from the two cohorts studied, Critical Care and Gerontic nursing. Five Melbourne metropolitan hospitals were utilized within the study to access the subjects.

All institutions were approached either through formal application to their Ethics/Nursing Research Committees or via the Director of Nursing or Assistant Director of Nursing. All research proposals submitted followed the National Health and Medical Research Council (NHMRC) guidelines, with individual specifications met for each institution.

Sample

Two hundred and twenty Critical Care and Gerontic nurses were invited to participate in the study. Fifty-six subjects responded (25% of population approached): thirty Critical Care nurses, and twenty-six Gerontic nurses. All subjects invited to participate in the study were registered nurses employed by their institution to work in the areas studied, these being Critical Care and Gerontic specialties. All staff rostered in the period over which the packages were be dispensed were invited to participate in the study.

From the total sample (N = 56), only forty-six (n = 46) respondents were included in the data analyses for learning styles and thirty-nine (n = 39) for critical thinking. Eighty nine percent of the respondents were female.
Ten respondents did not complete the Learning Style Inventory and hence were excluded from the data analysis. Respondents who answered more than thirty-eight of the fifty-two critical thinking questions were included in the data analysis for this construct.

Age range was open to encompass all staff rostered on the units. This was theoretically appropriate given that learning is seen to occur across the life span.

Unit Managers were supplied with a lay description of the study and the ‘Participant Information Sheet’ (Appendix 1). Once verbal consent was granted within each unit, inservice sessions commenced (where possible) and questionnaire packages were distributed.

**Inservice Sessions**

Numerous inservice sessions were given by the author within the participating units to the majority of rostered staff. Inservice sessions were held for both day and night duty.

Inservice sessions involved an overview of the study, discussing the participants’ rights and roles, ethical requirements such as confidentiality, data storage, and contact numbers if assistance was required, and how to return the questionnaires. Returning of any questionnaire packages was done either by placing the package, and consent form (where applicable), in the sealed box[s] supplied within the units, or by returning it to the designated person within their institution.
Inservice sessions were held at the convenience of the units' involved. This made allowances for staff numbers, workload requirements, and other ward commitments. The number and frequency of sessions varied at the individual units' request with the least number of in-service sessions per unit being two and the most being five.

Inservice sessions were given to improve the understanding of the study by the staff. The staff who attended the in-service sessions were also asked whether they would be interested in any feedback once the study is completed; this was also thought to be helpful in increasing the return rate of the packages. The questionnaire packages were distributed both at in-service sessions, and by the Unit Managers.

**Instruments**

Participants were asked to complete all the documents in the questionnaire package. They were asked to complete the questionnaires in their own time to ensure a more relaxed atmosphere, free from fear of other staff members seeing their responses and free from the stressful influence of their work environment. Another requirement was that there was a clock within view to monitor the time since the Cornell Critical Thinking test is a timed test. Participants returned the data to secure boxes. The boxes were emptied as required by the author.
Questionnaire Package

The questionnaire package contained the following:

- A Consent form;
- Participant Information Sheet;
- Self-descriptive questionnaire;
- Kolb’s Learning Style Inventory; and
- Cornell’s Critical Thinking Test (Level Z).

(See Appendices 1 and 2 (i), (ii), and (iii))

Participant Information Sheet

The participant information sheet varied according to the institutions’ guidelines, and these were adhered to as required. The following information was given to the majority of potential subjects either solely by the participant information sheet or via the participant information sheet and inservice sessions. It involved:

- the topic of study;
- the participation requirements;
- that voluntary involvement was assured;
- what the study wished to achieve;
- confidentiality and ethical issues;
- data storage issues;
- stating that the study conformed to the National Health and Medical Research Council (NHMRC);
- whom to contact for information regarding the study.

(See Appendix 1)
Self Descriptive Questionnaire

The self-descriptive questionnaire was a simple response questionnaire formulated for this study, which asked for nine responses to various aspects regarding work, education level, gender and age. Participants were asked to tick the most appropriate response for their situation (Appendix 2(i)).

Kolb’s Learning Style Inventory

Kolb’s LSI (1976) is a brief, self-descriptive inventory designed to measure learning style constructs. There are nine sets of four adjectives that participants are asked to rank from being the most characteristic (4) to the least characteristic (1) of their learning style. The scores are tabulated on the four scales to find the emphasis on each learning mode. The combination scores are then calculated for each of the two learning dimensions, abstract-concrete (AC-CE) and active-reflective (AE-RO) from the learning mode scores. These scores represent the learner’s learning style on the two dimensional learning cycle derived by Kolb (Appendix 2 (ii)).

Two versions of the LSI exist; one being the original LSI constructed in 1976, the other a revised edition from 1985. The original version was revised due to questions regarding the instrument’s reliability and validity. This is an area of discussion that still exists today with the reliability and validity of the original LSI and the revised LSI being supported by some and contested by others.
The major criticisms, cited by DeCoux (1990), of the LSI were:

1. The LSI artificially supports the bipolar learning dimensions of Kolb’s construct due to its forced-ranking format.

2. The ipsative measurement format of the LSI does allow the identification of learners’ strengths; however it does not allow for comparison between individuals, therefore lacking overall comparability (Merrit & Marshall, 1984).

3. The placement of the axes in the four cell plots is not clear.

4. The format of the four choices offered for each item may produce a falsely high internal consistency measurement, due to a particular response set (Sims, Veres, Watson, & Buckner, 1986).

5. The LSI lacks construct validity (Fox, 1984; West, 1982).


The problem with this critique of the LSI is that it was not defined in most of these criticisms whether the original or revised LSI was used. Due to the year of publication of most of these articles one could presume that it was the original learning style inventory that was involved.

Various researchers (Ferrell, 1983; Katx, 1986; Merritt & Marshall, 1984) who believe the two bipolar learning dimensions to be correct have supported the original LSI. Ferrell (1983) factored four different learning style inventories and found Kolb’s LSI to be the only one to empirically support the theory underlying the resultant inventory. Geiger, Boyle, and Pinto (1992) claimed that the construct
validity work of Katz (1986) and Merritt and Marshall (1984) have also verified Kolb’s theory with the original LSI.

Ridley, Laschinger, and Goldenberd (1995) also support the use of the original LSI. They tested 55 third year diploma-nursing students with both versions and found conflicting results. This cast doubt on the revised version, as there is more construct validity for the original LSI (Kolb & Wolfe, 1981; Merritt & Marshall, 1984; Katz, 1986). Ridley, et al. (1995) also tested subjects’ adaptive competency profile (ACP), a self-rating Likert-type scale used to classify learning styles and to develop learning profiles. The alpha reliability coefficients and construct validity were both tested and supported for the ACP (Laschinger, 1992; Laschinger & Boss, 1984, 1989; Laschinger & MacMaster, 1992; and Kolb & Wolfe, 1981; Stutsky & Laschinger, 1995). These results found that the nursing students tested did not demonstrate strong assimilative competencies, as would be suggested by the abstract learning style classification on the revised LSI.

Cornwell, Manfredo, and Dunlap (1991) also cautioned the use of the revised LSI due to the underlying factor structure not supporting the two dimensions of learning.

In regards to the original LSI, Plovnick (1975) reported split-half reliability coefficients of 0.78 to 0.86 on the dimension scores AC-CE and AE-RO. Similarly, Laschinger (1986) reports test-retest reliability coefficients between 0.72 and 0.84 on the combination scores, providing support for the reliability of this instrument.
Cornell Critical Thinking Test, Level Z

There are two Cornell critical thinking tests, Level Z and Level X. They are aimed at different educational levels and cover slightly different aspects of critical thinking. Level Z is designed for adults, including undergraduate and graduate students. It is a self-administered, multiple-choice critical thinking test, which focuses mainly on the evaluative aspects of critical thinking rather than the productive aspects. Therefore the subjects are tested on whether they can judge the reliability of observational reports of others; however they do not examine if the subject can make reliable observations (Norris & Ennis, 1990).

Level Z covers the following proficiencies:

- Whether a statement follows from the premise;
- Whether something is an assumption;
- If an observation statement is reliable;
- If an alleged authority is reliable;
- Whether a simple generalization is warranted;
- Whether a hypothesis is warranted;
- If an argument depends on an ambiguity;
- Whether a statement is overly vague or overly specific;
- If a reason is relevant.

Note. Adapted from Norris and Ennis (1990, p. 62).

Level Z is a fifty-minute, 52 item, and multi-choice critical thinking test. It is a non-nursing focused test, which draws on the respondents' critical thinking skills from everyday type situations. The respondents are asked to choose the 'best'
answer to each item to which they can only respond A, B, or C. An explanation is
given at the start of each of the seven sections of the test as to what type of
responses are available to choose from. They are instructed to mark their answers
on the answer sheet supplied.

The seven sections covered by the Cornell Critical Thinking Test are shown in
Table 2. They include deduction, meaning, credibility, inductive inference,
definition and unstated reasons, and assumption identification. Although aspects of
critical thinking are listed separately, there is considerable overlap among them in
critical thinking. This overlap is reflected in the tests, given that some items
contribute to more than one aspect of critical thinking.

Table 2. Aspects of critical thinking incorporated in Level Z and rough
assignment of items thereto.

<table>
<thead>
<tr>
<th>Aspects of critical thinking</th>
<th>Items of Level Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction</td>
<td>17, 26-42</td>
</tr>
<tr>
<td>Deduction</td>
<td>1-10, 39-52</td>
</tr>
<tr>
<td>Value Judgment</td>
<td>not tested</td>
</tr>
<tr>
<td>Observation</td>
<td>22-25</td>
</tr>
<tr>
<td>Credibility</td>
<td>22-25</td>
</tr>
<tr>
<td>Assumptions</td>
<td>43-52</td>
</tr>
<tr>
<td>Meanings</td>
<td>11-21, 43-46</td>
</tr>
</tbody>
</table>

Note. Adapted from Ennis, Millman, & Tomko (1990, p. 2).
Ideally a general critical thinking test should also cover attitudes of a critical thinker such as open-mindedness, caution, motivation, value judgments, and being focused. However this would be extremely difficult and hence is not included in the Cornell Critical Thinking Tests. The above traits are attributes of critical thinking; however to avoid penalization for the social, political and economic value judgements that the subjects possess, they are excluded from the test.

Sternberg (1986) has criticized the Cornell Critical Thinking test, along with other philosophically based critical thinking tests, for not accurately testing all critical thinking traits. Sternberg believes philosophically based critical thinking tests are highly verbally loaded, measuring reasoning within a verbal context rather than in straight knowledge or factual comprehension. Via psychologically based critical thinking tests, Sternberg believes that a separation of critical thinking and intelligence does not occur, and that the test is divided equally between verbal and non-verbal content.

Current tests (Watson-Glaser Critical Thinking Appraisal; Cornell Critical Thinking Test; New Jersey Test of Reasoning Skills; Triarchic Test of Intellectual Skills) are available yet tend to overlap in the skills they measure. Any critical thinking tests will have difficulty in accurately measuring critical thinking without the added variables of personal and situational constraints. Sternberg (1986) believes a large gap exists between applying critical thinking tests in their current format, usually in the form of multiple-choice tests, and in applying it to everyday life.
Reliability estimates for the Cornell Critical Thinking test Level Z range from 0.50 to 0.77 (Ennis, et al., 1990). Claims of construct validity are based primarily on correlational studies, involving measures of critical thinking and scholastic aptitudes. Coefficients tend to cluster around 0.5. Ennis, et al. (1990), do not attempt to claim that construct validity has been definitively established.
RESULTS

Only one of the three hypotheses was supported by the results obtained within this study. There were significant results pertaining to the negative relationship between age and critical thinking, and between nursing position and critical thinking.

Hypothesis (1) - Critical Care nurses are more likely than Gerontic nurses to display a Divergent learning style.

Critical Care nurses are not any more likely than Gerontic nurses to display a Divergent learning style. The differences in learning styles between Gerontic and Critical Care cohorts were not significant. Critical Care respondents were predominantly Accommodative in learning style, compared with the Gerontic respondents who were similarly represented in both Divergent and Accommodative learning styles (Table 3).

<table>
<thead>
<tr>
<th></th>
<th>Diverger</th>
<th>Accommodator</th>
<th>Converger</th>
<th>Assimilator</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Critical Care Nurses</strong></td>
<td>7</td>
<td>15</td>
<td>2</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td><strong>Gerontic Nurses</strong></td>
<td>9</td>
<td>6</td>
<td>1</td>
<td>5</td>
<td>21</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>16</td>
<td>21</td>
<td>3</td>
<td>6</td>
<td>46</td>
</tr>
</tbody>
</table>
The results show there is a predominance of Concrete learning styles. The dominant learning style is that of the Accommodator (n = 21), followed by the Divergent learning style (n = 16). These two learning styles represented 66% of the sample. There was no significant difference in distribution across the remaining learning styles for the Critical Care and Gerontic respondents. However within the Gerontic cohort, there are five respondents with Assimilator learning styles compared with one respondent with a Converger learning style. The remaining Critical Care respondents (n = 3), hold Converger and Assimilator learning styles.

To explicate the above result in finer detail, reference to Tables 4(a) and 4(b) display the differences between the groups on the AE-RO (Active Experimentation – Reflective Observation) dimension than on the AC-CE (Abstract Conceptualization – Concrete Experience) dimension. The differences were not significant.

Table 4 (a). Descriptive statistics for learning dimensions across nursing specialties

<table>
<thead>
<tr>
<th></th>
<th>AC-CE</th>
<th>AE-RO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical Care Nurses</td>
<td>Mean</td>
<td>-1.08</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>5.32</td>
</tr>
<tr>
<td>Gerontic Nurses</td>
<td>Mean</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>4.53</td>
</tr>
<tr>
<td>Total</td>
<td>Mean</td>
<td>-1.11</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>5.02</td>
</tr>
</tbody>
</table>
Table 4 (b). Analysis of variance for learning dimensions

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC-CE Between</td>
<td>50.628</td>
<td>1</td>
<td>50.628</td>
<td>2.053</td>
<td>.159</td>
</tr>
<tr>
<td>Within Groups</td>
<td>1109.840</td>
<td>45</td>
<td>24.663</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1160.468</td>
<td>46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AE-RO Between</td>
<td>87.421</td>
<td>1</td>
<td>87.421</td>
<td>2.610</td>
<td>.113</td>
</tr>
<tr>
<td>(Combined)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within Groups</td>
<td>1473.992</td>
<td>44</td>
<td>33.500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1561.413</td>
<td>45</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tables 5 (a) and 5 (b) indicate that the Critical Care nurses ranked higher on the CE (significant at p = 0.026) and AE mode of learning compared with their Gerontic cohort, whereas the latter ranked higher on the RO mode of learning. However it must be noted that only the CE mode of learning was found to be significant. Refer to the results on Kolb’s model, below, for further detail about these differences.

Table 5 (a). Means and standard deviations for learning modes across nursing specialties

<table>
<thead>
<tr>
<th></th>
<th>CE</th>
<th>RO</th>
<th>AC</th>
<th>AE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical Care</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurses</td>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>17.68</td>
<td>13.92</td>
<td>16.60</td>
<td>17.64</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>3.30</td>
<td>4.38</td>
<td>3.72</td>
<td>2.93</td>
</tr>
<tr>
<td>Gerontic Nurses</td>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>15.41</td>
<td>14.95</td>
<td>16.41</td>
<td>15.95</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>3.47</td>
<td>3.58</td>
<td>2.75</td>
<td>3.06</td>
</tr>
<tr>
<td>Total</td>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>3.54</td>
<td>4.01</td>
<td>3.27</td>
<td>3.07</td>
</tr>
</tbody>
</table>
Table 5 (b). Analysis of variance for Learning Styles

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>60.348</td>
<td>1</td>
<td>60.348</td>
<td>5.276</td>
<td>.026</td>
</tr>
<tr>
<td>Within Groups</td>
<td>514.758</td>
<td>45</td>
<td>11.439</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>575.106</td>
<td>46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>12.525</td>
<td>1</td>
<td>12.525</td>
<td>.773</td>
<td>.384</td>
</tr>
<tr>
<td>Within Groups</td>
<td>728.795</td>
<td>45</td>
<td>16.195</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>741.319</td>
<td>46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>.426</td>
<td>1</td>
<td>.426</td>
<td>.039</td>
<td>.844</td>
</tr>
<tr>
<td>Within Groups</td>
<td>491.318</td>
<td>45</td>
<td>10.918</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>491.745</td>
<td>46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>32.505</td>
<td>1</td>
<td>32.505</td>
<td>3.642</td>
<td>.063</td>
</tr>
<tr>
<td>Within Groups</td>
<td>392.712</td>
<td>44</td>
<td>8.925</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>425.217</td>
<td>45</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hypothesis (2) - Critical Care nurses are more likely than Gerontology nurses to display a higher critical thinking ability.

Critical Care nurses were found to display higher critical thinking ability compared with Gerontic nurses ($p = 0.008$). A comparison of means showed that Critical Care respondents scored higher on the Cornell Critical Thinking test compared with the Gerontic respondents. Therefore Hypothesis (2) was supported (Tables 6 (a) and 6 (b)).
Table 6 (a). Means and standard deviations for Critical Thinking across nursing specialties.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Std. Deviation</td>
<td></td>
</tr>
<tr>
<td>Critical Care</td>
<td>26.86</td>
<td>21</td>
<td>3.50</td>
</tr>
<tr>
<td>Gerontic</td>
<td>23.67</td>
<td>18</td>
<td>3.53</td>
</tr>
<tr>
<td>Total</td>
<td>25.38</td>
<td>39</td>
<td>3.82</td>
</tr>
</tbody>
</table>

Table 6 (b). Analysis of variance for Critical Thinking.

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical Thinking Main Effects</td>
<td>98.659</td>
<td>1</td>
<td>98.659</td>
<td>7.995</td>
<td>.008</td>
</tr>
<tr>
<td>Model</td>
<td>98.659</td>
<td>1</td>
<td>98.659</td>
<td>7.995</td>
<td>.008</td>
</tr>
<tr>
<td>Residual</td>
<td>456.571</td>
<td>37</td>
<td>12.340</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>555.231</td>
<td>38</td>
<td>14.611</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hypothesis (3) - Specialist nurses categorized as having a ‘Divergent’ learning style display higher critical thinking abilities than those who are characterized by other learning styles.

Individuals who were characterized by the Divergent learning style did not display higher critical thinking abilities than others (Table 7). Respondents grouped within learning styles’ displayed mean critical thinking scores between 20.00 and 25.33 out of a possible maximum score of 52.00. The learning style group with the
highest critical thinking score was that of the Converger, followed by the Accommodator group, then the Diverger group and the Assimilator group.

Table 7. Descriptive statistics for Critical Thinking scores across Learning Style orientations

<table>
<thead>
<tr>
<th>Style</th>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diverger</td>
<td>21.93</td>
<td>14</td>
<td>7.33</td>
</tr>
<tr>
<td>Accommodator</td>
<td>23.85</td>
<td>20</td>
<td>8.08</td>
</tr>
<tr>
<td>Converger</td>
<td>25.33</td>
<td>3</td>
<td>3.51</td>
</tr>
<tr>
<td>Assimilator</td>
<td>20.00</td>
<td>6</td>
<td>7.82</td>
</tr>
<tr>
<td>Total</td>
<td>22.79</td>
<td>43</td>
<td>7.51</td>
</tr>
</tbody>
</table>

A negative relationship between critical thinking and all learning modes exist (see Appendix 3). This relationship was significant for RO ($r=-0.350$) and AC ($r=-0.264$) at the 0.05 level (1-tailed).

Test of Kolb’s Model

Kolb’s placement of the zero within the LSI grid is simulated through a multi-dimensional scaling analysis in order to shed light upon the questions raised by
Gordon (1985, cited DeCoux, 1990). The zero point falls closer to the CE pole of the AC-CE dimension, and closer to the AE pole of the AE-RO dimension. This partially supports Kolb’s model in reference to the configuration of the modes being the same as that of Kolb (see Figure 4).¹

Figure 4. Test of Kolb’s model (Individual differences Euclidean model).

¹ Appendix (4) illustrates the differences between the two cohorts, with the Critical Care cohort characterised more strongly by the Concrete Experience Learning mode, and the Geriatric cohort characterised more strongly by Reflective Observation. Reference to the actual figure shows, however, that these differences are exaggerated due to the different scaling levels. Differences are greater between the groups on Dimension 2, which is composed of the Concrete Experience and Reflective Observation at one pole, and Abstract Conceptualization at the other.
Characteristics of participants

Education

In the main, Critical Care respondents had completed study within their specialty (93%). One of the two respondents who had no qualifications in Critical Care had qualifications in natural medicine. One third (32%) of the respondents, who held specialist qualifications within their specialty, also held qualifications in other areas such as Science, Education, and other nursing specialties such as Midwifery. These qualifications ranged from Bachelor to Master level.

Of the Gerontic cohort however, only 35% of Gerontic nurse respondents held specialist Gerontic qualifications. It should be noted that these ranged from short courses to Graduate Diploma level courses. A further 31% of the Gerontic sample had qualifications other than Gerontic nursing. These areas included Graduate Certificates and Graduate Diplomas in Community Health Nursing, Midwifery, Infant Welfare, Public Relations, and Operating Room nursing.

Age

No relationship between age and learning style was found.

There were differences in distribution of age across the cohorts (Table 8). Seventy-seven percent (n = 23) of the Critical Care cohort were aged between 26-35 years.
The Gerontic cohort displayed a wider spread across the age groups; however the 21-25 year old group represented 38.5% of this cohort (n = 10).

Table 8. Respondents’ ages across nursing specialties.

<table>
<thead>
<tr>
<th></th>
<th>21-25</th>
<th>26-30</th>
<th>31-35</th>
<th>36-40</th>
<th>41-45</th>
<th>46-50</th>
<th>51-55</th>
<th>56-60</th>
<th>61-65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gerontic</td>
<td>10</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Critical Care</td>
<td>1</td>
<td>16</td>
<td>7</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Interaction of age and critical thinking

There was a negative correlation between age and critical thinking (r = -0.341), significant at the 0.01 level (1-tailed). Age however did not correlate with learning styles (see Appendix 3).

Work experience

Years worked within a specialty differed between cohorts (Table 9). The Critical Care cohort displayed a neat distribution between the third and twenty-fifth years. The majority of respondents within this cohort had worked in the specialty between five and ten years this represented 20 of the 30 respondents in this cohort. There were no respondents in the sample who had worked in the specialty for under three years or greater than twenty-five years.
Table 9. Frequencies of duration of work experience across nursing specialties

<table>
<thead>
<tr>
<th></th>
<th>0-1 YR</th>
<th>1-2 YR</th>
<th>3-4 YR</th>
<th>5-7 YR</th>
<th>8-10 YR</th>
<th>11-15 YR</th>
<th>16-20 YR</th>
<th>21-25 YR</th>
<th>25+ YR</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical Care</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 YR</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>17</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>55</td>
</tr>
</tbody>
</table>

The Gerontic cohort displayed a wide and uneven spread across the majority of year categories, ranging from less than one year to greater than twenty-five years. There were two different groups within the Gerontic cohort; 13 had worked seven years or less, and 11 had worked more than 11 years.

**Interactions of experience and position with critical thinking**

Due to the small sample size, it is our opinion it is not possible to reliably examine the relationship between duration in a specialty and critical thinking scores.

Specialist nurses in different positions scored significantly differently on critical thinking (p = 0.02). Both the staff nurses and Clinical Nurse Specialists gained the highest critical thinking scores, 23.58 and 23.31 respectively. Associate Unit Managers were ranked next on 21.70, then Unit Managers with 19.40, and Graduate nurses with 7.00 (Appendix 5). Age was controlled for in this analysis. However due to the small sample number, these results should be interpreted with caution.
DISCUSSION

Even though nurse specialties require specialist knowledge and skills, this study has not been able to show any relationship between these, and learning styles or critical thinking ability.

Learning traits of both cohorts

The results indicated that Critical Care and Gerontic nurses possess different learning styles.

Critical Care nurses were characterized by the Accommodator learning style. They ranked higher on the Concrete Experience and Active Experimentation modes of learning than the Gerontic cohort. The mean score of the Critical Care respondents was positioned higher on the Concrete Experience mode than that of the Active Experimentation mode. As previously stated, high scores on Concrete Experience depict a receptive, experience oriented approach to learning heavily reliant on feeling-based judgments.

Intuition has long been discussed as being present within the nursing profession (Correnti, 1992; Miller & Rew, 1989; Constance, 1987; Rew & Barrow, 1987; Carper, 1978; Rew, 1987; Young, 1987; Benner & Tanner, 1987; Benner, 1984; Dreyfus & Dreyfus, 1986). More recent authors have continued to review and renew the investigation of this phenomenon (Murray, 1994; Paul & Heaslip, 1995; King & Appleton, 1997; Easen & Wilcockson, 1996). However these more recent
authors have not proceeded to delve deeper into the investigation of intuition in the
nursing profession. It has merely been the definition of intuition that has been
investigated more so in recent years. Easen and Wilcockson (1996) have refined
the definition of intuition. They believe that intuition is a non-linear decision
making process which occurs as a rapid and effortless non-conscious process. They
continue to state that intuition involves a sound, rational, and relevant knowledge
base, that was developed via experience, which makes the learner so familiar with
these experiences that they have learnt how to recognize and react on appropriate
patterns.

The experience orientation and feeling-based judgments incorporated into the
Concrete Experience mode of learning may be representative of nursing intuition.

As intuition is nurtured through experience and knowledge, one would expect any
nurse who has worked within their specialty for a reasonable period, or had studied
within the specialty to be able to experience and use intuition in the clinical
setting. It could be postulated that individuals utilizing intuition would score
highly on Kolb’s Concrete Experience mode of learning.

There is difference in duration of work experience between the specialties as was
seen in Table 9. This may influence the level of respondents’ intuition within the
clinical setting. However due to limitations such as the small sample size it is
difficult to postulate whether this influenced the results.
The knowledge of respondents regarding their specialty may have nurtured intuition, and hence Concrete Experience ability. As the majority of Critical Care respondents had completed study within their specialty (93%), their specialist knowledge would have been advanced, hence influencing the intuitive ability of this cohort. As only 35% of Gerontic nurse respondents held specialist Gerontic qualifications, they ranged from short course to Graduate Diploma level. It could be suggested that the overall specialist knowledge base of Gerontic respondents was not at a level that would encourage intuition, resulting in a lower score in the Concrete Experience mode.

In the Concrete Experience mode of learning the learner tends to be feeling rather than thinking orientated, and more concerned with the complexity and uniqueness of present reality than with theories and generalizations. This in itself is interesting to note due to the fact that Critical Care nurses must be aware of the theoretical base behind everything that they are doing within their environment. They must work from a complex knowledge of facts regarding anatomy and pathophysiological processes, and the variety of technological tools to assist in client recovery. Hence the encouragement of specialist education within the specialty. Making allowances for this, the ability to be more concerned with the complexity of present reality is expected due to the nurse having to deal with the complexity of the client’s condition and concomitant factors.

According to Kolb, Concrete Experience learners are people orientated, open-minded and easily adapt to change. This is also expected in the Critical Care environment as the nurses must deal with the reality of the Critical Care
environment. Learning is enhanced through involvement and benefits from feedback and discussion. Frequent health team revision of clients’ progress generally includes discussion with intensivists, anaethatists, physiotherapists, dietitians, and so on.

Critical Care respondents scored higher on Active Experimentation than the Gerontic cohort. In the learning situation Critical Care respondents may place a higher emphasis on the practical and experimental application of a concept compared with the Gerontic respondents. They may place less importance on achieving reflective understanding, compared with what will work to get the situation resolved. This may be reflected in the Critical Care environment where the client’s life-threatening condition is to be resolved, whether by means of conventional or non-conventional methods. If one method or theory fails, the tendency is to try again by means of another pathway.

The majority of Critical Care respondents preferred the interactive learning style of the Accommodator. They do not like to rely on their own analytic ability, but rely on others for this. In the Critical Care nurse role they still require ultimate direction from the medical staff involved. Possibly due to a team approach in client care, and the critical condition of the client, they may be more at ease with the discussion and clarification of their findings with others.

Gerontic nurses displayed a mixture of Divergent, Accommodator, and Assimilator learning styles. Nurses with Divergent learning styles (n = 9) were more common than Accommodator learning styles (n = 6) or Assimilator learning styles (n = 5).
The mixture of learning styles could be representative of an environmental press that is not forcing any particular learner characteristics. Whether the environment encourages the diversity of learning styles or does not make any impact upon learning styles is unknown. This study did not examine the environmental press of either work environments and therefore no possible influences can be suggested.

As a whole, Gerontic respondents were placed more centrally within the Divergent quadrant between the Concrete Experience and Reflective Observation modes of learning (Figure 4). As previously stated, Divergent learners’ utilize their imagination widely. They observe more than active learners, are open minded, and gather information from concrete situations utilizing a multidimensional view. These traits may be necessary for Gerontic nurses due to the need to assess all the potential impacts an aging resident may face. Equally one could take the view that the Critical Care nurse would also require these traits due to immediate needs to assess and direct client care in order to prevent further decline in the client’s condition.

Divergent learners are sensitive to others’ feelings and values and tend to be aware of this in their learning situation. Within the Gerontic environment there are many emotional factors that impinge upon the residents and staff. Dealing with eventual evolution of the life and death cycle tends to emphasize the feeling of need to take a sensitive and emotive attitude towards this type of nursing. Understanding residents’ difficulty in communicating, the reduced dignity and self-esteem experienced by elderly residents who can no longer manage their personal needs
are also emotional factors Gerontic nurses must face. All of this may create an environment where sensitivity to others’ feelings and needs is paramount.

The Gerontic respondents scored higher on the Reflective Observation mode of learning than the Critical Care respondents. Scoring higher on this mode tends to support the view that Gerontic respondents would use observation and reflection in learning more frequently than Critical Care respondents. Gerontic respondents would therefore view ideas and situations multi-dimensionally, focusing on mastering a concept rather than in its possible practical application. They would form their opinions relying on their own thoughts, feelings, and thoughtful judgement even though they may not necessarily act on these opinions.

Management is less aggressive for the residents in aged care compared with clients in the Critical Care environment, allowing for longer periods of observation and reflection of the residents’ condition. A more passive approach may be reflected within the Gerontic environment due to death being the inevitable outcome of all elderly residents.

It is however interesting to note that the Gerontic cohort had a higher level of Reflective Observation than the Critical Care cohort, however this is not at a significant level. As the Critical Care nurses’ role involves refined assessment and observation skills to detect any changes in the client condition one would expect there to be equal if not greater use of reflection and observation within the Critical Care environment compared with the Gerontic environment.

The Accommodator learning style represented 28.5% of Gerontic respondents. This was quite a small number in comparison to the Critical Care cohort of whom
60% displayed the Accommodator style. Both these types of learners would have similar learning characteristics. It could be proposed that these learners might possess similar levels of intuition due to the experience orientation and feeling-based attitude to learning. However the data does not support this; with four of the five respondents having only one to four years of experience within the specialty, and only one respondent, who had worked one to two years in the specialty, holding a Graduate Diploma in the specialist area.

The other learning style displayed by the Gerontic cohort was that of the Assimilator. The dominant learning abilities of that style are Reflective Observation and Abstract Conceptualization. Four of the five respondents who scored within this learning style were situated closer to the Reflective Observation mode than that of the Abstract conceptualization learning mode. This indicated that they would tend to more reflective means of learning within that learning style rather than the abstract. Notwithstanding the small number of learners with this style, they are significantly represented within the overall Gerontic sample (24%) making discussion of this finding necessary.

As previously stated, Assimilators have the opposite dominant learning characteristics to Accommodators’ learning style. Inductive reasoning and creating theoretical models are a dominant characteristic of this style. These people excel in grasping a wide range of observations and information and uniting it with a concise and logical explanation. They are good at testing theories and ideas, organizing information, designing experiments, building conceptual models, and analyzing quantitatively. These individuals are more focused on ideas, concepts,
and logic than on people, and believe more in the importance of a theory’s logical soundness than in its practical significance.

Due to the fact that four of the five Assimilator learners’ are centrally located within Kolb’s learning style grid, with a stronger tendency towards the Reflective Observation mode, one would contest the view that these learners would hold strong Assimilative learner characteristics.

The results indicated that the Gerontic respondents are more balanced learners than the Critical Care respondents due to their mean scores being situated more centrally within the LSI grid. The closer one is to the centre of the grid the more one is comfortable with incorporating Divergent, Accommodative, Convergent and Assimilative learning traits into the learning experience. The further one is from the centre of the grid the more one would rely upon one particular learning style or mode. As the Gerontic cohort are overall more balanced in learning style, they would be more comfortable with incorporating the variety of learning styles into their learning process. In contrast the Critical Care cohort would tend to prefer more concrete methods of learning as they have a stronger association with the concrete experience mode of learning than the Gerontic cohort.

Both cohorts displayed similar numbers of Divergent learning styles. In comparing the work environments of the two cohorts, the clients’/residents’ immediate physical and psychological demands differ largely in acuity. However the similar presence of the Divergent learning style within both these cohorts suggests that there may be similarities within their working environments. The Divergent traits
of imagination, ‘brainstorming’, and observation may be just as relevant for either work environment due to the ongoing assessment for the prioritization of the clients’ needs.

**Comparability of Results**

Generalization of the results of this study is not possible since only Critical Care and Gerontic cohorts were studied. It is therefore not strictly appropriate to compare the learning styles and critical thinking results of these cohorts with those of other nursing specialties. Notwithstanding this methodological limitation, discussion of the results is placed in the context of other studies (Laschinger & Boss, 1984; Laschinger, 1986; Haislett, Hughes, Atkinson, & Williams, 1993; Staton-Cross 1988; Ridley, Laschinger, & Goldenberd, 1995).

The results from this study support the findings of others. The Accommodator learning style has previously been shown to be the predominant learning style of nurses. The findings of other authors also support the predominantly concrete learning styles within a nursing population.

Kolb’s model suggests that people in a professional discipline will develop learning styles in reflection of their environmental press. Environmental press refers to how one’s knowledge regarding a discipline is structured to achieve competencies that are necessary to work effectively within that discipline. Professions can be viewed in four types of disciplines: the social professions; the science-based professions; the natural sciences and mathematics; and the arts,
humanities and social sciences. For example, a science-based profession such as a physicist would be thought to include more abstract learners, falling between the convergent and assimilative styles. With regards to the people-oriented nursing profession, they would be more concrete in learning style, falling between the Accommodative and Divergent learning styles.

As the majority of these studies involve the study of student nurses it is positive to see that these previous results can be replicated in the study of not only general registered nurses, but that of specialist nurses. It could possibly imply that the learning style of student nurses remains stable from commencement of their undergraduate education to their entry in nurse specialism. It has also identified a commonality between nursing specialties.

**Critical thinking ability of Critical Care and Gerontic respondents**

Critical Care respondents displayed a higher overall critical thinking score compared with the Gerontic cohort; this technically supported Hypothesis (2). The difference between cohorts in relation to mean scores of critical thinking was small with Critical Care respondents scoring 26.86 and Gerontic respondents 23.67 (p = 0.008). Notwithstanding significance levels both cohorts displayed a similar degree of critical thinking.

This supports the fact that critical thinking is present within the nursing process. It is as prevalent within the Critical Care environment as it is within the Gerontic environment. Even though the Critical Care environment is full of fast acting,
critically precise and life saving care, it may not possess any more a need for
critical thinking than the Gerontic field. Therefore the critical thinking process
within the Gerontic nursing specialty may be just as utilized as it is within the
Critical Care nursing specialty.

Critical thinking, as previously stated, has been linked to educational level, general
intelligence, and verbal aptitude. Within this sample education levels vary. The
Critical Care cohort on the whole is more qualified with a higher educational level
than the Gerontic cohort, yet their critical thinking abilities are similar. Most
Critical Care respondents (93%) had undertaken at least one postgraduate
qualification, that being a Graduate Certificate or Graduate Diploma in Acute Care
(Critical Care) Nursing. This could be due to the professional forces within
Critical Care which have encouraged the possession of qualifications in the
specialty. As previously stated the Critical Care specialty is one of Australia’s
largest specialty groups whose dynamics have also led the way in the development
of nursing standards for specializations.

As for Gerontic nursing, professional forces do not seem as prominent as the
Critical Care cohort. Authors in the Gerontic area are still encouraging nurses to
undertake study specific to the specialty (King, 1995; Williams, 1992; Alfredson &
Annerstedt, 1994; Cheah & Moon, 1993). There does exist a common perception
that Gerontic nursing can be done by untrained workers (King, 1995). Caring for
the aged originated from poor law origins, where elderly care did not attract the
most able nurses, and the stigma that Gerontic nursing does not require specialist
nursing knowledge and skill is still present (Cheah & Moon, 1993). However due
to the increasing acuity and numbers of residents within aged care settings this lack of specialist knowledge can not continue. The knowledge and skills of Gerontic nurses will need be more advanced and specified to the aging problems of today’s society, not to that of a century ago.

Another reason for the differences within the educational level of the two cohorts could be due to the differences in work environment. There is a need for advanced skills and knowledge to work quickly and competently within the Critical Care environment, without knowledge of the complex technology and client illnesses, the client could be placed at risk. To attain such a level requires further education, more than what is received through an undergraduate nursing course. Conversely within the Gerontic environment, the care required of an elderly client focuses on assisting clients understand the aging process; control aging processes through hygienic practices; health promotion; and management of pathological conditions. This is often covered within the undergraduate nursing course in relation to the care of an adult; it is therefore not essential to complete further study within this particular area. This does not mean that further study within this area is not desirable. To fully understand and deal with the aging processes does require additional education; however the client would possibly not be placed at risk by not having such qualifications.

Neither verbal aptitude nor general intelligence was tested due to study limitations. Therefore there is no evidence that supports or refutes the influence of these two areas on critical thinking (see Glaser, 1941; Little, 1972; Skinner, 1971, cited in Brabeck, 1981; Westbrook & Sellers, 1967). However it could be hypothesized
that nurses must possess a certain level of verbal aptitude to function as a nurse within the current climate. The role of Critical Care and Gerontic nurses includes a largely verbal component due to the oral communication required to directly care for a client, and to communicate nursing needs between nurses and with other allied health professionals in directing client care.

Even though general intelligence levels were not recorded, the results may be seen as supportive of Cattell’s (1971) theory of intelligence. The negative relationship between age and critical thinking (p = 0.01) could be seen as supportive of the work of Cattell on fluid and crystallized intelligence. It could be hypothesized that the older one gets, the more fluid intelligence is lost due mainly to cellular degeneration, while at the same time increasing in crystallized or socialized intelligence through life experience. As suggested previously, critical thinking needs to be taught and nurtured to develop critical thinking skills. If critical thinking abilities are not taught or used, critical thinking abilities will decrease with age along with fluid intelligence. In reference to this study, the critical thinking abilities of both cohorts declined as the age of the respondents increased. The fact that Critical Care respondents displayed higher critical thinking ability may have been a result of the age differences that existed between the two cohorts; as 19% of the Gerontic respondents were 51 years of age or greater, whereas none of the Critical Care respondents were within these age groups. Only 10% of Critical Care respondents were within the 41 to 65 age groups. Since age correlates negatively with critical thinking it may be assumed that the difference in critical thinking ability between the cohorts was age related and not specialty related.
Both specialties were expected to require critical thinking skills such as frequent problem solving, decision making, and evaluation in view for optimal outcomes for the client. This was especially so within the Critical Care cohort where many critical thinking dispositions are thought to be required in caring for a critically ill client. The results do not support this view, and in fact suggest that neither cohort require or perform critical thinking to achieve optimal client outcomes.

If either cohort practiced critical thinking in their daily environment, it would be anticipated that they would score highly on examination of these abilities. This would be due to the frequently used and hence developed critical thinking skills that they would be thought to possess. If, however, critical thinking skills were not utilized within the specialist environment, critical thinking abilities would not be developed further and therefore the critical thinking disposition would decline along with fluid intelligence.

The above interpretation may be flawed due to sampling bias and lack of comparison with other nursing groups. The small sample size and convenience sampling may have increased sampling error, therefore making it non-representative of the population studied.

Additional factors that may account for the results include respondents completing the test at work. This may have resulted in non-optimal results. Although respondents were required to complete the tests in their own time, frequently staff would say that they had completed the questionnaires at work, either on day or night duty. One respondent commented within the questionnaire that they had
completed the package on night duty “while my body was telling me – it wanted to
go to sleep – so I found it difficult to concentrate”!

Filling out the questionnaires at work would strongly influence the critical thinking
results, as it was a timed test, requiring the respondents’ concentration, and use of
critical thinking abilities. Personal and situational constraints would influence the
respondent working to full potential. Respondents would have had limited time
within the shift to complete a fifty minute questionnaire. Limited motivation and
working memory capacity would also occur, as the nurses’ focus would be
ultimately upon their clients and work environment. This would limit the
utilization of full critical thinking competence.

**Relationship between critical thinking and learning styles**

A negative relationship between critical thinking and all learning modes and
learning styles was found, with the negative relationship between critical thinking
and modes Abstract Conceptualization and Reflective Observation being
significant ($p = 0.05$). These results do not support Hypothesis (3). This did not
support the view made earlier that the traits of Kolb’s Divergent learning style
were representative of a good ‘critical thinker’, and therefore that nurses with a
Divergent learning style would be good at critical thinking.

Due to there being no suggested classification for critical thinking ability within
the tabulation of results, labeling a respondent’s critical thinking ability (e.g. poor;
fair; moderate; good; very good) is at the discretion of the researcher. Within this
study all respondents displayed critical thinking scores between 23.75 and 28.00 out of a total score of fifty-two; this would be seen as being a fair to moderate result.

The results displaying the Convergent learning style as recording the highest critical thinking scores do appear to correlate with Kolb’s view of the attributes of the Convergent learning style. Dominant characteristics of this style involve problem solving, decision making and the practical utilization of ideas. Critical thinking also requires these skills.

The Accommodative style learner would not be expected to be as good at critical thinking compared with the others due to the descriptions given by Kolb of their traits. These learners are generally insecure in their own analytic ability, and utilize a trial and error manner of problem solving, often acting on ‘gut’ feelings rather than logical analysis.

It is interesting that none of the modes or learning styles positively correlate with critical thinking. Given that a large majority (48%) of respondents held a Divergent learning style and were positioned centrally within the learning grid - giving them a very balanced learning style - there may have been insufficient differences between the respondents’ learning styles to show any other relationship between the learning modes.

From Kolb’s classification of the learning modes, scoring higher in the Abstract Conceptualization mode should represent traits very similar to that of good critical
thinkers. As previously stated learners with a high score on Abstract Conceptualization will display a logical and scientific approach to problem solving. They are deductive, thinking learners. Ideally from this perspective those most suited to critical thinking would be learners from the Assimilator or Converger groups due to representation on the Abstract-Concrete end of the axis.

Test of Kolb’s Model

The findings did not support the original assumption that the Critical Care respondents would be Divergent in learning style and Gerontic respondents predominately of an Accommodator learning style. Whether this is attributable to the environmental press of the two areas or due to various limitations of the study is unknown.

In order to identify the generality of Kolb’s model, and also, to assess its appropriateness for a sample such as this, multi-dimensional scaling analysis was used to test Kolb’s two-dimensional model (Figure 4). Identification of each of the four modes, and within the structure described by Kolb was achieved, with Abstract Conceptualization and Concrete Experience being opposed points on the one axis, and Active Experimentation and Reflective Observation situated also at opposing ends on the same axis (Figure 4). This representation of Kolb’s model is even more important since the sample was homogenous in learning style, as shown by the balanced learning styles of the majority (48%) of the sample lending stronger support to Kolb’s model.
However there were two findings in particular that are suggestive that Kolb's model has low validity. Firstly, there were no significant differences in critical thinking between the four learning styles. And secondly, only significant negative relationships were found between learning styles and critical thinking.

**Characteristics of participants**

**Education and its effect on learning styles and critical thinking**

No links can be drawn between the level of education and one’s learning styles or critical thinking abilities due to the similar learning style and critical thinking results obtained within this study. Even with the vast differences in educational level between the two cohorts the respondents had very similar learning styles and critical thinking abilities. Therefore the level of post-basic education was not responsible for any differences in the learning styles and critical thinking between cohorts.

**Age differences between Critical Care and Gerontic respondents**

The differences within work environments were displayed by the variances in age between cohorts. The Gerontic cohort spread across the spectrum of ages investigated. Possibly Gerontic nursing is an attractive specialty to work in at any age. Whether the rate of change to nursing care is low meaning that nurses who leave the profession due to family or other reasons are able to return to Gerontic nursing with little updating to the nursing knowledge or skills. Or possibly a lower burnout rate amongst staff means that the efflux of nurses does not occur at such a
great rate making it possible for nurses to remain in this specialty for lengthy periods.

The 21-25 year old group represented 38.5% of the Gerontic cohort. Due to the small sample size this may not be representative of the population as Alfredson and Annerstedt (1994) found a mean age of around 40 years within their sample (n = 34). The large representation by Graduate nurses is possibly due to various issues within the Australian health care setting. Primarily there is a large need for staff within this environment due to the increased number of the aged requiring care. Due to the staff shortages and ongoing difficulty in acquiring staff there no requirement to hold specialist qualifications within the area of Gerontic nursing. Deregulation of nursing homes has led to the lapsing in staffing requirements leading to higher numbers of non-nurses or nursing assistants who may or may not have undergone a short course in basic adult care, within the Gerontic specialty. This has also added to the stigma where it is thought that no specialist knowledge or qualifications are required to work within the aged care setting.

The Critical Care cohort had predominantly 26-35 year olds representing 76.7% of this group (n = 23). This sample age is similar to that of Stechmiller and Yarandi, (1993) and Bucknall and Thomas (1996), who also had similar aged samples. Stechmiller and Yarandi, (1993) resulted in a mean age of 34.32 years, with 32% of the nurses under the age of 30 years, and 75% were between the ages of 20 and 39 years of age (n = 300). Bucknall and Thomas (1996) had a similar sample (n = 230) with 74.7% of their sample aged 25-34 years and 21.7% aged 35-44 years of age.
The fact that the Critical Care respondents (26-35 years) were generally older than the Gerontic group (21-25 years) again displays the need for the more advanced nursing skills that are required within this environment. Graduate nurses do not possess the advanced nursing skills that are required within the Critical Care environment. They are still learning the skills of time management, prioritization, along with continuing their knowledge of disease processes, diagnostic techniques and any nursing interventions they have not come across during their undergraduate training.

The smaller age variance amongst the Critical Care cohort could possibly be due to a higher burn out rate amongst this cohort. It is also possible that they may direct their careers in other areas away from the clinical aspects of critical care, or there may more difficulty in returning to this area after a period of absence.

The Critical Care area has been one specialty where the burnout phenomenon has been recognized. Burnout often results in the employee either leaving their position or remaining in the position and functioning ineffectively due to their emotional and physical fatigue (Hudak, Gallo, & Benz, 1990). This could be one cause of a younger work force within the Critical Care environment compared with that of the Gerontic work environment.

Certain aspects of the Critical Care nurse’s role that attributes to burnout has been identified (Stechmiller & Yarandi, 1993); the main variable identified to contribute to burnout was that of job satisfaction. Job satisfaction has been investigated further by Bucknall and Thomas (1996), who found a positive
relationship between decision task autonomy and task satisfaction for individual critical care decision tasks. This lead to the conclusions that Critical Care nurses desire autonomy in decision task making and are more satisfied when they can execute it.

This desire to exercise their decision-making skills may also be the reason for staff to leave the clinical Critical Care environment for other career paths. Nurse input into health team decision making has long been a source of interprofessional tensions (Bucknall & Thomas, 1996), and if the unit structure did not account for nurse involvement in decision making job dissatisfaction resulted and a consequent increasing attrition rate.

Due to the rapid change in technology and treatments that are continually advancing the complexity of Critical Care nursing, leaving the clinical field for even a short period of time will result in a loss of knowledge and understanding of required nursing care. The possible loss of skill and knowledge may lead the Critical Care nurse to work in other that may be less intimidating. Otherwise they may need to return to further study to update their knowledge within the Critical Care area.

**Position and critical thinking**

Critical thinking was found to predominate amongst staff nurses and Clinical Nurse Specialists who rated the highest critical thinking scores. These two staff positions require close client contact and hence more involvement with the
management of the clients' condition. The staff nurse's role primarily involves
direct client care. The Clinical Nurse Specialist would have a higher proven
knowledge base for their area of expertise than the staff nurse would as they must
meet particular specialist knowledge and skill-base criteria to be practicing within
a Clinical Nurse Specialist role. They also would be involved in some education,
research and administrative roles.

Associate Unit Managers were ranked next on critical thinking ability. Their
knowledge base within the area of expertise should be like that of the Clinical
Nurse Specialist. Their position involves overseeing client care along with
coordinating the running of the ward, with some education, research and other
administrative roles.

Unit Managers were ranked next on critical thinking ability. Their role is primarily
managerial with generally no client contact, as they are primarily involved in ward
administration. Their clinical knowledge base within the area of expertise may
possibly have been similar to that of the Associate Unit Manager or Clinical Nurse
Specialist however their focus of expertise may have reduced their specialist
knowledge base due to lack of direct client contact. Depending upon the ward,
they may also be involved in education and research roles.

The Graduate nurses ranked the lowest in critical thinking. The Graduate nurse
position would involve client care, at a novice level. The skill and knowledge base
of the graduate nurse is still developing and they have not been within the clinical
setting for longer than one year.
It could be presumed that the staff nurse and Clinical Nurse Specialist respondents' critical thinking abilities were enhanced due to a higher exposure to direct client care and hence more frequent problem solving decisions, more-so than their knowledge base of their expertise. However if knowledge base within the area of expertise were the precipitating factor enhancing critical thinking abilities, it would be expected that the Associate Unit Managers and Unit Managers would test higher than the staff nurse on critical thinking abilities. This is in contrast to Dull's views that the tool of background knowledge (along with good vocabulary and observation) is important with becoming adept at critical thinking (cited Cierzniak, 1985).

Therefore the views of Norris and Ennis (1990) that critical thinking potential is reliant on the interaction between an inherent disposition and the environment in which it is nurtured is supported. This would lead one to presume that the clinical environment, along with sufficient knowledge base, nurtures the ability to think critically. This was shown by staff nurses' and Clinical Nurse Specialists' higher critical thinking score compared with the Associate Unit Manager and Unit Manager.

The low mean critical thinking score of the Graduate Nurse respondents however is surprising. One would presume that recent exposure to clinical skills training within a primarily academic environment with the integration and encouragement of critical thinking within the nursing curriculum, would have encouraged good
critical thinking skills. Possibly the new work environment may interfere with their ability to think critically particularly in the context of lack of nursing knowledge and experience, and possibly reduced self-confidence within new nursing roles. As previously stated, an individual’s environment and their expertise with a topic will affect critical thinking abilities (Sternberg, 1986).

Results pertaining to the relationship between position of specialist nurses and critical thinking scores should be interpreted with caution due to small sample size notwithstanding the fact that differences were significant ($p = 0.020$).
LIMITATIONS

The findings did not support all the three hypotheses for this study. To some extent, this may have been due to various limitations within the study.

The sample size was small (N = 56). Logistics - primarily time restrictions - forced the use of a convenience sample.

Sampling bias is also another possible limitation within this study. The type of person who agreed to participate, or not participate, in the study may be of a particular character - therefore influencing the sample characteristics. People who chose not to participate may, for example, have been predisposed to an Accommodator learning style. This style is characterized in part by insecurity regarding reliance on analytic ability. Since this study involves the testing of critical thinking abilities this proposition may be plausible. Others who may chose to participate, for example, could more likely be predisposed toward the Divergent learning style - as they would be open minded to the necessity for nursing research and be more sensitive to the researcher’s feelings and values.

Other limitations include those that may hinder the utilization of the respondents’ full competence. These, as described by Sternberg (1986), include limited information, limited time, limited working memory capacity, and limited motivation.
The critical thinking ability of an individual is influenced by their expertise regarding that topic. The Cornell Critical Thinking Test (Level Z) is a non-nursing critical thinking test that is designed around scenarios that adults should be able to perform within every day life. Therefore the respondents' knowledge of nursing scenarios was not required. It is therefore not thought to be a limitation in this study. The only possible drawback regarding the test is the respondents possibly not conforming to test instructions. It is desirable that the test be completed in a set time frame to improve accuracy of assessment.

A major detractor in the analysis of learning styles, and in supporting the model described by Kolb was the complex ranking system of the two dimensions. Even though Kolb's grid initially appears to be equally represented in each of the ends of the two dimensions, this is not really the case. The number ranking of each of the four ends vary with all ending in a different scale. The spacing of the digits are unequally distributed along the dimensions therefore making the reconstruction of this grid extremely difficult.
RECOMMENDATIONS

The results of this project have been useful in understanding the range of learning styles that exist in these nursing specialties. Through the results of this study, and others, the predominance of concrete learning styles has been found. This can be useful for the facilitation of learning within the nursing education setting, both general and specialist. This can occur through the direction of educational sessions to the learning needs of the majority of learners via concrete learning methods. Allowing for the needs of concrete learners could only lead to enhanced learning potential from any educational experience. Notwithstanding this view, the learning need of all learning styles must be implemented not only to cater for the small number of abstract learners but also to achieve more balanced learner characteristics of all concerned.

Another benefit from understanding learners’ styles and characteristics for learning is to enhance learning potential. For example, educational courses such as a Postgraduate Diploma in Adult Acute Care or Gerontology, should be structured to enhance learning by assisting and motivating learners to understand, and solve problems appropriate to their own learning styles and that of others. It is therefore recommended to review course delivery practices to ensure the enhancement of learning and create a positive experience regarding learning, by directing educational strategies towards learners’ particular learning needs.

Recommendations for the nursing profession include further investigation of the education and implementation of critical thinking at all levels of the nursing
profession. Emphasis would be especially within the university and clinical setting. If critical thinking is adequately nurtured within the undergraduate setting, ideally once the nurse enters the clinical setting they are already capable of thinking critically. Therefore once the graduate’s knowledge regarding the discipline increases, the utilization of critical thinking should also increase.

On the basis of these results the clinical setting may not be as prominent in the encouragement and utilization of critical thinking as previously thought. Surely there is a place for critical thinking within the clinical setting, which could only lead to improved client care, and the development of improved work conditions or even work practices. Whether the environmental press of the clinical setting does not encourage or promote critical thinking is unclear. Further investigation into this area is suggested.

Even though the results of this study have been significant in some areas, it is desirable to replicate this study with a larger sample. If any learning modes hold a significant positive relationship with critical thinking, nursing education could then provide a more conducive environment for the nurturance of critical thinking abilities.

A larger replication would also lend further support for the structure of Kolb’s learning style grid with reference to the configuration of the learning modes, and possibly give further information concerning the placement of the zero points on the two learning dimensions.
To enhance the professional standing and overall dynamics of the Gerontic nursing specialty, it is recommended that ongoing support should be provided from senior nursing staff, nursing administration, and specialty groups for the continuation of education and qualifications within the Gerontic field. As the number and acuity of the aged increases within the aged care setting, it will be increasingly important for Gerontic nurses to take more responsibility for their professional development in caring for residents' needs.

The phenomenon of burnout in nursing has been investigated (Stechmiller & Yarandi, 1993; Bucknall & Thomas, 1996; Alfredson & Annerstedt, 1994), and found to contribute towards the turnover rate of many nurses within the clinical setting. For further investigation into the reasons for age differences between Critical Care and Gerontic nurses, it is recommended that further study be undertaken in this area for further clarification.

Due to the paucity of study linking age and critical thinking, further research into the negative relationship found between age and critical thinking is recommended to give further support to the findings of this study.

Another area worth investigating is the relationship between a nurse's position within the clinical setting and their critical thinking ability. Due to this study finding the greater the clinical client contact a specialist nurse has the higher the critical thinking ability, a larger and more specific replication of this is area is necessary to validate the findings of this study.
REFERENCES


# APPENDICES

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Appendix 1: Participant information sheet.

09.10.97

Maree Jenkin
P.O. Box 582
Richmond, 3121.

Re: Master of Education - Minor thesis,
    Faculty of Education,
    The University of Melbourne.
    Principal Investigator - Dr. Esther Care
    Other Investigator - Maree Jenkin

Learning Styles and Critical Thinking abilities of specialist nurses, does a difference exist?

Dear Colleague,

Thank you for your time to read this information regarding my study. I invite you to participate in the study to assist me in discovering more about learning styles and critical thinking.

This study involves measuring your Learning Style and your Critical Thinking abilities as a specialist nurse in an attempt to discover any differences that may exist between different nursing specialist groups.

Participation in the study will involve an hour of your time to complete the questionnaires which are designed to gather information regarding your clinical background and to examine your individual preferences in the areas discussed above. If possible please attempt to answer all questions as this will make the final statistics more valuable. However if that is not possible please feel free to return any completed documents as any information from you will be greatly appreciated. Your participation within this study is entirely voluntary and you can withdraw at any time without prejudice.

The results of this project may be useful in understanding the range of learning styles that exist between different nursing specialist groups. As a result of this study, continuing education programs addressing specific learning styles will be able to be developed.

Neither your name nor any form of identification is required on the questionnaire, this will ensure your confidentiality. Please return the documents in the box provided on your ward, which only I will access twice a week for document collection. The Principal and Other Investigator will have access to this data for the purpose of this study. The data will be safely stored at The University of Melbourne for a period of five years and then destroyed after that time.

The study conforms to the required ethical guidelines stipulated by the National Health and Medical Research Council (NHMRC), and will be approved by the appropriate Ethics Committees.

If for any reason you would like to inquire regards any aspect of this study, please feel free to write to me at the above address or page me on (03) 132222, Pager 4196.

Thank you again for assisting me in my studies,

Yours sincerely,

Maree Jenkin.

RN, GradDipACNsg.,
Grad.DipEd.St, MRCNA.
Appendix 2(i): Self-descriptive questionnaire.

Learning Styles and Critical Thinking abilities of specialist nurses, does a difference exist?

THE UNIVERSITY OF MELBOURNE
FACULTY OF EDUCATION


Please tick the most appropriate response for the questions listed:

1. Your current nursing specialty:
   - Critical Care □
   - Gerontology □

2. Duration worked in the above specialty:
   - <1 yr □
   - 1-3 yrs □
   - 4-5 yrs □
   - 6-7 yrs □
   - 8-10 yrs □
   - 11-15 yrs □
   - >15 yrs □

3. Shifts worked per week within the above specialty:
   - <2 □
   - 2 □
   - 3 □
   - 4 □
   - 5 □
   - >5 □

4. What is your position within this specialty?
   - Graduate Nurse □
   - Staff Nurse □
   - Clinical Nurse Specialist □
   - Associate Unit Manager □
   - Unit Manager □

5. Do you hold any clinical nursing qualifications in the above specialty?
   - Yes □
   - No □

If yes, please tick the appropriate response below:
   - Graduate Certificate □
   - Graduate Diploma □
   - Other □

If other, please state below:
6. Do you hold any other qualifications not within the specialty mentioned above?
   Yes ☐  No ☐
   If yes, please list these below:

7. How many years have you worked post registration?
   <1 yrs ☐  1-2 yrs ☐  3-4 yrs ☐
   5-7 yrs ☐  8-10 yrs ☐  11-15 yrs ☐
   16-20 yrs ☐  21-25 yrs ☐  >25 yrs ☐

8. Your gender:
   Male ☐  Female ☐

9. Your age:
   21-25 yrs ☐  26-30 yrs ☐  31-35 yrs ☐
   36-40 yrs ☐  41-45 yrs ☐  46-50 yrs ☐
   51-55 yrs ☐  56-60 yrs ☐  61-65 yrs ☐

If you wish to make any comments on the study upon completing the documents, please feel free to do so in the area provided below.

Thank-you for your time and effort to fill in these questionnaires.
Appendix 2(ii). Kolb's Learning Style Inventory.
THE LEARNING STYLE INVENTORY

This survey is for describing how you learn—the way you find out about and deal with ideas and situations in your life. Different people learn best in different ways. The different ways of learning described in the survey are equally good. The aim is to describe how you learn, not to evaluate your learning ability. You might find it hard to choose the descriptions that best characterize your learning style. Keep in mind that there are no right or wrong answers—all the choices are equally acceptable.

Instructions

There are nine sets of four descriptions listed in this inventory. Mark the words in each set that are most like you, second most like you, third most like you, and least like you. Put a four (4) next to the description that is most like you, a three (3) next to the description that is second most like you, a two (2) next to the description that is third most like you, and a one (1) next to the description that is least like you (4 = most like you; 1 = least like you). Be sure to assign a different rank number to each of the four words in each set; do not make ties.

Example:

0. 4 happy 3 fast 1 angry 2 careful

(Some people find it easiest to decide first which word best describes them (4 happy) and then to decide the word that is least like them (1 angry). Then you can give a 3 to that word in the remaining pair that is most like you (3 fast) and a 2 to the word that is left over (2 careful).

__discriminating__  __tentative__  __involved__  __practical__
__receptive__  __relevant__  __analytical__  __impartial__
__feeling__  __watching__  __thinking__  __doing__
__accepting__  __risk taker__  __evaluative__  __aware__
__intuitive__  __productive__  __logical__  __questioning__
__abstract__  __observing__  __concrete__  __active__
__present-oriented__  __reflecting__  __future-oriented__  __pragmatic__
__experience__  __observation__  __conceptualization__  __experimentation__
__intense__  __reserved__  __rational__  __responsible__
Appendix 2(iii). Cornell Critical Thinking Test and scoring sheet.
INSTRUCTIONS

This is a test to see how clearly and carefully you think.

There are 52 items. You should be able to finish in the 50 minutes given, but be careful not to waste time. Avoid wild guessing, although it is all right to make shrewd guesses when you have good clues. There is one best answer to each item.

Mark your answers with soft pencil on the answer sheet. Do not make any marks on this booklet. If you finish within the given time, go back and check your answers.
SECTION IA

In the first five items, two men are debating about voting by eighteen-year-olds. Mr. Pinder is speaker in the first three items, Mr. Wilstings in the last two. Each item presents a set of statements and a conclusion. In each item, the conclusion is underlined. Do not be concerned with whether or not the conclusions or statements are true.

Mark items 1 through 5 according to the following system:

If the conclusion follows necessarily from the statements given, mark A.
If the conclusion contradicts the statements given, mark B.
If the conclusion neither follows necessarily nor contradicts the statements given, mark C.

If a conclusion follows necessarily, a person who accepts the statements is unavoidably committed to accepting the conclusion. When two things are contradictory, they cannot both be correct.

CONSIDER EACH ITEM INDEPENDENTLY OF THE OTHERS.

1. "Mr. Wilstings says that eighteen-year-olds haven't faced the problems of the world, and that anyone who hasn't faced these problems should not be able to vote. What he says is correct, but eighteen-year-olds still should be able to vote. They're mature human beings, aren't they?"

2. "Furthermore, eighteen-year-olds should be allowed to vote because anyone who will suffer or gain from a decision made by the voters ought to be permitted to vote. It is clear that eighteen-year-olds will suffer or gain from the decisions of the voters."

3. "Many eighteen-year-olds are serving their country. Now there can be no doubt that many people serving their country ought to be allowed the vote. From this you can see that many eighteen-year-olds ought to be allowed to vote."

4. "I agree with Mr. Pinder that anyone who will suffer or gain from a decision made by the voters ought to be permitted to vote. And it is true that eighteen-year-olds will suffer or gain from these decisions. But so will ten-year-olds. Therefore, eighteen-year-olds shouldn't be allowed to vote."

5. "Most eighteen-year-olds don't know the difference between right and wrong. The right to vote should not be possesed by the members of a group if most of them don't know this difference. It is obvious then that eighteen-year-olds shouldn't have the right to vote."
SECTION IB

In the next five items, the two men are debating about immigration. Mr. Pinder is speaking in the first three items, Mr. Wilstings in the last two.

Use the same system to mark items 6 through 10:
A. Conclusion follows necessarily from the statements given.
B. Conclusion contradicts the statements given.
C. Neither.

CONSIDER EACH ITEM INDEPENDENTLY OF THE OTHERS.

6. "Mr. Wilstings has proposed that we open our doors to all the foreigners who want to enter our beloved country. But foreigners always have made trouble and they always will. Most of them can't even speak English. Since any group that makes trouble is bad, it follows that foreigners are a bad bunch."

7. "You may not know it, but for the past ten years the Communists in our country have been supporting a policy of unrestricted immigration. It is obvious why they support this policy of opening our doors to foreigners. Now I hate to say this, but Mr. Wilstings' support of this policy leaves us but one conclusion. Mr. Wilstings is a Communist."

8. "Mr. Wilstings has said that most foreigners have made positive contributions to our country. This is true. I will also admit that a group is not bad if most of its members do make positive contributions. But don't be deceived by Mr. Wilstings' fine-sounding language. Foreigners are a bad group and shouldn't be admitted."

9. "I'm sorry that Mr. Pinder feels that way about it. Sure, foreigners make trouble and most of them can't speak English. But even though it's true that people that make trouble ought not to be admitted, we still ought to admit foreigners to our country. You don't want to be selfish do you?"

10. "All of you think it was all right to open our doors to all people from distant lands in the nineteenth century. Any person who thinks it was all right to do so at that time ought also to be in favor of doing so now. Thus, you ought to be in favor of opening our doors now to those from distant lands who are seeking admission to our country."
SECTION II

The discussion that follows is divided into parts to correspond to items 11 through 21. There is faulty thinking going on in each part. Your job for each item is to pick the one best reason why the thinking is faulty.

To take this part of the test, you need not know anything about the chlorination of water supplies.

11. DOBERT: I hear that you and some other crackpots are trying to get Gallton to chlorinate its water supply. You seem to think that this will do some good. There can be no doubt that either we should chlorinate or we shouldn't. Only a fool would be in favor of chlorinating the water, so we ought not do it.

ALGAN: You are correct at least in saying that we are trying to get the water chlorinated.

Pick the one best reason why some of this thinking is faulty.
A. Dobert is mistakenly assuming that there are only two alternatives.
B. Dobert is using a word in two ways.
C. Dobert is using emotional language that doesn't help to make his argument reasonable.

12. DOBERT: I guess you know that to put chlorine in the water is to threaten the health of every one of Gallton's citizens, and that, you'll admit, is bad.

ALGAN: What right do you have to say that our health will be threatened?

DOBERT: "Healthy living" may be defined as living according to nature. Now we don't find chlorine added to water in nature. Therefore, everyone's health would be threatened if chlorine were added.

Pick the one best reason why some of this thinking is faulty.
A. Dobert is using emotional language that doesn't help to make his argument reasonable.
B. Dobert's thinking is in error.
C. Dobert is using a word in two different ways.
13. DOBER: Furthermore, Gallton’s water is pure already. I know this from the report, which you haven’t seen yet, that will soon be released by the State Water Survey.

ALGAN: You can’t know that Gallton’s water is pure. The State Water Survey didn’t test all the water that we have available to us. They only took samples. Furthermore, you can’t know that they didn’t make an error in their investigation because there’s always a chance for error in any investigation. Therefore, you could never know that Gallton’s water is pure.

**Pick the one best reason why some of this thinking is faulty.**

A. Algan is not using “know” in its ordinary sense, yet he is expecting the effect that follows from its being used in the ordinary sense.

B. Dobert, in using secret evidence, is not being fair, since this evidence is not available to everyone for inspection.

C. Algan can’t know that an error was made in the investigation.

14. DOBER: I understand that you look on this thing as an experiment. I’m sure that the citizens of Gallton don’t want to be guinea pigs in this matter.

ALGAN: This is a demonstration. Nobody ought to object to a demonstration, since the purpose of a demonstration is not to find out something, but rather to show us something that is already known. An additional value of this demonstration of chlorination is that its purpose is also to test for the long-range effects of chlorination on the human body. This objective of the demonstration is a worthy one.

**Pick the one best reason why some of this thinking is faulty.**

A. Algan has not shown that knowing the long-range effects of chlorination is a worthy objective.

B. Algan is using a word in two ways.

C. There is an error in thinking in this part.

15. ALGAN: The question boils down to two alternatives. Either we want clean, chlorinated water or we want bad-smelling, disease-ridden water. The citizens of Gallton certainly don’t want bad-smelling, disease-ridden water. What is left but to chlorinate?

**Pick the one best reason why some of this thinking is faulty.**

A. Algan hasn’t shown that there are only two alternatives.

B. Algan is using emotional language that doesn’t help to make the argument reasonable.

C. Algan is using the same word in two ways.
16. DOBERT: Laying aside the question of whether medication is bad or good, wouldn't you say that you are proposing a plan for medication?

ALGAN: Not at all. Is killing germs in the water supply the same as treating a disease of the human body? Certainly not. Therefore, my plan cannot be called a plan for medication.

DOBERT: Oh, but it is medication. Isn't one of your stated goals the prevention of disease? Medication is the process of trying to restore or preserve health in any manner whatsoever. Whether your plan actually would result in preserving or restoring health doesn't matter. The point is that you would be trying to do so and thus would be medicating people.

Pick the one best reason why some of this thinking is faulty.
A. There is a serious mistake in the thinking in this part.
B. Dobert's conclusion doesn't necessarily follow from the reasons he gives.
C. Dobert and Algan are using the same word differently.

17. DOBERT: Can you prove that chlorination is useful in making water safe?

ALGAN: Yes, I can. Devon gets its water from the same place that we do. Three years ago, Devon had nine cases of typhoid fever. Two years ago they started to chlorinate and they had only two cases that year. That's proof enough.

Pick the one best reason why some of this thinking is faulty.
A. Algan is using the same word in two ways.
B. That's not a big enough reduction. If there were no typhoid at all the second year, then Algan would have proven his statement.
C. One such comparison is not enough to prove such a statement.

18. DOBERT: In reality you are proposing to poison our water supply when you propose to put chlorine gas in the water. Chlorine gas has been used in war to kill human beings. It is a deadly poison. Nobody wants to be poisoned.

ALGAN: But when chlorine is mixed 3 1/2 parts per million, nobody will be hurt at all.

DOBERT: That's not the point. You'd still be putting a deadly poison in the water. That's what it means to poison the water. So anyone drinking the water would necessarily be poisoned.

Pick the one best reason why some of this thinking is faulty.
A. Algan is missing the point.
B. Dobert is using the same word in two ways.
C. Dobert's thinking is in error.
19. DOBERT: Furthermore, Gallton's water is safe now.
   ALGAN: That's not true. Nothing is safe as long as there's a conceivable chance for something to go wrong. From this it follows that Gallton's water is not safe.

Pick the one best reason why some of this thinking is faulty.
A. Algan has made the word "safe" useless for communicating information.
B. Algan hasn't said what he means by "safe."
C. There is a flaw in Algan's thinking.

20. DOBERT: The citizens of Gallton will have to make a choice. Either we want absolutely pure water or we should keep our present setup. Now any chemist can tell you that from a practical point of view it is impossible to remove all the impurities from a water supply. So we should leave things the way they are.

Pick the one best reason why some of this thinking is faulty.
A. Dobert hasn't shown that there are only two alternatives.
B. Dobert is using the same word in two ways.
C. The conclusion doesn't necessarily follow from the reasons given.

21. DOBERT: To add chlorine is to add a drug to Gallton's water supply. Obviously, we don't want our citizens to be drugged every time they take a drink of water.

ALGAN: What right do you have to say that chlorine is a drug?

DOBERT: The term "drug" is defined in section 201 (g) of the Federal Food, Drug, and Cosmetic Act as an article intended for use in the diagnosis, cure, treatment, or prevention of disease in man or other animals. Now, since chlorine is intended for use in the prevention of disease, it is a drug.

Pick the one best reason why some of this thinking is faulty.
A. Dobert's thinking is in error.
B. Algan should realize that a person has a right to use a word in a special way. The important thing is that there be understanding of what is said.
C. Dobert is using a word in two different ways.
SECTIONS III, IV, AND V
REFER TO THE FOLLOWING EXPERIMENT:

An experiment was performed by Drs. E. E. Brown and M. R. Kolter in the veterinary laboratory of the British Ministry of Agriculture and Fisheries. The doctors were interested in what happens to ducklings that eat cabbage worms. Several cases had been reported to them in which ducklings had "mysteriously" died after being in cabbage patches containing cabbage worms.

Three types of ducklings were secured (Mallards, Pintails, and Canvasbacks), two broods of each. Each brood was then split into two equal groups as much alike as possible. For a one-week period they were provided an approved diet for ducklings. All had this diet, except that half of each brood were provided something more: two cabbage worms daily per duckling. The condition of the ducklings at the end of the week was observed and is reported in the following table:

<table>
<thead>
<tr>
<th>TYPE OF DUCKLING</th>
<th>ORIGINAL NUMBER IN BROOD</th>
<th>REGULAR DIET</th>
<th>REGULAR DIET PLUS WORMS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Healthy</td>
<td>Ill</td>
<td>Dead</td>
</tr>
<tr>
<td>MALLARD</td>
<td>8</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>PINTAIL</td>
<td>6</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CANVASBACK</td>
<td>8</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>TOTALS</td>
<td>44</td>
<td>18</td>
<td>3</td>
</tr>
</tbody>
</table>

The doctors drew this conclusion: CABBAGE WORMS ARE POISONOUS TO DUCKLINGS.
SECTION III

The experiment attracted a great deal of attention. Many statements were made about the experiment and about the protection of ducklings.

Items 22 through 25 each contain a pair of statements (A & B), which are underlined. Read both, then decide which, if either, is more believable.

Mark items 22 through 25 according to the following system:

If you think the first statement is more believable, mark A.
If you think the second statement is more believable, mark B.
If neither statement is more believable than the other, mark C.

In making your decisions use the information already provided and the information in parentheses after each statement.

22. A. Cabbage worms are poisonous to ducklings (said by Dr. Kolter).

B. Six Canvasbacks died during the week of the experiment (said by Dr. Kolter).

C. Neither statement is more believable.

23. A. Six Pintails were healthy at the end of the experiment (said by Dr. Brown).

B. Four worm-fed ducklings were ill at the end of the experiment (said by Dr. Brown).

C. Neither statement is more believable.

24. A. During the week following the experiment, all of the ill ducklings died. (From an article in a magazine that can be found on almost every newsstand. The author, a popular international writer, stated that he obtained his information from Drs. Brown and Kolter.)

B. During the week following the experiment, the rest of the worm-fed ducklings died (from the report written by Drs. Brown and Kolter).

C. Neither statement is more believable.

25. A. Independent laboratory studies have shown conclusively that ducklings sprayed with Wrodane will not be harmed by eating cabbage worms (from an article in a magazine published by a chemical company that makes Wrodane).

B. No satisfactory way has yet been found to counteract the poisonous effects of cabbage worms on ducklings (from the magazine article mentioned in Item No. 24, which appeared two months after the Wrodane article).

C. Neither statement is more believable.
SECTION IV

From the original experiment, the doctors drew this conclusion: CABBAGE WORMS ARE POISONOUS TO DUCKLINGS.

Mark items 26 through 38 according to the following system:

A. If true, this information supports the conclusion.
B. If true, this information goes against the conclusion.
C. This information does neither.

CONSIDER EACH ITEM INDEPENDENTLY OF THE OTHERS.

26. The experiment is repeated. The results are similar.

27. The experiment is repeated with three different varieties of ducklings, which are younger than the ones used in the original experiment. At the end of the week, two of the regular-diet ducklings are dead, and twenty of the worm-diet ducklings are dead.

28. At the time of the original experiment, there was an apple tree shedding apples into the cages of both sets of ducklings. The experimenters did not expect this to happen. About the same number of apples fell into each cage. This kind of apple does not affect the health of ducklings.

29. The experiment is repeated in Canada with twice as many ducklings. None of the ducklings die. At the end of the week, two of the regular-diet ducklings are ill, and three of the worm-diet ducklings are ill.

30. The experiment is repeated in Scotland. At the end of the week, all of the worm-fed ducklings are dead, and all of the regular-fed ducklings are alive and healthy. But it is discovered that the man who handled the worms had been spraying fruit trees with arsenic and had carelessly transferred some arsenic to the feeding pan of the worm-fed ducklings. Arsenic is a deadly poison.

31. A team of expert biologists examines the body structure and processes of ten common varieties of ducklings, including the three used in the experiment. The biologists can find no significant differences among the varieties examined except for coloring.

32. It is discovered that during the original experiment the regular-fed ducklings had less sunlight than the worm-fed ducklings. It is not known whether or not the difference in amount of sunshine would have an effect on the health of ducklings.

33. A group of well-known Canadian duck breeders report that they discovered long ago that it was dangerous to ducklings to let them run in a cabbage patch.
Reminder: Mark these items as follows:

A. If true, this information supports the conclusion.
B. If true, this information goes against the conclusion.
C. This information does not.

CONSIDER EACH ITEM INDEPENDENTLY OF THE OTHERS.

34. It is discovered that both sets of ducklings reached through their cages and drank water from a little ditch that ran past both cages. They drank practically no water out of the pans that were in the cages. The water in the ditch was ordinary water.

35. The experiment is repeated in Canada with three different varieties of ducklings. All of the ducklings die, whether worm-fed or not.

36. The experiment is repeated in the United States with twice as many ducklings. At the end of the week, 40 of the 44 regular-diet ducklings are alive and healthy, and 39 of the 44 worm-fed ducklings are alive and healthy.

37. It turns out that at the time of the original experiment a large oak tree was dropping acorns into the cages of the worm-fed ducklings only. The effect of this kind of acorn on the health of ducklings is not known.

38. A similar experiment is performed with young dogs. Another is performed with young turtles. In both cases the results are similar to those of the original duckling experiment.

SECTION V

A research worker sets out to test the truth of the statement:

IF ANY DUCKLING EATS A CABBAGE WORM,
THE DUCKLING WILL DIE WITHIN SIX HOURS.

The research worker has developed an accurate, painless, and noninjurious stomach-testing method for telling whether a duckling has eaten a cabbage worm during the previous twelve hours. The method can be used both with dead ducks and live ducks.

In planning his experiments, he needs to make some predictions from the above statement.

a. PREDICTIONS TELL WHAT WOULD BE TRUE, IF THE STATEMENT WERE TRUE.

b. PREDICTIONS SHOULD BE USEFUL IN GUIDING AN ACTUAL EXPERIMENT.
Remembering these two rules about predictions, answer items 39 through 42. The items refer to the seven possible predictions listed after item 42.

39. Of j, k, and l, which is the best prediction? Mark A for j; mark B for k; mark C for l.

40. Of k, l, and m, which is the best prediction? Mark A for k; mark B for l; mark C for m.

41. Of m, n, and o, which is the best prediction? Mark A for m; mark B for n; mark C for o.

42. Of n, o, and p, which is the best prediction? Mark A for n; mark B for o; mark C for p.

Possible predictions:

j. If any duckling eats a cabbage worm, the duckling will be dead within six hours; and if a stomach test is performed within twelve hours after eating the worm, the results of the stomach test will show that the duckling has eaten at least one cabbage worm.

k. If any duckling does not die within six hours after a given period, then it did not eat any cabbage worms during that period.

l. Suppose six hungry Pintail ducklings are put for one hour in a cabbage patch containing cabbage worms and then put in a clean cage for six hours. If any do not die during that period, the results of the stomach test will show that these ducklings did not eat any cabbage worms.

m. If one Mallard duckling is selected at random from each of ten different broods, and all ten ducklings are kept away from cabbage worms for a twelve-hour period, then none will die during the last six hours of the twelve-hour period.

n. If one Mallard duckling is selected at random from each of six different broods, and each selected duckling is fed a cabbage worm, all six ducklings will be dead within six hours.

o. Suppose twelve hungry, randomly selected Canvasback ducklings are turned loose for one hour in a cabbage patch containing cabbage worms and then put in a clean cage for six hours. If each dies during that period, the results of the stomach tests will show that each has eaten a cabbage worm.

p. If a group of ten healthy Canvasback ducklings that would probably live if not fed cabbage worms is randomly split in half, and each half is treated the same except that one group of five eats cabbage worms, then the worm-fed ducklings will die within six hours and the other ducklings probably will not.
SECTION VI

Items 43 through 46 provide situations in which a definition is called for. From the three definitions that follow each description, pick the one (A, B, or C) that best gives the meaning.

43. “That’s a nice stock car you have there, Bill,” his mother remarked.

“Stock car!” exclaimed Bill. “That’s no stock car. Did you ever see a car in a dealer’s showroom with bumpers made out of heavy pipe? Do the automobile manufacturers turn out cars with no fenders? Of course not.”

Bill’s mother then asked, “Just what do you mean by ‘stock car’?”

Of the following, which is the best way to state Bill’s notion of a stock car?

A. A stock car is an automobile that is for the most part made of standard parts put out by automobile manufacturers, but which might have missing fenders and special bumpers.

B. A stock car is an automobile that has fenders and does not have bumpers made out of pipe.

C. A stock car is a standard automobile, as turned out by the factory and sold to the public.

44. “It certainly is a stock car,” said Joan. “It has an ordinary engine that hasn’t been changed since it came off the assembly line. That alone makes it a stock car and that’s all that matters.”

Of the following, what is the best way to state Joan’s notion of a stock car?

A. A stock car is an automobile that is for the most part made of standard parts put out by automobile manufacturers, but which might have the fenders missing and special bumpers.

B. A stock car is an automobile with a standard engine.

C. A stock car is where the engine is standard.
45. "What are you making with that dough?" asked Mary's father.

"Dough!" exclaimed Mary. "Did you ever see anything made with yeast that was baked immediately after it was mixed? Naturally not," she said as she put the mixture into the oven immediately after mixing it. "Therefore, it's not dough."

"What do you mean by 'dough'?" her father asked.

Of the following, which is the best way to state Mary's notion of dough?

A. Dough is a mixture of flour and other ingredients, including yeast.
B. Dough is a mixture of flour and other ingredients, not baked immediately.
C. Dough is a mixture of flour and other ingredients, often baked in an oven.

46. "Why, of course that's dough," said Jim. "You're making cookies aren't you? It's not even called dough unless it's used for cookies."

Of the following, which is the best way to state Jim's notion of dough?

A. Dough is a mixture of flour and other ingredients not baked immediately unless used for cookies.
B. Dough is a mixture of flour and other ingredients which is used for cookies.
C. Dough is a mixture of flour and other ingredients, which is used for cookies unless it's baked immediately.

SECTION VII

In items 47 through 52, someone is speaking; but in each case there is an unstated assumption. An assumption is a statement that is taken for granted. From the choices that follow, select the one (A, B, or C) that is most probably the unstated assumption. Consider each item by itself.

47. MR. DOBERT: The fact that Galton's children have been forced to work explains their misbehavior.

A. Children who have never been forced to work behave properly.
B. Children who behave improperly have been forced to work.
C. Children who have been forced to work behave improperly.
Reminder: Select the one (A, B, or C) that is most probably the unstated assumption.

48. MRS. DOBERT: What we should do is not make them work. Then they would be all right. I know it.
   A. Children who are forced to work will misbehave.
   B. Children who are not forced to work will behave properly.
   C. Children who behave properly have not been forced to work.

49. MRS. ALGAN: We ought to make them work. That will cure them.
   A. Children who aren't forced to work will misbehave.
   B. Children who are forced to work will behave properly.
   C. Children who behave properly have been forced to work.

50. MR. ALGAN: The explanation of the misbehavior of Gallton's present-day crop of youngsters is a simple one. These children have been severely punished at some time or other. That's the trouble.
   A. Children who have been severely punished misbehave.
   B. Children who misbehave have been severely punished at some time.
   C. Children who haven't been severely punished behave properly.

51. MRS. DOBERT: Their behavior can be explained by realizing that most of these youngsters have never been punished.
   A. Children who are punished behave properly.
   B. Children who behave improperly have never been punished.
   C. Children who have never been punished behave improperly.

52. MR. DOBERT: What we should do is never punish them. That would take care of things.
   A. Children who behave badly have been punished at some time.
   B. Children who are punished will misbehave.
   C. Children who behave properly have never been punished.

THE END. GO BACK AND CHECK YOUR ANSWERS.
CORNELL CRITICAL THINKING TEST
ANSWER SHEET (FOR LEVEL X OR LEVEL Z)
BY: ROBERT H. ENNIS & JASON MILLMAN

1 A B C  21 A B C  41 A B C  61 A B C
2 A B C  22 A B C  42 A B C  62 A B C
3 A B C  23 A B C  43 A B C  63 A B C
4 A B C  24 A B C  44 A B C  64 A B C
5 A B C  25 A B C  45 A B C  65 A B C
6 A B C  26 A B C  46 A B C  66 A B C
7 A B C  27 A B C  47 A B C  67 A B C
8 A B C  28 A B C  48 A B C  68 A B C
9 A B C  29 A B C  49 A B C  69 A B C
10 A B C  30 A B C  50 A B C  70 A B C
11 A B C  31 A B C  51 A B C  71 A B C
12 A B C  32 A B C  52 A B C  72 A B C
13 A B C  33 A B C  53 A B C  73 A B C
14 A B C  34 A B C  54 A B C  74 A B C
15 A B C  35 A B C  55 A B C  75 A B C
16 A B C  36 A B C  56 A B C  76 A B C
17 A B C  37 A B C  57 A B C  77 A B C
18 A B C  38 A B C  58 A B C  78 A B C
19 A B C  39 A B C  59 A B C  79 A B C
20 A B C  40 A B C  60 A B C  80 A B C
Appendix 3. Correlational matrix for learning styles with critical thinking.

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Appendix 4. Differences between cohorts on Kolb’s learning style dimensions.

Individual differences

Key.
1 = Critical Care
2 = Gerontic
Appendix 5. Frequencies within positions.

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Author/s:
Jenkin, Maree Michelle

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