



The relationship between critical thinking and learning styles in nursing students
by Patricia Wamsley Wilson

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Nursing
Montana State University

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Abstract:

In order to think critically, one must first perceive and then process information. One's learning style is the individual's way of perceiving and processing information (Smith & Kolb, 1986). There is an increasing emphasis in nursing education on developing critical thinking skills in nursing students. There is limited research on the relationship of critical thinking and learning styles in nursing students.

The relationship between critical thinking and learning styles of baccalaureate nursing students was investigated in this study. The convenience sample consisted of 29 senior students enrolled in a baccalaureate nursing program in the Western States. Critical thinking ability was measured by the score on the Watson-Glaser Critical Thinking Appraisal Form S and learning style was measured by Kolb's (1985) Learning Style Inventory. Data were analyzed using t-tests and analysis of variance (ANOVA).

Results showed there was not a significant relationship between critical thinking and learning styles. Critical thinking scores in this population were consistent with critical thinking scores in other baccalaureate nursing populations. Learning styles represented in this population were found to be similar to populations studied in previous research. Age was not significantly related to critical thinking score as was self-reported GPA. Implications of these findings are discussed for nursing research, education, and practice.

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by

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A thesis submitted in partial fulfillment
of the requirements for the degree

of

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This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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ABSTRACT

In order to think critically, one must first perceive and then process information. One's learning style is the individual's way of perceiving and processing information (Smith & Kolb, 1986). There is an increasing emphasis in nursing education on developing critical thinking skills in nursing students. There is limited research on the relationship of critical thinking and learning styles in nursing students.

The relationship between critical thinking and learning styles of baccalaureate nursing students was investigated in this study. The convenience sample consisted of 29 senior students enrolled in a baccalaureate nursing program in the Western States. Critical thinking ability was measured by the score on the Watson-Glaser Critical Thinking Appraisal Form S and learning style was measured by Kolb's (1985) Learning Style Inventory. Data were analyzed using t-tests and analysis of variance (ANOVA).

Results showed there was not a significant relationship between critical thinking and learning styles. Critical thinking scores in this population were consistent with critical thinking scores in other baccalaureate nursing populations. Learning styles represented in this population were found to be similar to populations studied in previous research. Age was not significantly related to critical thinking score as was self-reported GPA. Implications of these findings are discussed for nursing research, education, and practice.

CHAPTER 1

INTRODUCTION

Critical thinking is an essential skill for nurses practicing in a world of rapidly advancing technology, increasing complexity of care, and new economic realities. A key component of nursing practice, regardless of practice area, is the nurse's ability to process information and to make decisions using critical thinking skills. The ability to process information critically will become more of a challenge as the amount of information available in the world is doubling every five years (Pritchett, 1994).

How will nurses respond to the constant, accelerating changes of the future? Paul (1993), the founding director of the Center for Critical Thinking asserts that:

The most inescapable imperative of the future is continuous change, change that involves complex adjustments to the increasingly complex systems that dominate our lives. Therefore the distinguishing characteristics of those who will not only survive but thrive in the future, will be abilities and traits, both intellectual and emotional, that entail excellence in evaluating and responding to the conditions of change. (p. xi)

Critical thinking is one such distinguishing characteristic needed to thrive in the future. Critical thinking will enable nurses to evaluate traditional,

entrenched methods and procedures and will encourage the use of new ideas and solutions (Gillmore, 1993).

The challenge for nursing education is to provide student nurses with the skills necessary to become critical thinkers. In fact, nursing process and critical thinking have been identified most frequently by nursing faculty as concepts essential to a nursing curriculum (Valiga & Bruderle, 1994).

In order to think critically, one must first perceive and then process information. One's learning style is the individual's way of perceiving and processing information. (Smith & Kolb, 1986). Kolb (1985) describes learning as similar to problem solving and characterized by four different learning modes: concrete experience, reflective observation, abstract conceptualization, and active experimentation. A person's tendency to utilize one or more of these components over another constitutes the person's preferred learning style. Problem-solving and learning occur with the learning style in which the person is most skilled and comfortable.

However, Kolb (1984) believes skill can be developed in non-dominant learning styles. Miller and Malcolm (1990) state "if students' learning styles were assessed, learning activities that further reinforce strengths or that develop weaker phases could be planned systematically to maximize

students' thinking and problem-solving abilities" (p. 72). Case (1994) also suggests that encouraging the use of less accustomed learning styles will enhance critical thinking.

Learning styles may be related to critical thinking abilities. Both are concerned with information processing, perceiving, thinking, and problem-solving. Kolb (1984) equates learning with problem-solving. Many of the definitions of critical thinking are based on critical thinking as problem-solving (Kurfiss, 1988; Malek, 1986; Nehring, Burham & Marek, 1986; Watson & Glaser, 1980)

Purpose

There is limited research on the relationships between critical thinking and learning styles. No studies were found in a review of the literature that examined the relationships of critical thinking as measured by the Watson-Glaser Critical Thinking Appraisal and learning styles as measured by Kolb's (1985) Learning Style Inventory (LSI). The purpose of this research was to add to the body of knowledge concerned with critical thinking and learning styles. Is the way one perceives and processes information (learning style) related to the ability to think critically? The major purpose of this study will be to examine the relationship between the student's learning style as measured by Kolb, and critical thinking scores in senior

baccalaureate nursing students, as measured by the Watson-Glaser Critical Thinking Appraisal, Form S (1994). A secondary purpose was to assess the relationship between critical thinking and the variables of age, gender, and self-reported grade point average (GPA).

Background and Significance

Developing critical thinking skills among professional nurses has long been recognized as important in enhancing the ability to utilize the nursing process to provide safe and competent nursing care (Case, 1994; Creighton, 1984; Jenkins, 1985; Levenstein, 1981; Miller & Malcolm, 1990). By thinking critically about the assumptions that form their reasoning and actions, nurses will learn what information is valid, when to trust instincts, and what alternative courses of action can be taken in a given clinical situation (Brookfield, 1993).

Critical thinking skills are essential for nursing leaders in the 21st century as they will be key leaders involved in the decision making necessary to provide quality care in a rapidly changing environment. Critical thinking by nurses in education, practice, and research is essential if decisions are to be made wisely.

Interest in critical thinking is traced to Glaser's "An Experiment in the Development of Critical Thinking" (1941).

His work, along with Watson's (1925) work, formed the precursors of the Watson Glaser Critical Thinking Appraisal (WGCTA).

The term critical thinking began permeating the American school system in the late 1970's. In 1989, The National League for Nursing (NLN) recognized the importance of the development of critical thinking when it was included as a specific criterion for the accreditation of baccalaureate programs (NLN, 1989; 1992). The American Association of Colleges of Nursing (AACN) (1993) identified critical thinking and the ability to seek and analyze information as important cognitive skills required of nursing graduates. Thus, much of the nursing research on critical thinking has centered on the impact of formal nursing education on the acquisition of critical thinking skills (Bauwens & Gerhard, 1987; Berger, 1984; Brooks & Shepherd, 1990; Frederickson, 1979; Frederickson & Mayer, 1977; Kintgen-Andrews, 1988; Maynard, 1996; Richards, 1977; Saarmann, Freitas, Rapps, & Riegel, 1992; Sullivan, 1987).

There are many different models of learning style. Curry (1983) reviewed 21 of these models and developed a conceptual framework for organizing them into three mutually exclusive strata. The strata include instructional preference models, information processing models, and cognitive personality style models.

Instructional preference models assess the ways people prefer to learn, e.g. the conditions and modes of learning present in the teaching-learning environment. The Dunn, Dunn, and Price Model is well known in this category (Curry, 1983).

Information processing models address the intellectual approach people take to assimilate information, e.g., abstract versus concrete. The Kolb (1976, 1985) and Gregorc (1982) tools are examples of information processing models.

Cognitive personality style models attempt to explain the underlying and relatively stable dimensions of personality that do not interact directly with the environment and have wide applicability to predict behavior. The Myers-Briggs Type Indicator (1976) is the best known in this strata.

Kolb's Learning Style Inventory (1985), an information processing model, was the tool used for assessing learning styles in this research. Information processing models are similar to models of critical thinking as they both deal with the intellectual approach people take to assimilate information. The Kolb model has been used to a greater extent in nursing research than the Gregorc model. In addition, the Kolb model was chosen for this research over the Gregorc model due to the similarities of learning styles, problem-solving, and critical thinking. Kolb uses

the term learning style and problem-solving interchangeably. Many of the definitions of critical thinking incorporate the concept of problem-solving (Klaassens, 1988; Kurfiss, 1988; Malek, 1986; Nehring, Durham, & Macek, 1986; Watson & Glaser, 1980).

Problem Statement/Research Questions

This study addressed the following questions:

1) Is there a difference in critical thinking scores in senior baccalaureate student nurses with different learning styles?

2) Is there a difference in critical thinking scores in senior baccalaureate student nurses across the variables of age, gender, and self-reported GPA?

Conceptual Framework

The conceptual framework guiding this study was based on Watson and Glaser's (1980, 1994) critical thinking theory and on Kolb's (1976, 1984, 1985) experiential learning theory. Watson and Glaser (1980) conceptualize critical thinking as a composite of attitudes, knowledge, and skills. The Watson Glaser Critical Thinking Appraisal (WGCTA) is composed of five subtests:

a) inference: discriminating among degrees of truth or falsity of inferences drawn from given data

- b) recognition of assumptions: recognizing unstated assumptions or presuppositions in given statements or assertions
- c) deduction: determining whether certain conclusions necessarily follow from information in given statements or premises
- d) interpretation: weighing evidence and deciding if generalizations or conclusions based on the given data are warranted
- e) evaluation of arguments: distinguishing between arguments that are strong and relevant and those that are weak or irrelevant to a particular question at issue (Watson & Glaser, 1994, p. 9-10).

Each of these subtests is designed to measure a somewhat different aspect of the composite of critical thinking. A high level of competency in critical thinking may be defined as the ability to correctly perform the domain of tasks represented by the five subtests.

Kolb's (1984) experiential learning model stresses the role experience plays in learning. The theory essentially states that people are constantly learning as a direct result of here-and-now experiences in all settings from school, to work, to play, to social interactions. The second major principle of the theory is that all people do not

learn alike. The learning process is conceptualized as having the following four learning orientations:

- a) abstract conceptualization (AC)- a conceptually-based, analytic approach to learning
- b) concrete experience (CE)-an experience-based, involved approach to learning
- c) reflective observation (RO)-an observation-based, impartial approach to learning
- d) active experimentation (AE)-an action-based, active approach to learning (Smith & Kolb, 1986)

The LSI (Kolb, 1985) measures an individual's relative emphasis on these orientations. The combination scores indicate the extent to which an individual's preferred style is abstract versus concrete (AC-CE) and active versus reflective (AE-RO). Learning styles represent the degree to which a person favors these two dimensions. Learners take in or perceive new information from the environment using either concrete experience or abstract conceptualization. Learners then process perceptions using active experimentation or reflective observation (Haislett, Hughes, Atkinson, & Williams, 1993).

Definitions

For the purpose of this study the following definitions were used:

Age: the length of life in years and grouped in decades; specifically, 20-30, 31-40, 41-50, and >50 years.

Self-reported grade-point average (GPA): the average grade compiled on a four-point scale reported by the subject. A higher GPA was 3.0 and above and a lower GPA was less than 3.0.

Senior baccalaureate student nurse: a person who is not a registered nurse and who is currently enrolled in either the first or second semester of their senior year in a collegiate program leading to a baccalaureate degree in nursing.

Critical thinking: attitudes, knowledge, and skills, including:

- (1) attitudes of inquiry that involve an ability to recognize the existence of problems and an acceptance of the general need for evidence in support of what is asserted to be true;
- (2) knowledge of the nature of valid inferences, abstractions, and generalizations in which the weight or accuracy of different kinds of evidence are logically determined; and
- (3) skills in employing and applying the above attitudes and knowledge (Watson & Glaser, 1980, p. 1).

Learning style: an individual's way of perceiving and processing information.

Assumptions

The following assumptions were related to this research:

1. Critical thinking is a complex multidimensional construct.

2. There are different learning styles among people.

3. Senior baccalaureate nursing students will accurately report their GPA.

4. Senior baccalaureate nursing students participating in this study could read and comprehend the Watson-Glaser Critical Thinking Appraisal and the Kolb's Learning Style Inventory.

5. The sample selected for the study was representative of the population.

Limitations

1. A convenience sample of student nurses was used therefore the results may not be generalizable to the greater population of student nurses.

2. Subjects were selected from one school of nursing and may not be representative of all baccalaureate nursing students.

3. Generalizability of this study was limited due to the small sample size.

CHAPTER 2

LITERATURE REVIEW

There is no universally accepted definition or conceptualization of critical thinking (Ford & Profetto-McGrath, 1994). Critical thinking is a complex construct with many components (Pless & Clayton, 1993). Glaser's (1941) early conceptualization of critical thinking included the three main components of knowledge, attitude of inquiry, and skills used in applying the knowledge and attitude of inquiry.

In 1990, a panel of experts using the Delphi method, came to a consensus that critical thinking involves two dimensions: cognitive skills and affective dispositions (Facione, 1990). There is agreement in the literature that critical thinking is a composite of knowledge, attitudes, and skills (Brookfield, 1987; Ennis, 1985; Miller & Malcolm, 1990; Paul, 1993; & Watson & Glaser, 1980). There is no agreement in the literature on what composes these essential attitudes and skills.

Miller and Malcolm (1990) illustrated the interaction of attitudes, knowledge, and skills in a model of critical thinking in nursing curricula. Kataoka-Yahiro and Saylor (1994) expanded the critical thinking model of Glaser (1941)

and Miller and Malcolm to include the components of nursing experience, competencies, and standards.

The Watson-Glaser (1941) model provides the foundation for the conceptual model of critical thinking used in this study. The Watson-Glaser Critical Thinking Appraisal measures five abilities identified by Dressel and Mayhew (1954) as abilities that appear related to the concept of critical thinking. The abilities are: (1) the ability to define a problem; (2) the ability to select pertinent information for the solution of a problem; (3) the ability to recognize stated and unstated assumptions; (4) the ability to formulate and select relevant and promising hypotheses; and (5) the ability to draw valid conclusions and judge the validity of inferences.

In 1990, a cross disciplinary panel completed a two year Delphi project which achieved consensus on a robust concept of critical thinking (Facione, 1990). Critical thinking was defined as "purposeful, self-regulatory judgment, a human cognitive process. As a result of this non-linear process, a person forms a judgment about what to do or believe in a given context" (p. 9). The panel identified a core set of cognitive skills used in the process of critical thinking: analysis, interpretation, inference, explanation, and self-regulation to form a judgment and to monitor and improve the quality of that

judgment. These cognitive skills are similar to those identified by Watson and Glaser (1980, 1994). The WGCTA measures inference, recognition of assumptions, deduction, interpretation and evaluation of arguments.

There are many interpretations of the cognitive skills needed in critical thinking (Brookfield, 1987; Case, 1994; Ennis, 1985; & Paul, 1993). Case (1994) describes the cognitive skills of organizing, clustering, assembling evidence, discriminating, comparing, contrasting, evaluating against criteria, and developing criteria for evaluation. Brookfield (1987) describes identifying and challenging assumptions, challenging the importance of the context, imaging and exploring alternatives, and reflective skepticism. Reflective skepticism refers to being skeptical of claims to universal truths or to ultimate explanations. There is overlap in these authors concepts of the cognitive skills needed in critical thinking, those defined by the Delphi Panel, and those measured by the WGCTA.

In addition to cognitive skills, the 1990 Delphi consensus statement identified an overall disposition toward critical thinking, a constellation of attitudes, a set of intellectual virtues, or habits of mind (Facione, 1990). These experts described the characteristics of the "ideal critical thinker" as follows:

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 (Facione, 1990, p. 3).

The above definition is consistent with Watson and Glaser's recognition of the importance of an attitude of inquiry that includes the ability to recognize problems and the need for evidence to support what is believed to be true. Critical thinkers are constantly asking questions and seeking to clarify answers in all settings.

Valiga and Bruderle (1994) in a study of concepts critical to nursing curricula received several responses noting that the following concepts were "linked" or similar; critical thinking and problem-solving, nursing process and problem solving, and decision making and critical thinking. These authors suggest there is a need for concept clarification between these concepts as not everyone who thought critical thinking was a critical concept (n=100) thought the same about decision-making (n=74) or problem-solving (n=63). The terms clinical judgment, clinical reasoning, problem-solving, and critical thinking are often used interchangeably (Alfaro-LeFevre, 1995).

In a survey of deans and directors of baccalaureate, masters, and doctoral schools of nursing, critical thinking was described as a rational-linear problem solving activity

that reflects the nursing process (Jones & Brown, 1991). Jones and Brown (1991) believed the results indicated educators were unclear about the mechanisms or operations of critical thinking. A broader more multidimensional focus has evolved as the concept of critical thinking has been studied (Kataoka-Yahiro & Saylor, 1994; Miller & Malcolm, 1990).

Critical Thinking Research

The majority of nursing research on critical thinking focuses on the development of critical thinking ability in nursing students. The instrument most frequently used as an outcome measure of critical thinking ability is the Watson-Glaser Critical Thinking Appraisal (WGCTA) (Hart & Waltz, 1988; Perciful & Nester, 1996). The following summary of the research on critical thinking using the WGCTA as the measurement tool, is divided into longitudinal studies and cross-sectional studies.

Four longitudinal studies found no significant change in critical thinking scores using the WGCTA (1980) during the measured time frame in the students' nursing programs. Bauwens and Gerhardt (1987) found no significant increase in critical thinking ability in 53 BSN students over two years from entry into the upper division nursing program and the final month prior to graduation. Pearson correlation and multiple regression analysis were used to examine

relationships with other variables. The Pearson correlation between the WGCTA entry score and the National Council Licensing Examination (NCLEX) was .31 ($p=.002$). The entry WGCTA and the entry GPA accounted for 15% of the variance in NCLEX scores. Because there was no significant change in the WGCTA score at the end of the educational program, the investigators concluded that the WGCTA is not a valid measure of the cognitive processes underlying the nursing process. However, they also concluded that the findings support the usefulness of the WGCTA as a potential pre-admission predictor of nursing success.

Behrens (1996) found critical thinking scores did not significantly change from entry to exit for 17 nursing students in a diploma nursing program. The difference between entry mean critical thinking score of 52.8 and exit mean score of 53.1 was not significant, $t(16) = -.0119$, $p < .10$. The mean entry critical thinking score for traditional students (49.8) was significantly lower than for nontraditional students (53.4), $t(107) = 3.01$, $p < .01$. The study did not address the differences between traditional and non-traditional students beyond the first semester.

Kintgen-Andrews (1988) used the WGCTA to assess 55 practical nursing students, 38 pre-health science freshman, 55 associate degree (AD) nursing students, and 29 sophomore level baccalaureate students and found no significant gains

at the 0.05 level in critical thinking ability in any of the groups over one academic year. One group, the sophomores, had a mean spring WGCTA that was lower than their fall WGCTA score.

Sullivan (1987) found no significant change in the WGCTA in 46 registered nurse (RN) students upon entry and exit of a baccalaureate program ($t=.10$, $p=.918$). A significant negative correlation was found in critical thinking scores between students' year of basic nursing school graduation and entry into the BSN program critical thinking scores. The more time that had passed since a subject graduated from an AD or diploma program, the higher his/her critical thinking score was at entry to the BSN program. It is interesting to note that no correlation was found in comparison with the exit score.

Four other longitudinal studies showed a significant increase in critical thinking scores measured during the students' nursing program. Berger (1984) found significant gains in scores in 137 BSN students from sophomore year (mean score=77) to senior year (mean score=80). Berger reported the increase was statistically significant $t=3.98$ (no p value was cited). She also found nursing students had higher critical thinking scores (mean score=77) than Liberal Arts Freshman students (mean score=70) and Liberal Arts Seniors (mean score=74).

Frederickson (1979), in a pilot study ($N=14$), found significant improvement in critical thinking between pretest scores (when baccalaureate nursing students enter the nursing sequence) and posttest scores (when the same students complete the nursing course sequence). The t obtained, 2.82, exceeds the critical values of t ($t=2.78$; $p>2.78$, $p>.01$).

Gross, Takazawa, and Rose (1987) administered the WGCTA to assess critical thinking ability from entry to exit in both associate degree and baccalaureate degree nursing students. Of those for whom both pre-test and post-test scores were available ($n=71$), there were highly significant improvements ($p<.000$). In the AS group, the improvement in mean score was from 44.5 (entry) to 55.0 (exit). In the BS group, the mean for the 33 scores changed from 45.6 to 57.9 out of a possible 80 points.

Miller (1992) also found significant improvement ($p=.05$) in 137 RN's who completed a baccalaureate degree program from admission pretest ($M=70$) to completion posttest ($M=72.5$). The pretest was administered during the first course of the nursing major and the post-test during the last course in the nursing program. In this study, graduates from diploma programs made significantly greater gains in critical thinking scores than did graduates from AD programs. The mean age of the students was 33.5 years with a

mean of nine years of work experience. The mean critical thinking scores in this study and the Berger (1984) study are higher than others reported in the literature as both studies used an earlier version of the WGCTA, (Form Ym), which has 100 possible points.

One recent longitudinal study found critical thinking as measured by the WGCTA did not change significantly from sophomore to senior year in 121 randomly selected baccalaureate nursing students (Maynard, 1996). However, a significant increase was found in scores of practicing nurses in a subsample group of 24 nurses with a mean of 2.2 years in current nursing positions. Multivariate analysis of variance, repeated measures analysis of variance, and contrast statistical methods were used with a .05 level of significance. Maynard (1996) concluded that the experiential component of practice emerged as the key influencing factor on the development of competence and critical thinking.

Results of cross-sectional studies on critical thinking abilities were equally mixed. Two studies support the impact of education on critical thinking. Brooks and Shepherd (1992) in a study of 200 students from four types of nursing programs, found seniors from generic baccalaureate ($\bar{M}=61.3$) and RN baccalaureate ($\bar{M}=61.1$) programs scored higher on the WGCTA than AD ($\bar{M}=50.0$) and diploma ($\bar{M}=51.3$) program seniors. The mean age for the

diploma program students was 21.40, the generic baccalaureate students was 22.70, the associate students was 31.70, and the RN baccalaureate students was 30.70 years. Eighty percent of the RN baccalaureate subjects had more than three years of experience in the profession. The higher scores in the RN baccalaureate group may have been influenced by age and/or experience in the profession. However, the generic baccalaureate students were a younger group without experience in the profession and scored similar to the RN students.

The impact of education was substantiated by Pardue (1987) in her study of 121 practicing nurses. Results indicated that nurses with baccalaureate and master's degrees had higher scores than associate degree and diploma nurses on the WGCTA. The mean score for baccalaureate degree nurses was 61.00, for master's degree nurses 64.00, for associate degree nurses 52.00, and for diploma nurses 56.00. One way analysis of variance was used to test the null hypothesis that there will be no significant difference in critical thinking among the groups. The F ratio of 7.20 was significant ($p=.001$). However, perceived decision-making skills were not significantly different between the groups.

Howenstein, Bilodeau, Brogna, and Good (1996) also found level of education to make a significant difference in WGCTA scores ($F[3,157]=6.57, p<.001$) with diploma and

associate prepared nurses scoring lower than baccalaureate and masters prepared nurses. No significant relationship was found between practice area and WGCTA scores ($F[3,158]=0.757, p>.05$) in this convenience sample of 152 practicing nurses from two urban teaching hospitals.

Kintgen-Andrews (1991) poses the question: Does nursing education impact upon critical thinking, or are higher critical thinking scores in BS or MS students related to progressive selectivity of students? Kintgen-Andrews (1991) wonders whether the lower scoring AD student is the type of student who is likely to enter and complete a baccalaureate program.

Two other cross-sectional studies failed to identify differences in critical thinking scores for students at different educational levels. Matthews and Gaul (1979) found no significant differences in scores between 26 graduate students and 22 undergraduate students. The Mann-Whitney U test was applied to the data to determine if there were differences between the two groups in the ability to think critically ($u=224, p<0.2$).

Saarmann, Freitas, Rapps, & Riegel (1992) compared critical thinking skills of senior BSN students, AD graduates, sophomore BSN students, and faculty (each group $n=32$). Differences among the groups in critical thinking ability (CTA) were determined using analysis of covariance

controlling for the influence of age (ANCOVA). The mean CTA of the faculty was 65.41 (± 7.53) compared to 57.91 (± 10.52) for sophomore nursing students out of a possible 80.00 points. Critical thinking ability was highest for faculty, although differences did not reach statistical significance when the influence of age was controlled ($F=1.97, df=1, 123, p=.163$). CTA score of AD nurses and graduating BSN nurses were 61.41 (± 7.97) and 61.78 (± 8.71), respectively.

Critical Thinking and GPA

Several studies on critical thinking have shown critical thinking to have a mild positive correlate with GPA and Scholastic Aptitude Test (SAT) scores. Frederickson (1979) in a longitudinal study ($N=14$) found no relationship between the WGCTA score and the GPA of students in the first nursing course of a baccalaureate program ($t=2.18, p>.05, df=12$). However, there was a relationship at the .05 level between WGCTA scores obtained upon completion of the final nursing course and GPA with students obtaining higher critical thinking scores having higher GPA's than students with low critical thinking scores.

Gross, Takazawa, & Rose (1987) found the cumulative GPA was significantly related to WGCTA scores at both entry to program ($r=.32$) and exit ($r=.35$) in 45 baccalaureate nursing students ($p<.05$). In the same study, with 52 AD nursing

students, the cumulative GPA was not significantly related to WGCTA scores on entry to program ($r=.05$) and exit ($r=-.15$) at the $p<.05$ level. A comparison of mean age of both groups showed no significant difference in age. Gross et al. (1987) concluded that the greater number of years of college experience in the BS group enhanced critical thinking and academic performance and validated the BS degree as the minimum standard for entry into professional practice.

Gunning (1981) found critical thinking ability was significantly related to nursing grade point average ($r=.399$, $p=.001$) in 66 senior baccalaureate nursing students at two different schools. Gunning (1991) concluded the use of the WGCTA to predict academic achievement in a nursing program merits further investigation.

Miller (1992) in a study of 137 registered nurses in a baccalaureate program used the Pearson's product-moment correlation coefficient to analyze findings. She found a significant relationship ($r=.204$, $p<.05$) when correlating GPA for nursing courses with the WGCTA score at graduation. No significant difference ($r=.136$, $p<.05$) was found correlating the general education GPA with the WGCTA. Miller states more research is needed but implies one explanation may be that the nursing curriculum is making a greater contribution to the development of critical thinking skills

than the general education component of the total college curriculum.

Kintgen-Andrews (1988) found correlations between WGCTA and nursing GPA to range from .24 to .65 in a study of practical nursing, AD, and BS students ($N=177$). The correlations between WGCTA and NCLEX scores were of interest: practical nursing students-fall WGCTA: .5494 ($p=.001$), spring WGCTA: .5587 ($p=.011$); AD students-fall WGCTA: .5224 ($p=.011$), spring WGCTA: .5090 ($p=.001$).

Bauwens and Gerhard (1987), in a study of 177 volunteer baccalaureate nursing students, reported a Pearson correlation of .32 between entry WGCTA scores and nursing GPA and a correlation of .24 between exiting WGCTA scores and nursing GPA. Multiple regression analysis demonstrated that 1st semester WGCTA scores and entry GPA's together accounted for 15% of the variance in NCLEX scores ($p=.001$).

Tiessen (1987) conducted a study of 150 baccalaureate students to determine which of eight variables contributed most strongly to students' ability to think critically. Results showed low positive correlations between critical thinking score (using the WGCTA) and SAT quantitative scores (.38), SAT verbal scores (.33), GPA (.32), and number of credit hours in the arts and humanities (.30) All were significant at the $p<.01$ level.

Sullivan (1987) found significant positive correlations ($p < .05$) between critical thinking scores and GPA measured upon entry and exit for 46 registered nurses enrolled in a baccalaureate program. Two thirds of the RN's were diploma graduates and one third were associate degree graduates.

One study of 137 sophomore students in a baccalaureate nursing program contradicted the above findings (Berger, 1984). Berger, who found statistically significant improved WGCTA scores from sophomore to senior year, found no statistically significant relationship between critical thinking ability and GPA in either nursing or science courses ($r = .139$ and $.219$ respectively). However, a significant positive relationship was found between science and nursing grade point averages, indicating those who did well in science also did well in nursing ($r = .357$).

Critical Thinking and Age

Several authors believe that critical thinking correlates with age (Kintgen-Andrews, 1988; Saarmann, Freitas, Rapps, & Riegel, 1992; Tiessen, 1987). Older people are more likely to be critical thinkers because they have had more opportunities to practice critical thinking (Alfaro-LeFevre, 1995). Saarmann et al. (1992) found critical thinking ability appears to be more influenced by age than educational preparation. In this study, faculty were compared with associate prepared RN's, baccalaureate

prepared RN's, and sophomore baccalaureate nursing groups ($n=32$ for each group). Faculty ages ranged from 31-64 years, most ADN nurses were between 31 and 35 years of age. Ages of BSN nurses were distributed bimodally in the 23-26 and 31-35 year groups with most sophomore students in the 18-22 year range. Differences among the groups in critical thinking ability was determined using analysis of covariance controlling for the influence of age. Faculty scored highest on the WGCTA but the difference was not significant when the influence of age was controlled. These results indicate age or years of practice may influence critical thinking ability more than educational preparation. Saarmann et al. (1992) concluded the wide range of ages in all groups and the differences in length of nursing experience suggests exposure to a variety of influential life experiences which may have been a factor in the results.

Tiessen (1987) in a study of 150 baccalaureate students found that age and critical thinking also demonstrated a positive correlation (.16), significant at the $p < .10$ level. Ages of subjects ranged from 18 to 39 years with a mean age of 21.29 years.

Kintgen-Andrews (1988) found that age had a positive correlation with the WGCTA score in all groups studied. The study compared career ladder practical nursing (PN) and AD nursing students with their university counterpart with

regard to the development of critical thinking over one academic year. The sample included 55 PN students, 55 AD students, 38 pre-health science freshman and 29 generic baccalaureate sophomore nursing students. Kintgen-Andrews (1988) found age had a positive correlation with both the WGCTA fall and the WGCTA spring scores for sophomores in this longitudinal study.

One study (Howenstein, Bilodeau, Brogna, & Good, 1996) found a significant negative correlation between age and WGCTA scores ($r[158]=-.25$) in a sample of 152 practicing nurses. Years of experience was also negatively correlated with WGCTA scores ($r[158]=-.24$). These researchers also found that higher level of education was associated with critical thinking so they recommended the older, more experienced nurses should be encouraged to pursue higher education.

Critical Thinking and Gender

Berger (1984) found no significant difference in critical thinking as measured by the WGCTA between male and female BSN students ($N=137$). The mean score for males was 75 compared to 77 for females out of a possible score of 100. The numbers in each sample group were not cited in the reference.

Crites (as cited in Berger, 1984) found no significant difference in the critical thinking abilities of males and

females. Research using WGCTA Forms A and B, and the earlier Forms Ym and Zm, also found no consistent differences based on gender in critical thinking ability (Watson & Glaser, 1994).

Learning Styles

Kolb's (1984) experiential learning theory emphasizes the crucial role experience plays in the process of learning and human development. The theory is founded on the work of John Dewey, Jean Piaget, Carl Jung and Kurt Lewin (Kolb, 1984). The model describes how experience is translated into concepts which are then used to guide the choice of new experiences (Smith & Kolb, 1986). The work place is the learning environment that enhances and supplements formal education and fosters personal development. It is this experiential learning environment that feeds the constantly growing knowledge base of the critically thinking practicing nurse.

Learning is defined as the process whereby knowledge is created through the transformation of experience. Learning styles are not limited to the education world but also apply to the individual's adaptation to life, such as decision-making, problem-solving, and lifestyle in general (Kolb, 1984).

Kolb identified four different learning modes that are part of a four stage cycle of learning from experience: concrete experience (CE) (feeling), reflective observation (RO) (watching), abstract conceptualization (AC) (thinking), and active experimentation (AE) (doing). Kolb's conceptualization of the four stage learning model suggests that learning requires abilities that are polar opposites (Smith & Kolb, 1986). A learner must continually choose which set of learning abilities to use in a specific learning situation.

The two main dimensions of the model correspond to the two major ways by which one learns; the first is how a learner perceives new information or experience (the concrete-abstract dimension), the second is how the learner processes what has been perceived (the active-reflective dimension). Different learners favor different dimensions. Truly effective learners are able to rely flexibly on each of the four dimensions in whatever combinations a situation requires (Smith & Kolb, 1986).

In concrete experience (CE), learners rely more on feelings than on a systematic approach to problems and situations. In the reflective observation (RO) stage, people learn by watching and listening to understand situations from different perspectives. In the abstract conceptualization (AC) stage, learning involves using logic

and ideas rather than feelings to understand problems or situations. Learning in the active experimentation (AE) stage takes an active form and learners value getting things done. While learning, the cycle may repeat several times.

Concrete experience (CE) is the polar opposite of abstract conceptualization (AC) while reflective observation (RO) is the opposite of active experimentation (AE). A learner who relies heavily on concrete experience may find it easy to identify problems that need to be solved. However, that learner may need to increase his/her ability to evaluate possible solutions as in abstract conceptualization. Another learner may find his/her strong point is carrying out or implementing solutions as in active experimentation. This learner may need to work carefully on selecting the problem as in reflective observation.

Kolb found that people fell into four basic groups that corresponded to the combinations of the four types of abilities and named these styles converger, diverger, assimilator, and accommodator. The convergent style relies primarily on the dominant learning abilities of abstract conceptualization (AC) and active experimentation (AE). The greatest strength of this approach lies in problem solving, decision making, and the practical applications of ideas. Knowledge is organized through hypothetical-deductive reasoning and can be focused on specific problems.

Convergent learners are controlled in their expression of emotion. They prefer technical tasks and problems rather than social and interpersonal issues (Kolb, 1984).

The divergent style learner has the opposite strengths from convergence, emphasizing concrete experience (CE) and reflective observation (RO). The greatest strength of this style lies in imaginative ability and awareness of meaning and values. The primary adaptive ability of divergence is to view concrete situations from many perspectives and to organize many relationships into a meaningful "gestalt." Divergers are interested in people and tend to be imaginative and feeling-oriented (Kolb, 1984).

With assimilation style, the dominant learning abilities are abstract conceptualization (AC) and reflective observation (RO). The greatest strength of this orientation lies in inductive reasoning and the ability to create theoretical models, in assimilating disparate observations into an integrated explanation. As with convergence, this orientation is less focused on people and more concerned with ideas and abstract concepts. Ideas, however, are judged less in this orientation by their practical value (Kolb, 1984).

The accommodative style has the opposite strengths from assimilation, emphasizing concrete experience (CE) and active experimentation (AE). The greatest strength of this

orientation is in doing things, in carrying out plans and tasks and in getting involved in new experiences. In situations where the theory or plans do not fit the facts, those with an accommodative style will most likely discard the plan or theory. With the opposite learning style, assimilation, one would be more likely to disregard or reexamine the facts. People with an accommodative orientation tend to solve problems in an intuitive trial-and-error manner relying heavily on other people for information rather than on their own analytic ability (Kolb, 1984).

Learning Style Research

Learning style theory has been the object of research for over two decades. Nurse educators have investigated learning styles as an important variable in the education of nursing students using Kolb's (1976) theory of experiential learning from a number of different perspectives.

Most studies have found that student nurses tend to be accommodators or divergers (Brudenell & Carpenter, 1990; Christensen, Lee, & Bugg, 1979; Hodges, 1988; King, 1986; Laschinger, 1986; Laschinger & Boss, 1984; Lassan, 1984; & Merritt, 1983). These two learning styles use concrete experience and differ only in the use of active experimentation versus reflective observation. These studies support Kolb's suggestion that particular fields or

professions tend to attract certain types of learners (Wolfe & Kolb, 1979).

In a study of 49 RN's and 30 generic students enrolled in a baccalaureate program, King (1986) found that 75% of both groups were categorized as either accommodators or divergent learners. The study was conducted during the first semester of the senior year. Fifty-five percent ($n=27$) of the RN group were divergers and 37% ($n=11$) of the generic group were divergers. Fifty percent ($n=15$) of the generic group were accommodators where as 24% ($n=12$) of the RN group were accommodators. The mean age of the generic group was 21.33 and the mean age of the RN group was 33.91.

Brudenell & Carpenter (1990), in a convenience sample of 40 registered nurses enrolled in their junior year of a baccalaureate nursing program, found all four learning styles represented (accommodators 24%, assimilators 22%, convergers 19%, and divergers 35%). This study examined the relationship between learning style and attitudes toward computer assisted instruction.

Carpenter (1989), using a stratified random sample of 53 students enrolled in three different nursing programs, found 60% of the subjects changed their learning styles over the twelve week study period. Thirty-nine percent of this sample were between the ages of 36 and 45. The year in

school during which the study was conducted was not indicated.

Mentkowski and Strait's (1983) longitudinal study compared 200 entering and graduating baccalaureate nursing students from a cross section of freshman to senior students and found an increase in orientation toward active experimentation learning style. Kolb's learning style inventory (LSI) was used to examine learning styles of incoming nursing students ($n=166$) compared to learning styles of more advanced nursing students (those two years into the program and those near graduation) ($n=102$). A majority of students had concrete learning styles. Fifty-nine percent of the first year group were either accommodators or divergers. There was a statistically significant greater proportion of students with concrete learning styles than students with abstract style ($p < 0.05$). The more advanced students were found to have a significantly greater incidence of concrete learning styles than first year students ($p < 0.02$). The authors suggest an increased concreteness with exposure to nursing education as consistent with Kolb's theory that learning style is accentuated with increased exposure to the discipline.

Four other studies had different results. Haislett, Hughes, Atkinson, and Williams (1993) in a convenience sample ($N=100$) of first semester baccalaureate nursing

students found most (75%) were assimilators (AC & RO) and divergers (CE & RO) making reflective observation the most common mode of learning. The average age of this sample of student nurses was 19.10 years. In this study, the more active learning styles (the accommodators and convergers) were combined and the more reflective learning styles (the assimilators and divergers) were combined. A two-tailed t -test indicated that the more reflective learning styles ($M=2.65$) earned a significantly better grade point ratio (GPR) than the active learning styles ($M=2.19$) ($t=-2.94$, $p=0.004$). Also, the concrete styles (accommodators and divergers) were compared to the abstract styles (the assimilators and convergers). The two-tailed t -test indicated that students with abstract preferences ($M=2.69$) earned significantly better GPR's than the students with more concrete preferences ($M=2.39$), ($t=2.13$, $p=0.04$).

Haislett, et al. (1993) concluded that the accommodators were the most at risk learning style group in the first year of the nursing curriculum. They suggest nursing faculty should offer seminars to enhance abstract conceptualization and reflective observation skills for the accommodators especially during the first year of the program. They further suggest that faculty need to help students develop skills in all four learning styles to

become the flexible learners who will be able to handle the increasing demands of the nursing profession.

Hodges (1988) found no significant differences in learning styles of 62 student nurses, 10 nurse teachers, and 15 ward sisters. The data was arranged in a contingency table that included more than two rows or columns. The data were analyzed using the alpha squared test: $r \times k$ case. Using this test, preference for learning style did not vary significantly between these groups. There were 40 divergers, 23 accommodators, 14 assimilators, and 10 convergers.

Another study (Highfield, 1988) found 56% of the sample of nursing students were assimilators (AC & RO) and 12% were convergers (AC & AE). However, 48% of this sample were non-traditional students with a mean age of 28 years.

Highfield's (1988) results were supported by Joyce-Nagata (1996) in her study of traditional baccalaureate nursing students ($n=229$), registered nurse baccalaureate students ($n=42$), baccalaureate nursing students holding a previous non-nursing degree ($n=60$), and nursing educators ($n=19$). One hundred forty-seven (41.64%) were assimilators and 84 (23.8%) were accommodators. Convergers and divergers were equally split with 61 in each group or 17.28%. Assimilators were the predominant learning style in each group. There were no statistically significant differences in preferred learning styles among traditional, registered

nurse, and non-nursing degree students. Differences for nurse educators were not determined due to the small sample size.

Ages of the traditional students ranged from 18-24. The registered nurse baccalaureate students were over 24 years of age with no mean age or range cited in the research. Age was not indicated for the non-nursing degree students. Joyce-Nagata concluded that the majority of the nursing students were abstract learners and tended to be reflective observers more often than active experimenters. She suggests that nurse educators need to develop teaching methodologies to encourage students to develop skills in active experimentation.

Kolb (1984) theorized that students learn best when teaching methodologies match students' preferred learning styles. This was not substantiated in the above study by Joyce-Nagata (1996). She examined whether there was a difference in academic performance of nursing students with faculty/student learning style congruency as measured by Kolb's Learning Style Inventory. One hundred five (31.4%) of the faculty/student pairs were not matched in learning styles. This group achieved a grade mean of 89.99. Eighty-nine (26%) of the participants had preferred learning styles matched on both abstract-concrete and active-reflective dimensions and achieved a grade mean of 90.98. Seventy nine

(23.7%) had learning styles matched on only the abstract-concrete dimension and achieved a 91.09 grade mean.

When matched on only the active-reflective dimension, 61 students (18.3 %) achieved a grade mean of 90.71. There was no significant difference at the .05 level in these groups. Joyce-Nagata (1996) suggests that these results may have been influenced by the fact that these students had already completed 2 years of core curriculum, were at an advanced level, and may have developed a homogeneous disciplinary culture. She recommends further investigation of the relationship of learning style to teaching style.

Goldrick, Gruendemann, & Larson (1993) in a large, multicenter, random sample of 303 registered nurses found that the majority of nurses practicing in speciality settings (64%) had an abstract learning style and were either assimilators or convergers. The largest proportion of these (36%) were assimilators. These researchers speculate that either nurses become more abstract in their learning style as they develop or that nurses who practice in critical care, operating rooms, and infection control may be more abstract in learning styles because of the problem-solving required in these specialities. These researchers encourage educators to assess learning styles to build upon strengths and to facilitate developing skills in weaker learning style areas.

Many unanswered questions remain. The results are mixed about what is the predominant learning style of student nurses when they enter nursing school, when they graduate, and after several years in practice. Further longitudinal studies are needed to track the evolution of learning styles from beginning nursing students to practicing clinicians. This type of research has implications for nurse educators in nursing schools and clinical practice settings.

Critical Thinking and Learning Styles

Little information has been collected on the relationships between critical thinking and learning styles. Only five studies were found in a review of the literature that examined learning styles, critical thinking, and related concepts such as decision-making and clinical problem-solving in the same study (Glavin-Spiehs, 1991, Gunning, 1981, Herbster, Abel, Hargrove, & Weems, 1987; Kissinger & Munjas, 1981; and Underwood, 1987). No studies were found in a review of the literature that examined the relationships of critical thinking as measured by the Watson-Glaser Critical Thinking Appraisal and learning styles as measured by Kolb's (1984) Learning Style Inventory.

Three of the above studies examined learning styles using a tool to measure the cognitive style of field

independence or field dependence as described by Witkin, Moore, Goodenough, & Cox (1977) and variables such as critical thinking, problem solving, and clinical judgment. Field independence represents a type of learning style. Field independent people process data in a nonpersonal, linear, and analytic fashion (Witkin, Moore, Goodenough, & Cox, 1977). People who are field dependent view situations globally, rely upon ongoing external cues, feedback and prefer interpersonal, socially-oriented situations.

Gunning (1981) in a study of 66 senior baccalaureate students found a relationship between critical thinking ability using the WGCTA and field independence of students ($r=.3726$, $p=.002$). There was also a statistically significant, though not particularly strong relationship, between field independence and clinical problem-solving ability ($r=.2793$, $p=.023$) as measured by the Nursing Performance Simulation Instrument. There was no significant relationship between critical thinking ability and problem-solving ability ($r=.1954$, $p=.119$). This study provided evidence that a student's cognitive style may be related to how he/she performs in the practice of nursing.

Glavin-Spiehs (1991) examined the relationship of field dependence/independence and two measures of clinical judgment in 82 senior baccalaureate nursing students from four universities. She found no significant differences

between the cognitive styles of field dependence and field independence and two measures of clinical judgment. Tools used to measure clinical judgment were The Nursing Performance Simulation Instrument and an interactive videodisc simulation.

Kissinger and Munjas (1981) conducted an investigation of 201 baccalaureate students to determine the relationship between cognitive style and paper-and-pencil simulated clinical problems. A statistically significant relationship ($r=.20$, $p=.01$) was determined between field independence and test scores. Considering the reliance on external cues used by field dependent persons, paper-and-pencil evaluation measures may not possess the cues necessary for the field dependent subjects to demonstrate their abilities.

Sweeney (1988) described the increase of older students in university classes and the need for instructors to be cognizant of various learning styles and critical thinking abilities of older students. However, only one study could be found in the literature that examined critical thinking and learning styles (Herbster, Abel, Hargrove, & Weems (1987). Herbster et al. (1987) conducted a study involving 66 student teachers, utilizing Gregorc's Learning Style Delineator (1979) and a critical thinking instrument they developed that identified three categories of critical thinkers: risk takers, assumption analyzers, and those who

are openness oriented. Gregorc identified four learning styles similar to Kolb's (1976) four learning styles. Gregorc's four styles are concrete sequential, concrete random, abstract sequential, and abstract random. The majority of student teachers in the study were concrete sequential (CS) learners and utilized assumption analysis (AA) as their predominant critical thinking preference. The majority of abstract random (AR) learners utilized risk taking (RT) as their predominant critical thinking preference. Concrete random (CR) people used all three critical thinking processes. The relationship between critical thinking and learning styles was not significant at the .05 level.

Underwood (1987) examined the relationship between measures of nursing process and learning style using the RN Evaluation Instrument and the Kolb LSI (1985) with 130 nursing students. Canonical variate analysis revealed a significant relationship between the "diagnosis" factor from the nursing process variable set measure and the reflective observation factor from the learning style variable set. Further explorations of the data indicated that overlap between the two sets of variables suggest a relationship between the "nursing diagnosis" nursing process measure and the "reflective observation" information processing learning style measure. There was a significant degree of conceptual

