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.
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

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APPROVAL

of a thesis submitted by

Patricia Wamsley Wilson

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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Signature  Patricia Wilson
Date  4/17/97
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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, & Riegal, 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(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 (M=61.3) and RN baccalaureate (M=61.1) programs scored higher on the WGCTA than AD (M=50.0) and diploma (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 \((r=.139 \text{ and } .219 \text{ respectively})\). 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, & Riegal, 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.

Brudènell & 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 x 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 nontraditional 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 videotdisc 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
overlap between the theoretical dimensions of information processing learning style and the nursing process model of decision making. The researcher suggests that when learners are involved in the acquisition of a body of knowledge and the transfer of the same to a new clinical nursing situation, the most critical component is that of reflective observation.

The difficulty in looking at the relationship between critical thinking and learning styles is compounded by the many tools available to measure both of these concepts. The complexity of both constructs is apparent.

**Summary**

Critical thinking is not a construct that can be easily defined. There is no standard definition of critical thinking because it is a complicated and intricate process (Maynard, 1996; Perciful & Nester, 1996; Pless & Clayton, 1993; Rane-Szostak & Robertson, 1996). It is unclear whether critical thinking develops with formal education or work experiences or both.

Research does not provide strong support for the concept that nursing education impacts favorably on generic critical thinking ability (Hickman, 1993; Kintgen-Andrews, 1991). Lack of valid instrumentation may be one reason why nurse researchers have found inconsistent correlation of
critical thinking, decision-making, and clinical judgment (Hickman, 1993; Pless & Clayton, 1993). There is agreement that critical thinking is a complex construct and that research efforts need to be directed at developing an appropriate instrument to measure the critical thinking that occurs in nursing practice (Hickman, 1993; Kintgen-Andrews, 1991). There appears to be evidence that critical thinking ability is related to advancing age (Kintgen-Andrews, 1988; Saarmann, Freitas, Rapps, & Riegal, 1992; Tiessen, 1987). It remains unclear how experience impacts the development of critical thinking. These limitations should not discourage nurses as the evidence of the importance of critical thinking remains strong as the 21st century approaches.

Learning style may be related to critical thinking. Two of Kolb's four abilities, that of reflective observation and abstract conceptualization appear the most congruent with the cognitive skills identified in critical thinking. Students who score high on the reflective observation (RO) and abstract conceptualization (AC) scales of Kolb's learning style inventory, the assimilators, may score higher on the WGCTA.

Kolb believes that skill can be developed in non-dominant phases. In fact, Kolb (1976) believes for the learner to be effective, the learner needs strengths in all abilities. For example, the learner must be able to get
fully and openly involved (concrete experience) to reflect upon and interpret new experiences from many perspectives without bias (RO); to create concepts that integrate his observations into logical sound theories (AC); and to use these theories to make decisions and solve problems (AE) (Kolb, 1976). If students' learning styles were assessed in relation to critical thinking ability, learning activities that further reinforce strengths or that develop weaker phases could be planned to maximize students critical thinking and problem-solving abilities (Case, 1994; Miller & Malcolm, 1990). Hence, the purpose of this study to explore the relationships between learning styles and critical thinking.
CHAPTER 3

METHODS

Population and Sample

The target population for this study was senior baccalaureate student nurses who were enrolled in a northwestern university. The sampling unit consisted of senior baccalaureate student nurses enrolled in the school of nursing. A nonprobability convenience sample of these seniors was used. It is acknowledged that this method of sampling does limit the generalizability of the findings. Inclusion criteria was senior baccalaureate student nurses. Exclusion criteria was senior baccalaureate student nurses who were currently registered nurses completing a baccalaureate degree.

Design

A nonexperimental, exploratory correlational design was utilized to examine the relationship between critical thinking and learning styles. Other independent variables of age, gender, and self-reported GPA was examined in relationship to the dependent variable of critical thinking. Critical thinking ability was measured by the WGCTA-Form S
(1994) and learning style was measured by Kolb's Learning Style Inventory -LSI (1985). The exploratory correlational design was appropriate since few research studies have examined the relationship between these concepts. Woods and Catanzaro (1988) state the correlational design emphasizes explorations of relationships of multiple variables measured at a single time point in a sample from a designated population.

Data Collection

The tools were administered to senior baccalaureate student nurses before graduation. Each student was asked to read and sign a letter of consent to participate (see Appendix A). All testing was conducted by the researcher. Those students who signed the letter of consent to participate were given an envelope that contained all testing materials coded with a subject number. Students were instructed not to put their names on the test and to complete the Background Data Tool. Data on demographic variables of age, gender, and self-reported GPA was obtained from the Background Data Tool (see Appendix B).

Students were next given instructions for completing the Learning Style Inventory (LSI) (1985). Permission to use the LSI in this research was obtained (see Appendix C). The directions from the test manual (Kolb, 1985) were read as
suggested in the instructions for use. The Watson-Glaser Critical Thinking Appraisal (WGCTA) (Form S) was given next. Permission to use the WGCTA was obtained as long as a copy of the instrument itself was not included in this thesis (see Appendix D). Directions printed in the test manual (Watson & Glaser, 1994) were read to the subjects. No time limit was imposed on data collection.

This study was conducted following approval from the College of Nursing Human Subjects Review Committee. Data entry and computer analysis was completed by the researcher.

**Instrumentation**

**Kolb’s Learning Style Inventory**

The Kolb Learning Style Inventory has been the most widely used instrument for examining learning styles (Kruzich, Friesen, & Van Soest, 1986). Despite its wide use, the Kolb Learning Style Inventory has been criticized (DeCoux, 1990; Stumpf and Freedman, 1981). Stumpf and Freedman (1981) felt more empirical evidence is needed to support the instrument’s construct validity and internal reliability. Some of this criticism has been corrected by the LSI-1985.

LSI-1985 is a self-assessment instrument that yields six scores: four basic scores and two combination scores. The scores represent the individual’s emphasis on each stage
of the learning cycle. Two combination scores indicate the extent to which an individual emphasizes abstractness over concreteness (AC-CE) and emphasizes action over reflection (AE-RO). The combination scores are plotted on a matrix composed of abstract-concrete and active-reflective dimensions. The intersection of these lines on the grid indicates the preference for the learning style of converger, diverger, assimilator, and accommodator.

The Learning Style Inventory (LSI-1985) is a 12-item questionnaire which takes about five to ten minutes to complete. A phrase such as "When I learn..." or "I learn best from..." begin each item and the respondents have four choices describing how they learn. Each choice represents one of the learning modes. A likert scale from 1 to 4 is used by the respondent to rank the choices. For example, to complete the phrase When I learn..., the choices include: I get involved (CE); I like to observe (RO), I evaluate things (AC) and I like to be active (AE) (Kolb, 1985).

The LSI-1985 is the revised version intended to satisfy concerns about reliability and validity. Smith and Kolb (1986) report internal consistency coefficients (Cronbach’s alpha) ranging from .73 to .88 (M=.81); specifically .82 (CE); .73 (RO); .83 (AC); .78 (AE); .88 (AC-CE); and .81 (AE-RO). Three studies reported alpha coefficients that were all in the mid-.80’s on each dimension (Sims, Veres, Watson,
& Backner, 1986; Veres, Sims, & Shake, 1987; Sims, Veres, & Shake, 1989).

Split half reliability measures between six items from the original Learning Style Inventory and 6 items from the LSI-1985 ranged from .71-.85 (N=268). Correlation between the original Learning Style Inventory total and LSI-1985 total ranged from .87-.93 (Smith & Kolb, 1986).

Validity for the original Learning Style Inventory has been established through correlations with the Myers-Brigg Type Indicator (MBTI) (Kolb, 1976). DeCoux (1990) concluded following a review of the literature that there is little support for the validity of Kolb's LSI as there was a lack of significant relationships between learning styles and other variables in nursing students. However, the validity of the LSI has been supported by other researchers. Laschinger and Boss (1989) in a study of 66 post-RN and 121 upper level generic baccalaureate nursing students found support for the construct validity of Kolb's experiential learning theory in nursing populations. Goldrick, Gruendemann, and Larson (1993) also supported the LSI in their random study of 303 practicing nurses as an effective means of identifying nurses' learning styles and teaching/learning preferences. Joyce-Nagata's (1996) study of 334 nursing students and nursing educators also supports the validity of the LSI-1985 for use in nursing.
Watson Glaser Critical Thinking Appraisal

The Watson Glaser Critical Thinking Appraisal (WGCTA) has been used for over 25 years and has undergone research, experimental analysis, and revision. In 1964, The Psychological Corporation published WGCTA Forms Ym and Zm; each contained 100 items and replaced an earlier version of the test, Form Am. In 1980, Forms Ym and Zm were modified to contain 80 items and published as Form A and Form B (Watson & Glaser, 1994). Form S, composed of 16 scenarios and 40 items from the 80-item Form A was published in 1994. Form S was developed to offer a shorter, more quickly administered version of the WGCTA without changing the essential nature of the constructs measured (Watson & Glaser, 1994). Critical thinking ability in this study was measured by the Watson-Glaser Critical Thinking Appraisal Test (WGCTA) Form S (1994).

The WGCTA measures the following abilities, identified by Dressel and Mayhew (1954), that appear to be related to the concept of critical thinking: (a) the ability to define a problem, (b) the ability to select pertinent information for the solution to a problem, (c) the ability to recognize stated and unstated assumptions, (d) the ability to formulate and select relevant and promising hypotheses, and (e) the ability to draw valid conclusions and judge the validity of inferences. The WGCTA provides an estimate of an
individual’s abilities in each of these areas by five subtests. A high level of competency in critical thinking may be operationally defined as the ability to perform correctly the domain of tasks represented by the five subtests (Watson & Glaser, 1994).

Watson and Glaser (1980) view critical thinking as a composite of attitudes, knowledge, and skills. The WGCTA was developed with that conceptualization of critical thinking. It is recognized there are limitations in using one tool to measure such a broad concept as critical thinking. However, WGCTA has been used widely used as a research tool in measuring critical thinking in nursing students (Schumacher & Severson, 1996). Thus, it provides the best measure to compare critical thinking to learning styles in a field of research where few studies have examined the relationship between these concepts.

The WGCTA Form S is composed of 16 scenarios and 40 questions that address inference, recognition of assumptions, deduction, interpretation, and evaluation of argument. Raw scores are reported as the number of correct items (0-40).

Internal consistency has been determined by split-half reliability coefficients ranging from .66 to .87 in over twenty groups of adults in various occupations (N ranged from 23-909) (Watson & Glaser, 1994). In the development
sample (N=1,608), Cronbach’s alpha coefficient was .81 for Form S. The internal consistency estimates for the subtest for Form S were moderately low, consistent with prior research on other forms of the WGCTA. For this reason, subtest scores should not be used alone. The standard error of measurement was calculated for a number of groups separately and ranged from 2.05-2.77. Validity coefficients for baccalaureate nursing students given forms A and B (N=45 each group) were .32 and .35 respectively for the criterion of cumulative GPA (Gross, Takazawa, & Rose, 1987).

Test-retest reliability was investigated in a study of 42 publishing company employess (92.9% non-minority; 54.8% female). The participants worked in a variety of positions from secretary to project director and were given Form S two weeks apart. Mean score for first testing was 30.5 and second testing was 31.4 while test-retest correlation was .81 (p<.001).

**Human Subjects and the Consent Process**

The human subject review materials were submitted for approval to the College of Nursing Human Subjects Review Committee. Data collection began after approval was obtained. A letter of consent for participation (see Appendix A) was read by the researcher to the potential subjects explaining the nature of the study, the potential
risks and benefits, and how confidentiality would be maintained. The participants were informed that the study would not directly benefit them but the information provided could assist educators in understanding the relationships between critical thinking abilities and type of learning style. The researcher explained that the results would have no bearing on students' grades, the tools would take approximately 45-60 minutes to complete, and the students could proceed at their own pace. Data collection occurred outside of scheduled class time.

Each study participant had the right to refuse to answer any question. Each questionnaire was assigned a code number. Data was returned with only the code number and no names attached. The results were recorded and coded on a master subject sheet to maintain confidentiality. Data was kept in a locked file cabinet and shared only with the thesis committee members. Participants were told the information from the study would be published as part of the researcher's master's thesis and available in the college of nursing. In addition, the results will be shared with health professionals through publications and professional presentations. Individual participation will remain confidential.

Student participation was voluntary. Those students who choose to participate in the study signed the letter of
consent to participate and received a copy of the letter for their records.

**Statistical Analysis**

The results of an individual's WGCTA (1994) and LSI-1985 were coded by the investigator. A computer statistical software program was used to analyze this data. Frequency distributions for the variables were determined. Descriptive statistics were used to describe the sample range, mean, and standard deviation on scores obtained on the WGCTA for each learning style group.

T-tests are commonly used to assess differences between group means. Specifically the t-test for dependent samples is used to compare two measures obtained from the same individuals (Woods & Catanzaro, 1988). Analysis of variance (ANOVA) is an inferential statistical procedure also used when the researcher wants to test the differences between two or more groups on mean scores (Woods & Catanzaro, 1988). ANOVA was used to compare each of the four learning style groups with mean critical thinking scores. The level of significance that was used for this research was 0.05.

Analysis of variance (ANOVA) was used to analyze the first research question: Is there a difference in critical thinking scores in student nurses with different learning styles? The mean critical thinking score and standard
deviation was calculated for each of the four learning styles as well as for the combination scores (AC-CE) and (AE-RO). ANOVA indicates whether or not a significant difference exists between groups but does not tell which groups differ (Wood & Catanzaro, 1988).

Next accommodators and convergers were combined consolidating the active learning preferences and assimilators and divergers were combined consolidating the more reflective learning preferences. Mean critical thinking scores and standard deviation for the paired groups was then calculated. Two-tailed t-tests were used to determine the differences in critical thinking scores between the paired groups.

Accommodators and divergers were grouped as were the assimilators and convergers. These groupings were to ascertain any possible difference between the concrete and abstract styles in critical thinking.

Analysis of variance (ANOVA) and t-tests were used to answer the second research question: Is there a difference in critical thinking scores in student nurses across the variables of age, gender, and self-reported GPA? For the variable of age, the mean critical thinking score and standard deviation was calculated for each age group: 20-30, 31-40, 41-50, and >50. Analysis of variance (ANOVA) was used
to test for significant differences between the mean critical thinking scores of these groups.

For the variable of gender, the mean critical thinking score and standard deviation for males and females was calculated. A two-tailed t-test was used to determine whether there was a difference in critical thinking scores between males and females.

For the variable of self-reported GPA, the mean critical thinking score and standard deviation was calculated for those with a self-reported GPA of 3.0 and above (a higher GPA) and those with a self-reported GPA of <3.0 (a lower GPA). A two-tailed t-test was used to determine the differences in critical thinking scores between the two groups.
CHAPTER 4

RESULTS

This study was conducted to investigate the differences in critical thinking scores among nursing students with different learning styles. Age, gender, semester in school, and self-reported GPA were also examined in relationship to critical thinking scores.

Data were obtained from 29 senior baccalaureate nursing students. One learning style inventory, completed incorrectly, was eliminated from the data analysis. The statistical software program SPSS was used to analyze the data. Discussion of the statistical analysis is presented in this chapter. A .05 significance level was set for all analyses.

Descriptive Data

The convenience sample consisted of 29 senior nursing students who were currently enrolled in a baccalaureate nursing program at a western university. Registered nurses in the baccalaureate program were excluded from the study. Of those participating, 26 were female (89.7%) and 3 were male (10.3%). Seventeen (58.6%) of the students were in the
20 to 30 age group, 11 (37.9%) were in the 31-40 age group, and 1 (3.4%) student was in the 41-50 age group. Of the 29, 5 (17.2%) reported a grade point average (GPA) of 2.60 to 2.99, and 24 (82.8%) reported a GPA of 3.00 to 4.00. Seventeen of the students (58.6%) were second semester seniors and 12 (41.4%) were first semester seniors.

Learning Style

There were 11 (37.9%) divergers and 8 (27.6%) accommodators. Concrete experience, the learning preference shared by the divergers and accommodators, was the learning strategy characterizing 65.5% of the sample. The remainder of the sample consisted of 5 (17.2%) convergers and 4 (13.8%) assimilators.

Critical Thinking

Descriptive statistics were used to describe the mean and standard deviation on scores obtained on the WGCTA for each learning style (see Table 1). The maximum possible score was 40.00. The mean critical thinking score for the 29 seniors was 29.34 with a standard deviation of 4.53.
Table 1. Critical Thinking Scores.

<table>
<thead>
<tr>
<th>Variables</th>
<th>n</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Learning Styles</td>
<td>29</td>
<td>29.34</td>
<td>4.53</td>
</tr>
<tr>
<td>Diverger</td>
<td>11</td>
<td>27.73</td>
<td>4.88</td>
</tr>
<tr>
<td>Assimilator</td>
<td>4</td>
<td>31.00</td>
<td>2.16</td>
</tr>
<tr>
<td>Accommodator</td>
<td>8</td>
<td>29.75</td>
<td>4.89</td>
</tr>
<tr>
<td>Converger</td>
<td>5</td>
<td>31.00</td>
<td>5.00</td>
</tr>
<tr>
<td>20-30 yrs.</td>
<td>17</td>
<td>27.94</td>
<td>4.48</td>
</tr>
<tr>
<td>31-40 yrs.</td>
<td>11</td>
<td>31.18</td>
<td>4.12</td>
</tr>
<tr>
<td>41-50</td>
<td>1</td>
<td>33.00</td>
<td></td>
</tr>
<tr>
<td>2.60-2.99 GPA</td>
<td>5</td>
<td>28.20</td>
<td>4.76</td>
</tr>
<tr>
<td>3.00-3.58 GPA</td>
<td>15</td>
<td>29.13</td>
<td>5.18</td>
</tr>
<tr>
<td>3.59-4.00 GPA</td>
<td>9</td>
<td>30.33</td>
<td>3.39</td>
</tr>
<tr>
<td>Males</td>
<td>3</td>
<td>29.67</td>
<td>4.53</td>
</tr>
<tr>
<td>Females</td>
<td>26</td>
<td>29.30</td>
<td>4.76</td>
</tr>
</tbody>
</table>

Findings

Following the demographic analysis, the research questions were answered using statistical methods.
**Question One:** Is there a difference in critical thinking scores in senior baccalaureate student nurses with different learning styles?

Analysis of variance (ANOVA) was used to answer the first research question. No significant differences in critical thinking scores were found among nurses with different learning styles, \( p = .48 \), (see Table 2).

<table>
<thead>
<tr>
<th>Variance Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>3</td>
<td>54.75</td>
<td>18.25</td>
<td>.84</td>
<td>.48</td>
</tr>
<tr>
<td>Within Groups</td>
<td>24</td>
<td>519.68</td>
<td>21.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>574.43</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The accommodators and convergers were combined in a group consolidating the active learning preferences. The means and standard deviations were calculated for this group and compared to a group containing the assimilators and divergers (the more reflective learning preferences). A two-tailed t-test was used to determine the differences in critical thinking scores between the groups. No statistically significant difference was found, \( t(26) = -.93 \), \( p = .78 \) (see Table 3).
Table 3. Differences Between Active and Reflective Learning Styles

<table>
<thead>
<tr>
<th>Learning Styles</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accommodators &amp; Convergers</td>
<td>15</td>
<td>28.60</td>
<td>4.50</td>
<td>-.93</td>
</tr>
<tr>
<td>(Active Styles)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assimilators &amp; Divergers</td>
<td>13</td>
<td>30.23</td>
<td>4.76</td>
<td></td>
</tr>
<tr>
<td>(Reflective Styles)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

p = .78, df = 26.

In a similar fashion, a two-tailed t-test was used to ascertain any difference between concrete and abstract styles in critical thinking scores. No significant difference was found, t(26) = -1.31, p = .38 (see Table 4).

Table 4. Differences Between Concrete and Abstract Learning Styles

<table>
<thead>
<tr>
<th>Learning Styles</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accommodators &amp; Divergers</td>
<td>19</td>
<td>28.58</td>
<td>4.86</td>
<td>-1.31</td>
</tr>
<tr>
<td>(Concrete Styles)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assimilators &amp; Convergers</td>
<td>9</td>
<td>31.00</td>
<td>3.78</td>
<td></td>
</tr>
<tr>
<td>(Abstract Styles)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

p = .38, df = 26.
Question Two: Is there a difference in critical thinking scores in senior baccalaureate student nurses across the variables of age, gender, and self-reported GPA? Analysis of variance (ANOVA) and t-tests were used to answer this question. For the variable of age, no statistically significant difference was found in critical thinking scores, $F(2, 26) = 2.22, p = .13$, (see Table 5).

Table 5. Critical Thinking and Age

<table>
<thead>
<tr>
<th>Variance Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>2</td>
<td>83.97</td>
<td>41.99</td>
<td>2.22</td>
<td>.13</td>
</tr>
<tr>
<td>Within Groups</td>
<td>26</td>
<td>490.58</td>
<td>18.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>574.55</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For the variable of gender, a two-tailed t-test showed no significant difference in critical thinking scores between males and females $t(27) = .13, p = .25$ (see Table 6).
Table 6. Differences Between Males and Females

<table>
<thead>
<tr>
<th>Gender</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>3</td>
<td>29.67</td>
<td>2.08</td>
<td>.13</td>
</tr>
<tr>
<td>Females</td>
<td>26</td>
<td>29.30</td>
<td>4.75</td>
<td></td>
</tr>
</tbody>
</table>

For the variable of semester in school, a two-tailed t-test showed no significant differences in critical thinking scores between first and second semester seniors $t(27) = -.50, p = .74$ (see Table 7).

Table 7. Critical Thinking and Semester in School

<table>
<thead>
<tr>
<th>Semester</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Semester</td>
<td>12</td>
<td>28.83</td>
<td>4.09</td>
<td>-.50</td>
</tr>
<tr>
<td>Second Semester</td>
<td>17</td>
<td>29.71</td>
<td>4.91</td>
<td></td>
</tr>
</tbody>
</table>

$p = .74, df = 27$.

The final variable analyzed for differences in critical thinking scores was self-reported GPA. Again, no
A statistically significant difference was found using a two-tailed t-test (see Table 8).

**Table 8. Differences Between GPA and Critical Thinking Scores**

<table>
<thead>
<tr>
<th>Critical Thinking Scores</th>
<th>GPA</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.60-2.99 GPA</td>
<td>5</td>
<td>28.40</td>
<td>4.67</td>
<td>-.51</td>
<td></td>
</tr>
<tr>
<td>3.00-4.00 GPA</td>
<td>24</td>
<td>29.54</td>
<td>4.57</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( p = .84, \text{ df } = 27 \)
CHAPTER 5

DISCUSSION

This study was designed to examine the relationship between learning styles as measured by Kolb’s Learning Style Inventory (LSI) and critical thinking skills as measured by the Watson-Glaser Critical Thinking Appraisal, Form S (1994). Critical thinking scores were also examined in relationship to the variables of age, gender, and self-reported GPA. The discussion in this chapter will refer sequentially to the research questions.

Research Questions

Question One

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

Nursing education values the idea of critical thinking as a necessary outcome of the educational process and as a characteristic that distinguishes a professional nurse (Kataoka-Yahiro & Saylor, 1994). Learning style, defined as an individual’s way of perceiving and processing
information, may be related to critical thinking ability as measured by the WGCTA.

There were no statistically significant differences in critical thinking scores among the four different learning styles (diverger, converger, accommodator, and assimilator) identified by Kolb (1984). The small sample size of each style may have been a factor contributing to the lack of statistical significance. There were four assimilators, five convergers, eight accommodators, and eleven divergers in this sample. One participant did not complete the learning style inventory correctly.

To further explore the possible relationship between critical thinking and learning styles, accommodators and convergers (n=15) were combined consolidating the more active learning preferences and compared to the more reflective learning preferences (assimilators and divergers, n=13). No statistically significant differences in critical thinking scores were found between the more active and more reflective learners.

In a similar fashion, subjects with concrete learning styles (accommodators & divergers, n=19) were compared to subjects with abstract learning styles (assimilators and convergers, n=9). No statistically significant differences in critical thinking scores were found between the concrete and abstract learners.
Descriptive analysis of the sample for this investigation revealed a mean critical thinking score of 29.34 (n=29) with a standard deviation of 4.53 out of a maximum raw score of 40.00. Caution must be used when comparing the mean critical thinking scores of this research with other research utilizing the WGCTA as different versions have different possible maximum scores. For example, WGCTA Forms Ym and Zm each contain 100 items, while the WGCTA Form A and Form B each contain 80 items (Watson & Glaser, 1994). A table of equivalence between Form S and Form A or B is presented in the 1994 WGCTA Manual. Information on the equivalence of Form A or B with Forms Ym and Zm is published in the 1980 edition of the WGCTA Manual. A score of 29 on Form S is equivalent to a score of 57-58 on Form A or B (Watson & Glaser, 1994) and a score of 57-58 on Form A corresponds to a 70-73 on Form Ym (Watson & Glaser, 1980).

The results of this study add information to the research on critical thinking of student nurses in baccalaureate academic settings. The mean score of this sample (M=29.34) is higher in comparison to Behrens (1996) longitudinal study of nursing students in a diploma nursing program (n=17) where the mean critical thinking score was 52.80 on entry and 53.10 on exit using Form A.
The mean score of this sample is also higher than associate degree students’ entry critical thinking scores (M=44.50) and exit critical thinking scores (M=55.00) in Gross, Takazawa, & Rose’s (1987) study using Form A and B. The mean score of this research is comparable to the exit score (M=57.9) of the baccalaureate students in the Gross et al. (1987) study.

Miller (1992) found a mean score of 72.5 using Form Ym which corresponds to a score of 57-58 on Form A and 29 on Form S (Watson & Glaser, 1980, 1994). The mean critical thinking score of this study also matches the entry and exit mean score of 57 in baccalaureate students in a midwestern university (Sullivan, 1987).

The mean critical thinking score in this study (M=29.30) is lower than the mean score of 61.10 in baccalaureate students in the Brooks & Shepherd (1990) study out of a possible score of 80 (Form A or B was not specified). However, the baccalaureate students in the Brooks & Shepherd study were registered nurse graduates from associate and diploma programs in an eastern university and were not part of a larger generic program. One questions if the higher mean score in this study may be influenced by the variables of age and/or work experience.

The mean critical thinking score in this study was also lower than the mean score of 61.00 in associate students and
61.40 in baccalaureate students from a western university in Saarmann, Freitas, Rapps, & Riegel's (1992) study out of a possible score of 80 (Form A or B was not specified). Most of the associate nurses were between the ages of 31-35. Ages of BSN nurses were distributed bimodally in the 23 to 26 and 31 to 35 groups. Saarmann et al. (1992) concluded critical thinking ability appears to be more an influence of age than educational preparation.

Norms provided with the Forms A and B indicate that junior and senior students in four year colleges had a mean score of 59-60, whereas students in junior and community colleges obtained a mean score of 52 (Watson & Glaser, 1980). Specifically, nursing students in baccalaureate programs at universities in the South, West, and Midwest attained mean scores of 56, 56, and 60 respectively. The results of this study using Form S with a mean of 29.30 comparable to a mean of 57-58 on Form A or Form B are slightly lower than the mean of 59-60 in upper division students in four year colleges but are slightly higher than the mean of 56 for baccalaureate nursing programs in the West.

The question still remains as posed by Kintgen-Andrews (1988): Does baccalaureate education develop better critical thinkers than associate or diploma programs or do baccalaureate students score higher on critical thinking
scores due to preselection of students? For example, is the
difference in scores between baccalaureate and associate
degree students attributable to the fact that associate and
diploma nurses may not be the type of students who are
likely to complete a baccalaureate program. The question
warrants further study.

Learning Styles

The majority of the students in this sample were
divergers (38%) and accommodators (28%) accounting for 66%
of the total sample. This supports the growing body of
research that found the majority of nursing students to be
either divergers or accommodators (Brudenell & Carpenter
1990; Christensen, Lee & Bugg, 1979; Hodges, 1988, King,
1986; Laschinger, 1986; Laschinger & Boss, 1984; Lassan,
1984; Mentkowski & Strait, 1983; 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
type of learners (Wolfe & Kolb, 1979). These results also
support a finding of Smith & Kolb (1986) that service
occupations like social work, psychology, and nursing
require an understanding and sensibility to feelings that
are often the strong suit of the diverger.
Other studies refute these findings (Joyce-Nagata, 1996; Goldrick, Gruendemann, & Larson, 1993; Haislett, Hughes, Atkinson, & Williams, 1993; Highfield, 1988). Haislett et al. (1993) found 38% of their sample were assimilators and 36% were divergents. The students assessed in this study were first-semester nursing students who may be more abstract in their learning styles and yet to experience the more applied aspects of the nursing curriculum.

Highfield’s (1988) results found 56% of the sample of nursing students to be assimilators. However, 48% of the sample were non-traditional students with a mean age of 28 years. Goldrick, Gruendemann, & Larson (1993) found 64% of registered nurses practicing in specialty settings had an abstract learning style and were either assimilators or convergers. The largest proportion of these (36%) were assimilators. This leads to further speculation on the influence of age and practice settings on the evolution of learning styles.

Joyce-Nagata (1996) found assimilators to be the predominant learning style in baccalaureate students, RN baccalaureate students, and nurse educators. Assimilators were predominant in all groups. Students in this study had already completed two years of core curriculum before actually beginning nursing courses. It would be interesting
to evaluate the traditional students' learning styles at the end of the nursing program to obtain further information on the relationship of the applied aspects of the nursing curriculum on learning styles.

Question Two

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

Critical Thinking and Age

No statistically significant difference in critical thinking scores was found between the different age groups, (20-30, 31-40, or 41-50). This did not support the work of Kintgen-Andrews (1991), Saarmann, Freitas, Rapps, & Riegal (1992), or Tiessen (1987) who found statistically significant relationships between critical thinking and advancing age. It remains unclear how experience impacts the development of critical thinking. As Saarmann et al. (1992) concluded, the wide range of ages in all groups and the differences in length of nursing experience suggest exposure to a variety of influential life experiences and may have been a factor in the results.

Critical Thinking and Gender

Results from this study support Berger (1984) who demonstrated there was not a statistically significant
difference between males and females in critical thinking scores. Only three males participated in this study so caution must be used when interpreting these results. However, research using Forms A and B, and the earlier Forms Ym and Zm also found no consistent differences based on the gender of the examinee in critical thinking ability as measured by the WGCTA (Watson & Glaser, 1994).

Critical Thinking and GPA

This study failed to find a statistically significant relationship between critical thinking and self-reported GPA. This finding supported the results of Berger (1984) but refuted the work of several other researchers (Bauwens & Gerhard, 1987; Frederickson, 1979; Gross, Takazawa, & Rose, 1987; Gunning, 1981; Kintgen-Andrews, 1988; Miller, 1992; Sullivan, 1987; Tiessen, 1987). Again because of the small sample size in this study (n=4 in GPA<3.0 group and n=24 in the 3.00-4.00 GPA group) caution must be made in interpreting these results.

Study Limitations

Limitations of this study include the use of a non-random sampling procedure, a small sample size, and data collection at only one educational setting. The subjects may not be typical of all baccalaureate nursing students. The sample was limited to baccalaureate nursing students;
therefore, the sample is not representative of students enrolled in other types of nursing programs.

This study obtained responses from senior nursing students only. No assessment of critical thinking scores of freshman students was obtained. Thus, care must be taken in attributing levels of achievement in critical thinking abilities to certain aspects of the nursing curriculum.

The instrumentation selected for measurement places additional limitations on the study even though both instruments have demonstrated reliability and validity. A question remains whether or not the WGCTA is an appropriate tool for measuring critical thinking skills in nurses (Bauwens & Gerhard, 1987; Hickman, 1993) and whether the learning style inventory is an appropriate tool for nursing (DeCoux, 1990). Since more appropriate instruments for nursing have yet to be identified, findings need to be analyzed within the context of these possible limitations.

**Implications**

There are several implications from this study for the areas of nursing research, education, and practice. It is acknowledged that there is an increased emphasis in nursing education on students' critical thinking skills. The teaching point on this may be that more emphasis should be given to the thinking processes students engage in as they
identify problems and implement treatment strategies. There is increasing literature on teaching strategies that foster critical thinking (Baker, 1996; Brigham, 1993; Case, 1994; Callister, 1996; Kyzer, 1996). Further research is needed on teaching techniques which may foster critical thinking ability. One example for educators to consider is the use of computer assisted instruction as a tool to enhance critical thinking ability (Hickman, 1993; Perciful & Nester, 1996; Schank, 1990).

Research on critical thinking should be part of all academic programs on entrance and exit in order to examine the changes in critical thinking ability and to compare norms with other academic institutions in similar geographic areas. There is agreement that critical thinking is a complex construct and that research efforts need to be directed at developing an appropriate instrument to measure the critical thinking that occurs in nursing practice (Hickman, 1993; Kintgen-Andrews, 1991). Further research with new instruments such as the California Critical Thinking Disposition Inventory which was developed to assess the dispositional component of critical thinking are needed (Facione, Facione, & Sanchez, 1994).

Further research is also needed to follow students' critical thinking ability and learning styles and to evaluate changes which may occur in the clinical setting.
Studies are needed to support or refute Maynard's (1996) suggestion that aspects of critical thinking ability and competence may vary in practice settings or that critical thinking ability improves following professional experience (Brooks & Shepherd, 1992; Howenstein, Bilodeau, Brogna, & Good, 1996).

Kolb's (1984) experiential learning theory emphasizes the crucial role experience plays in the process of learning and human development. The workplace is the learning environment that enhances and supplements formal education and fosters development. Kolb believes skill can be developed in non-dominant phases of learning styles. In fact, Kolb (1976) believes for learning to be effective, strengths in all styles are needed. Educators in staff development and other practice setting roles need to be more involved in nursing research on such issues related to the practicing nurse. Research in the practice setting may have more importance in examining the role of critical thinking and learning styles due to the experiential nature of learning style theory.

All educators need to foster critical thinking skills in nurses and develop strategies to enhance learning styles and critical thinking skills as suggested by Case (1994) and Miller and Malcolm (1990). In addition, an organizational culture that values critical thinking is an essential factor
in the development, practice, and maintenance of these skills (Kyzer, 1996).

**Recommendations**

Recommendations for further research include replicating this study with a larger, randomized sample of students from various academic settings and geographic locations. It would also be interesting to examine these variables in student nurses at various levels in an academic program.

A longitudinal study is needed to follow the relationships of these concepts over time as a student enters and exits a nursing program and develops in clinical practice. In addition, the type of clinical practice settings may give insight into the development of critical thinking.

Finally an experimental design may provide further data on the impact of teaching strategies on the development of critical thinking skills. Critical thinking and learning styles could be assessed early in an academic experience followed by separating students into two groups. Learning activities could be planned for one group that maximize critical thinking skills and develop strengths in weaker learning styles to enhance thinking and problem solving abilities while the control group could receive traditional
lecture content. Both groups could then be reassessed at the end of one year to examine the impact of the instructional methods.

Summary

Research on critical thinking and learning styles remains in its infancy with many unanswered questions. If there is a relationship between critical thinking and learning styles, can educators enhance development of non-dominant learning styles and foster critical thinking? There is an important need in nursing education for research on cognitive skill development, teaching methods for critical thinking, and the ways in which instructional methods should be used to promote thinking among learners (Oermann, 1990). The impact of formal education and choice of practice setting on the development of critical thinking must be examined. It is crucial for the profession of nursing that more information on these issues be obtained if nurses are to be the critically thinking, knowledgeable professionals needed to provide the quality care of the future.


Appendix A

Letter of Consent for Participation
Sept. 6, 1996

Dear Student:

You are invited to participate in a study in which I hope to learn about the relationships between critical thinking ability and learning styles. I am a graduate student at Montana State University’s College of Nursing and this study is being conducted to fulfill my graduate thesis requirements. You were selected as a possible participant because you are a senior baccalaureate nursing student. If you are currently a registered nurse, please do not participate in this study.

As a participant in this study, you will be asked to complete three instruments. These instruments include: Kolb’s (1985) Learning Style Inventory, the Watson-Glaser Critical Thinking Appraisal (1994), and a Background Data Tool. These tools will take approximately 45-60 minutes to complete. You may proceed at your own pace. You have the right to refuse to answer any question and to withdraw from the study at any time.

Your participation in this study is voluntary. Participation, or non-participation, will not affect your grades in any way. There are no foreseeable risks to you for participation in this study. Completing these instruments will not benefit you personally, however results may assist nurse educators in understanding the relationship of critical thinking to learning styles.

All individual information obtained in connection with this study will be kept strictly confidential. Each participant will be assigned a code number. Data will be returned with only the code number and no names attached. Data will be kept in a locked file cabinet and only seen by myself and thesis committee members. No participant will be identified by name in any oral or written reports. Group results will be published in the form of a thesis and in nursing journals. Results of this study will be available at Montana State University’s College of Nursing’s Library.

You will be given a copy of this letter to keep. If you have any questions now or later with regard to this study, please feel free to contact me. I hope you will participate in this important study. Thank you in advance for your time and efforts if you choose to participate in this study.

Sincerely,

Patricia Wilson RN, BSN
1155 Swan Hill
Bigfork, MT 59911
(406)837-5186

I have read this letter and agree to participate in this study.

______________________________  ______________________________
Signature  Date
Appendix B

Background Data Tool
Background Data Tool

Code No. ___

Please circle the correct answer.

1. I am currently a:
   A. First semester senior
   B. Second semester senior

2. My age group is:
   A. 20-30
   B. 31-40
   C. 41-50
   D. 51 or greater

4. My gender is:
   A. Male
   B. Female

5. My current grade point average (GPA) is:
   A. <2.60
   B. 2.60-2.99
   C. 3.00-3.59
   D. 3.60-4.00

Thank you for answering these questions.
Appendix C
Permission to Use
Learning Style Inventory 1985
August 12, 1996

Pat Wilson RN, BSN
1155 Swan Hill Drive
Bigfork, MT 59911

Dear Ms. Wilson:

We received your permission letter last week. You may have permission to use the Learning Style Inventory that you purchased in your research. If you need more copies, they are in packages of 25 and can be purchased over the phone at 800-729-8074.

You may include the Learning Style Inventory, the Cycle of Learning and the Learning-Style Type Grid in your final thesis. Please include our copyright notation on every reproduction,

© Experience-Based Learning Systems, Inc.
Reproduced with permission from McBer and Company, Inc., 116 Huntington Avenue, Boston, MA, 02116. 617-437-7080.

If you are going to publish your results in a journal, we would prefer that you not include the actual Learning Style instrument. This includes the 12 item questionnaire and the two graphs. You may include the validity information and the experiential learning model however.

McBer and Company also does not allow the Learning Style Inventory to be put onto microfiche. If this is necessary, please replace the LSI related pages with an information sheet about how we can be contacted for further details.

Thank you for your cooperation. Please call with any questions.

Sincerely,

Tamara Friedman
Coordinator, Business Development & Research

HayGroup
Appendix D

Permission to Use

Watson-Glaser Critical Thinking Appraisal-Form S
October 30, 1995

Ms. Pat Wilson  
1155 Swan Hill  
Bigfork, MT 59911

Dear Ms. Wilson:

Thank you for your letter concerning your use of the *Watson-Glaser Critical Thinking Appraisal* in your thesis research.

As a responsible test publisher, we believe it is our duty to protect the security and integrity of our test instruments. Therefore, we cannot allow copies of the test instruments to be included with or stapled in your thesis. If available, sample items may be included, but actual test items cannot. Also, all testing must be conducted in your presence or that of another qualified individual so that all test materials remain secure.

We will gladly grant permission for the use of these test instruments if the above restrictions will be followed. Please indicate your agreement to these terms by signing and returning this letter for our files. When you sign and return this letter, you may contact Ms. Sarah Sanchez in Customer Service at (800) 228-0752, ext. 5427, to order your materials. If you have already placed an order, it will be released upon receipt of this signed letter. As a student, you are eligible for a 50% discount on the purchase of materials; however, you must request the 50% student discount and pay for the materials yourself in order to receive it.

Also, please forward a copy of your dissertation for our library upon completion.

Thank you for your interest in our test materials. If you have further questions or needs, please contact us.

Sincerely,

Christine Doebbler  
Manager  
Legal Affairs

AGREED:

[Signature]

Pat Wilson