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COMPARING CHANGES IN CONTENT KNOWLEDGE BETWEEN ONLINE PROBLEM BASED LEARNING AND TRADITIONAL INSTRUCTION IN UNDERGRADUATE HEALTH PROFESSIONAL STUDENTS

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DISSERTATION APPROVAL PAGE

This is to certify that the dissertation prepared by Kathleen A. Gould entitled Comparing Changes in Content Knowledge Between Online PBL and Traditional Instruction in Undergraduate Health Professional Students has been approved by the thesis committee as satisfactorily completing the dissertation requirements for the degree Doctor of Education in Instructional Technology.

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ABSTRACT

COMPARING CHANGES IN CONTENT KNOWLEDGE BETWEEN ONLINE PROBLEM BASED LEARNING AND TRADITIONAL INSTRUCTION IN UNDERGRADUATE HEALTH PROFESSIONAL STUDENTS

Kathleen Gould

Problem Based Learning (PBL), a student centered instructional strategy, has been implemented in the education of health care professionals to bridge the gap between theoretical knowledge and practical application. PBL has also been proposed as an instructional method that provides for active and collaborative learning in the online environment. Current research is inconclusive regarding the effect of PBL on content knowledge change and critical thinking skills (Colliver, 2000; Worrell & Profetto-McGrath, 2007). Furthermore self-directed learning readiness (SDLR) and motivation have been identified as attributes that may affect student success in PBL and online learning environments. This study investigated changes in student content knowledge after participation in an online PBL module or traditional instruction in an undergraduate nutrition course. The study also examined the relationships between student SDLR and motivation and content knowledge change. The findings of this study indicated that online PBL was as effective as traditional instruction in promoting content knowledge change. Student attributes of SDLR and motivation did not affect the observed change in content

knowledge. These outcomes demonstrate that online PBL is an effective alternative to traditional instruction in undergraduate health professional students. The majority of these students had high levels of SDLR and motivation indicating that they were prepared for this student centered instructional strategy.

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Chapter I. Introduction

The goal of educating health care professionals is to prepare them for effective participation in a challenging work environment. It is imperative that students in the health professions learn to utilize didactic information to solve authentic problems. Attitudes about appropriate methods to achieve this goal with health care professionals have evolved much like they have in other disciplines over the last century; movement from the apprenticeship model, to a traditional teacher directed behaviorist approach, to a student centered constructivist approach has slowly taken place (Tompkins, 2001). The student centered approach has been shown to increase student motivation for learning, increase applicability to real world situations and promote life-long learning (Hung, Bailey, & Jonassen, 2003; Jonassen, 2000). Problem Based Learning (PBL) has been suggested as one method that utilizes this student centered approach and improves critical thinking and clinical reasoning skills (Rounds & Rappaport, 2008). This instructional method involves the presentation of a clinical problem as a teaching strategy (Ridley, 2007). PBL allows for information to be mastered in the same context in which it will be used (Donner & Bickley, 1993) and therefore is a method of instruction that strives to bridge the gap between theoretical knowledge and practical application.

The increasing interest in student centered learning environments such as PBL has coincided with an expansion in online learning. In fact, PBL has been proposed as an effective online instructional strategy (Fisher, 2009; Phillips, 2005). Phillips (2005) contended that assignments with real world problems provided an effective active learning strategy in the online environment. Fisher (2009) has suggested that PBL, with case-based scenarios, is an effective way to promote collaboration among teams of students learning on line. Furthermore King et al. (2010) found that conducting PBL online was advantageous to increasing discipline specific

skills, team skills and fluency with information technology. Students enjoyed online PBL and responded positively when surveyed regarding their motivation for learning with this student centered instructional method (Nathoo, Goldhoff, & Quattrochi, 2005; Woltering, Herrler, Spitzer, & Spreckelsen, 2009).

While these findings lend support to the benefits of PBL as an online instructional strategy, research regarding learning outcomes as measured by changes in content knowledge in online PBL is lacking. In addition, it has been suggested that both PBL and online learning require students to be motivated and self-directed in order to achieve desired learning outcomes (Boyd, 2004; Levett-Jones, 2005, Schrum & Hung, 2002; Song, Singleton, Hill, & Koh, 2004), however little research on the effect that these student characteristics have on content knowledge after participation in online PBL exists. It is essential to determine the change in content knowledge after participation in online PBL and the influence that student motivation and self-directed learning readiness (SDLR) have on this knowledge change.

The research presented in this document studied undergraduate health professional students at a mid-Atlantic public university. In this study, two different learning environments (traditional lecture and online PBL) were used to teach a unit on diet and disease. The research was designed to determine the change in content knowledge from pre to posttest when students participated in traditional instruction versus an online PBL module. In addition, student motivation and SDLR were determined to ascertain the relationship of these characteristics to student performance in either environment. This document contains five chapters: Introduction, Literature Review, Methodology, Results and Findings, and Discussion. This chapter is composed of the following sections: Background, Statement of the Problem, Purpose of

Research, Significance, Research Design, Research Questions, Researcher's Personal Statement, and Definition of Terms.

Background

PBL has been conducted in medical schools since the early 1970's and more recently has been implemented in nursing education and training of other health care professionals in both face to face and online learning environments. Research has documented numerous strengths and challenges of PBL in both face to face (e.g. Donner & Bickley, 1993; Pastirik, 2006; Siu, Spence Lasschinger, & Vingilis,2005; Tiwari, Lai, So, & Yuen, 2006) and online settings (e.g. Anderson & Treadway,2009; Choi, 2003; Nathoo, et al, 2005; Rounds & Rappaport, 2008; Ryan, Dolling & Barnet, 2004; Schell & Kaufman, 2009; Spinello & Fischbach, 2004; Valaitis, Sword, Jones & Hodges, 2005). However there has been conflicting evidence regarding learning outcomes when PBL is compared to traditional instruction. Research has shown that students felt they experienced benefits from PBL that were not provided in traditional instruction (Choi, 2003; Pastirik, 2006; Siu et al., 2005; Spinello & Fischbach, 2004; Tiwari et al., 2006). However some students may not be adequately prepared or ready for the student centered collaborative learning characteristics of this method (Kirscher, Sweller & Clark, 2006; Levitt-Jones, 2005). Students who are accustomed to traditional instruction, which is often teacher centered or teacher directed, may be deficient in their SDLR and struggle with the transition to this self-directed learning mode (Levett-Jones, 2005). In a study of undergraduate engineering students, Litzinger, Wise, and Lee (2005) found that some students increased in their SDLR after participating in PBL while others decreased in this ability. Litzinger et al. (2005) suggested that perhaps decreases in SDLR after PBL occurred because "when students who are in the early stages of developing self-directed learning abilities are asked to perform as if they were self-directed the

potential for frustration on the part of the student is high" (Litzinger et al.,2005, p. 220). Although changes in SDLR have been measured after participation in an entire PBL course or curriculum there is a lack of research on the effect that SDLR has on the ability to achieve positive learning outcomes with PBL. The findings of Litzinger et al. (2005) suggest that there may be certain attributes related to SDLR that correlate with success in PBL.

Online PBL may provide additional challenges to students since it has been demonstrated that students who are motivated and self-regulated perform better in the online environment (Boyd, 2004; Schrum & Hung, 2002; Song, Singleton, Hill, & Koh, 2004). Researchers in the areas of both PBL and online learning suggested that these methods require the student to be self-directed and motivated to optimize their learning outcomes. Since PBL has been suggested as an effective instructional strategy in the online environment more study is needed to determine whether this method produces desired changes in content knowledge. In addition it is imperative to examine how student SDLR and motivation influence these learning outcomes as measured by changes in content knowledge. If SDLR and motivation are correlated to learning outcomes after participation in PBL then these student characteristics need to be taken into consideration when planning effective instruction.

Statement of the Problem

The shift from the apprenticeship method of teaching to more didactic instruction has often resulted in a disconnect between learning and application to practice. Traditional instruction provides students with expertise in "knowing that", but often falls short in creating an environment where students are competent at "knowing how". PBL has been proposed as an instructional method that allows students to direct their learning, resulting in an increase in critical thinking skills and application to practice. Online PBL may also assist students in

utilizing a variety of resources that can promote and strengthen life-long learning skills. However learning gains, as measured by changes in content knowledge, in online PBL have not been examined. Furthermore it has been suggested that perhaps not all students are prepared for this learning approach. Students who lack SDLR may struggle and become frustrated with the PBL approach and not reap the benefits of this instructional method (Levitt-Jones, 2006; Litzinger et al., 2005). In addition, student motivation for learning is an important attribute for success in PBL and online learning (Boyd, 2004; MacKinnon, 1999; Schrum & Hong, 2002; Song et al., 2004). With the increase in online learning environments directed at educating health care professionals it is important to examine whether PBL can be utilized effectively as an instructional method in this environment. In addition it is important to study if, and how, SDLR and motivation are correlated with the learning that occurs in online PBL in order to design effective learning environments.

Purpose of Research

The purpose of this study was to examine the relationships between changes in content knowledge and students' SDLR and motivation for learning after participation in an online PBL module. This study examined changes in student content knowledge after participation in an online PBL module and traditional instruction. Student SDLR and motivation were measured to determine the correlation of these student characteristics with content knowledge change.

Significance

This research helped to determine if undergraduate health professional students at a large mid-Atlantic university could be successful in changing their content knowledge by participating in either traditional lecture instruction or an online PBL module. The collection of data regarding student SDLR and motivation helped to determine if these student characteristics

impact success in online PBL and traditional learning environments. The results of this study helped to determine whether PBL is an effective strategy in the online environment. In addition the results shed light on the effect of student SDLR and motivation on their ability to gain knowledge in both traditional and online PBL learning environments. The results led to a conclusion about the success rates in these learning environments and the feasibility of offering online PBL as an alternate instructional strategy. Furthermore information obtained about the effects of SDLR and student motivation on learning outcomes determined the characteristics of student populations most likely to succeed in a particular learning environment.

Research Questions

In order to determine changes in content knowledge in the different learning environments as well as the effects of SDLR and motivation on these changes, this research was guided by the following questions:

1. Is there a statistically significant difference in student content knowledge after participation in an online PBL module as compared to traditional instruction?
2. Is the difference in content knowledge that results after participation in an online PBL module correlated with student SDLR?
3. Is the difference in content knowledge that results after participation in an online PBL module correlated with student motivation?

Research Design

This research study used a quasi-experimental design with non-equivalent groups. Quantitative methodologies were utilized with a sample of convenience composed of students from four sections of an introductory nutrition course. These class sections were taught by the

same instructor. The students self-selected into a specific section based on their scheduling needs. The hybrid nature of the course allowed for both face to face and online learning activities in all four sections. In an attempt to isolate the treatment group (online PBL) from the control group (traditional instruction), a sample of convenience consisting of two class sections for the control group and two class sections for the treatment group was utilized. A total of 127 students were enrolled in the four sections; 124 participated in the study.

Data for this research was collected through the use of two instruments including a content knowledge pre and posttest and the Self-directed Learning Readiness Motivation Assessment (SDLRMA). The content knowledge pretest was conducted in each section prior to exposure to the instructional activities used in this research. The content knowledge posttest was conducted after participation in the instruction. SDLR and student motivation scores were determined for each participant by utilizing an adaptation of the Self-Directed Learning Readiness Scale for Nursing Education (SDLRSNE) developed by Fisher, King and Tague (2001). Additional questions from the Motivated Strategies for Learning Questionnaire (MSLQ), that address student motivation, were added to the SDLRSNE instrument (Pintrich, Smith, Garcia, & McKeachie, 1991). This combined instrument, the SDLRMA was administered to students in a pre and posttest fashion, prior and subsequent to participation in the instructional activities.

Students that chose to participate in this study also provided additional demographic data (age, gender, major, computer experience, and reason for taking the course) as part of the SDLRMA instrument. After instruction, students provided information about their study habits including the resources used, additional sources of information, time spent outside of class and external experiences that may have affected content knowledge.

Institutional Review Board approval was granted by Towson University's Institutional Review Board (IRB) for Research Involving the Use of Human Participants under Exemption Number 12-A052 on March 8, 2012. A copy of the IRB approval can be found in Appendix A.

Limitations and Assumptions

As with all studies, there are always issues that need to be addressed regarding limitations and assumptions. This research was conducted with attempts to control as many factors as possible. For this study, the participants used the same syllabus, textbook, assignments, activities, lessons and tests throughout the semester. The only variable was the learning environment. The limitation and assumptions for this study were as follows:

- It is possible that outside sources and issues in the media surrounding diet and disease may have affected students' content knowledge. It is beyond the control of this research to keep participants from exposure to these influences. Data regarding outside influences was gathered and considered as part of the analysis. Details are presented in Chapter 4.
- The selection of participants may be a limitation of this study. Since this was a quasi-experimental design and subjects were not randomly assigned to either treatment or control group it was assumed that similar students would be distributed among the four sections of the course.
- Generalizability may be a limitation of this study. The characteristics of this group of students may be different from other undergraduate pre-nursing/health professions students. The sample size also limits the ability to apply the study's findings to a broader population because the study population may lack the variety found in other groups.

- The design of the PBL module may also be a limitation. Strategies were implemented to address the validity and design of the module. These strategies are presented more specifically in Chapter 3.
- The online PBL module was available to the PBL participants for a four week period. This time period may affect the influence that the PBL instructional strategy has on content knowledge change.
- Finally, as with all studies where the researcher is directly involved with the participants, existing researcher biases have the potential to affect outcomes. To address this potential, a statement of the participant as researcher is presented in the following section.

Researcher's Personal Statement

The researcher for this study also served as the instructor for all four course sections. Therefore, the implementation of the instructional unit and the results of the study are subject to my beliefs, biases, perceptions and experiences. The following statement is provided to assist the reader in having a clear understanding of my background and philosophy about teaching and learning.

I have been a Registered Dietitian for thirty-two years and in this capacity have taught nutrition and disease to patients and students in multiple settings. I genuinely love nutrition as a topic but realize that not all of my students may share the same level of interest for the subject matter or the course. However I feel that it is my mission to motivate students to increase their enthusiasm for the subject because of both the personal and professional benefits they could derive from an increased understanding of the relationship between diet, health and disease.

For the last seven years, I have been the sole instructor for HLTH 331, Nutrition for Health Professionals; a required course in the pre-nursing curriculum. I have observed that students are often able to learn didactic information but are then unable to use this information in problem solving. For example they may be able to recite the guidelines of a heart healthy diet but not be able to plan a heart healthy meal. I believe that this situation occurs because students are unable to see the relevance of their learning when it is achieved through traditional instruction. Perhaps they view the knowledge as required information that needs to be memorized but are unable to see how they might apply it in their personal and/or professional life.

I believe that students need to be actively engaged in realistic scenarios to receive the most benefit from the learning environment. Therefore, I developed the Diet and Disease Problem Based Learning Module (DDPBLM) based on constructivist instructional strategies that provide for a student centered environment in which the learners experience realistic situations they might encounter in clinical practice. I believe that this module will allow students to use didactic information in a scenario that is relevant to their intended role as a health care professional.

As the course instructor, I was involved in the implementation and design of both the traditional and DDPBLM instruction. This involvement along with my perceptions about the benefits and drawbacks of each learning environment may have influenced the outcomes of the study.

Summary

PBL has been utilized as an instructional method in medical schools since the 1970's and has more recently gained acceptance in the education of nurses and other health care professionals. Studies have shown that students enjoy PBL and are better able to apply didactic information to actual practice after participation in PBL. With the growth of online instruction, PBL has been suggested as an effective instructional strategy to engage students and encourage collaboration. However research is lacking to determine whether online PBL effectively increases content knowledge among student participants. In addition, evidence exists that students need to have self-directed learning abilities and be motivated to function in PBL and in the online environment.

This research built upon what is currently known regarding SDLR, student motivation and student outcomes in online PBL. These outcomes were measured by comparing changes in content knowledge with student SDLR and motivation scores.

The findings of this study helped provide an understanding of the relationship between SDLR and motivation to learning outcomes in online PBL. This understanding will further assist instructors in better preparing students for successful outcomes in online PBL.

Definition of Terms

Control of Learning Beliefs-The belief that outcomes are contingent on one's own efforts as opposed to the efforts of the instructor.

Extrinsic Motivation or Goal Orientation-The degree to which the student perceives to be participating in a task for reasons such as grades, rewards, performance, evaluation by others, and competition.

Face to face learning-Instruction that takes place physically in one place. In this case the learning takes place in the class room setting at Towson University.

Hybrid learning-Instruction that combines face to face class meetings with online learning activities.

Intrinsic Motivation or Goal Orientation- The degree to which the student perceives to be participating in a task for reasons such as challenge, curiosity or mastery.

Life-long learning- An ongoing, self-motivated pursuit of knowledge for personal or professional goals.

Online Learning-Electronically supported teaching and learning that utilizes digital resources and communication in place of traditional forms of instruction that occurs at a distance from the classroom environment.

Problem Based Learning (PBL)-A student centered instructional strategy that involves presenting students with an authentic problem that they work to collaboratively solve.

Self-directed Learning (SDL)- A process by which learners take the initiative with or without the assistance of others to identify their learning needs, formulate learning goals, find appropriate

resources for learning, choose and implement learning strategies, and evaluate learning outcomes.

Traditional Instruction-Instruction which consists of lectures and readings in printed texts. This instruction tends to be more teacher than student directed.

Chapter II. Review of Literature

Attitudes about appropriate methods to educate health care professionals have evolved much like that of other disciplines over the last century. Movement from the apprenticeship model to a teacher directed behaviorist approach and more recently to a student centered constructivist approach has slowly taken place. Despite this movement however, the behaviorist approach typified by the traditional lecture had been the focus of undergraduate nursing education leading into the turn of the century (Tompkins, 2001). This method, consisting of lists of behavioral objectives, learning outcomes determined through measureable behaviors, and student-teacher relationships characterized by one way transmission of information remained predominant in undergraduate settings as recently as ten years ago. However evidence suggested that this method of instruction lacked the ability to connect theory with practice and to develop critical thinking skills in the learner (Tompkins, 2001).

More recently, Finke (2009) suggested that because of changes in the health care environment and in higher education, the emphasis in nursing education has moved away from the lecture method as the primary means of instruction. In the last decade, Finke indicated that technology had become integrated into teaching and students were increasingly encouraged to become more actively involved in learning (Finke, 2009).

Health care professionals today must be equipped to function in an ever changing, complex medical environment. This environment demands that individuals become more active learners and be able to cultivate life-long learning ability, apply didactic knowledge to practice, and demonstrate critical thinking skills (Young & Maxwell, 2007). The need to develop these skills began to revolutionize nursing education and brought multiple methods of student centered instruction into the nursing classroom (Young & Maxwell, 2007). These changes in nursing

pedagogy have made it imperative to identify and study effective teaching methods in undergraduate education that enhance the skills required for effective professional performance. Student centered approaches, such as PBL, have shown promise in facilitating the acquisition and development of the skills needed for effective professional performance mentioned above. Additionally, PBL has been suggested as an effective instructional method specifically in the online environment (Fisher, 2009). As a growing number of programs offer hybrid and online courses, determining the effectiveness of PBL as an instructional method in this environment is urgent in order to validate its use.

This literature review will indicate that evidence exists to support online PBL as a method to increase student learning and foster skill development. However research will also show that this student centered approach may not produce the same beneficial outcomes for all students. Further investigation is needed to determine the learning outcomes of PBL in the online environment as compared to traditional instruction. It is important to identify the impact that PBL has on learning to substantiate its effectiveness as an instructional strategy. Additionally since both online instruction and PBL require students to be self-directed and motivated it is equally important to determine how these characteristics influence learning outcomes. Examining these student characteristics in PBL and traditional learning environments will assist instructional designers in understanding how to plan for effective instruction.

This review will explore the historical and contemporary context of nursing education, the theoretical basis for PBL, and the strengths and learning outcomes of PBL. Additionally the review will summarize what is known about the relationship of self-directed learning readiness (SDLR) and motivation to learning outcomes when PBL is utilized as an instructional method. This chapter contains the following sections: Historical Perspective of Nursing Education,

Contemporary Context of Nursing Education, Theoretical Framework for PBL, Problem Based Learning in Application, Self-Directed Learning and a summary.

Historical Perspective of Nursing Education

Nursing education has changed dramatically over the course of modern history and continues to undergo transition. Prior to World War II, nursing education historically took place in the hospital setting using the apprentice system. From the 1800's until the 1950's, student nurses learned by doing, taking care of sick patients in hospital wards while graduate nurses moved into the role of private duty nurses. This apprenticeship model of teaching focused on developing skills in the environment in which they would be utilized. While there were advantages to this approach, it focused on skill training rather than fostering evidence based practice.

The passage of the Hill-Burton Act in 1946 provided funds for hospital renovation and expansion and necessitated the education and training of increased numbers of health care professionals. Additionally, the development of intensive care units and the change in complexity of health care in the 1950s required more research based didactic instruction. The shortage of adequately trained health care professionals prompted the Carnegie Foundation to commission a study of nursing education in the United States. The findings of this study initiated a move away from hospital diploma programs where practical training took place and moved instruction into the classroom environment where trainees functioned as traditional students (Orsolini-Hain & Waters, 2009).

At the same time, President Harry S. Truman directed a national Commission on Higher Education to foster the expansion of community junior colleges. These colleges were designed

to increase the number of people prepared at technical and semiprofessional levels to serve the communities in which they were located. The expansion of the community college system combined with the nursing shortage moved nursing education into the community college setting. These associate degree programs accounted for 58.9% of all undergraduate nursing programs and 63% of RN graduates as of 2006 (Orsolini-Hain & Waters, 2009). Nurses educated in the community college setting were perceived to have a technical versus professional level of practice as compared to those prepared in four year baccalaureate institutions. However, over time, the continued nursing shortage resulted in little distinction between roles in actual nursing employment practices (Orsolini-Hain & Waters, 2009).

The current trend in nursing education is to move from two year associate degree programs to four year baccalaureate programs and beyond in order to enhance evidence based nursing practice in an increasingly complex health care environment (Orsolini-Hain & Waters, 2009). While the traditional classroom environment provided students with research based didactic information, it was less appropriate for providing practical application of this knowledge (Ehrenberg & Haggblom, 2007; Margetson, 2000). Furthermore the assumption that it was possible to cover all nursing content in a particular curriculum and that the instructor was responsible for covering this material was no longer valid, considering the explosion of knowledge in the last decade (NLN Board of Governors, 2003). In addition, the characteristics of the nursing student population have changed over the past half century. Prior to World War II, nursing was primarily regarded as a woman's profession and historically, males, minorities and students with disabilities were practically nonexistent in nursing training programs (Lowenstein, 2007). The Civil Rights movement of the 1960s and community college expansion made nursing education programs more available to a diverse population. This new pool of

learners included those from multiple ethnic backgrounds as well as non-traditional adult learners. These learners benefited from instructional design that took into consideration their backgrounds and prior learning. The increasing complexity of nursing practice and knowledge needed for professional performance coupled with the increased diversity of learners necessitated rethinking methods employed in the education of health care professionals.

Contemporary Context of Nursing Education

Today's pre-service health care professionals must be prepared to apply didactic knowledge to practice situations, develop critical thinking skills and increase their ability for lifelong learning. The traditional teaching strategy in the undergraduate classroom had been lecture and while this method was preferred by faculty and students, Cook (2007) suggested that it does little to promote critical thinking skills, application to practice or to accommodate the needs of today's learner. The National League of Nursing (2003) released a position statement that called for a movement away from traditional nursing education. The board stated that traditional instruction emphasized content laden, highly structured curriculum with measureable objectives and emphasized what to teach rather than the most effective instructional methods. Bradshaw (2007) contended that some students who adhered to traditional instructional methods, such as lecture and readings did not maximize their learning and that they benefited from more direct clinical experiences. Margetson (2000) suggested that transferring large amounts of information in traditional lecture format followed much later by application in practice was limited by the separation in time of these two events. He advocated for a "more holistic conception of education in which knowledge, understanding and practice develop as an integrated, growing web, where life-long learning is assumed because learning is part of life, not a preparation for it" (Margetson, 2000 p. 302). Supporting Margetson's claim, Ehrenberg and

Haggblom (2006) noted that traditional nursing education, decried by the National League of Nursing in 2003, separated the theoretical components from practical application. This disconnect between the clinical and theoretical components of nursing education produced a gap between “knowing that’ and knowing how”. In order to effectively function in the health care environment, it was important for nurses to be able to apply theory to actual practice and develop critical thinking and lifelong learning skills. Therefore a need exists to research and implement methods of learning in nursing education that enhance these skills.

The need to develop effective instructional strategies to better prepare students for professional practice coincides with the rapid growth of online instruction for nursing and other health care professionals. Hodson-Carlton, Siktberg, Flowers, and Scheibel (2003) indicated that distance education programs for nursing had grown at a phenomenal rate with the most growth occurring in RN to BSN programs. Holly (2009) noted that a search using Peterson’s College Search engine, designed to provide prospective students with college information, yielded 63 colleges and universities that offered registered nurse training in an online format. A search in 2012 using the same search engine and key words, “online nursing programs” yielded a total of 158 programs offering some or all content online. Included in this number were 134 traditional baccalaureate programs; 16 community college programs; and 8 online degree programs (Nelnet, 2011).

Online distance education offered advantages because it allowed students to continue to participate in the workforce while pursuing their professional degree. These distance programs provided more access to a diverse population who would not enroll in traditional programs because of full time employment or family commitments (0’Neill, 2009).

Effective online learning required interactivity between the instructor, the learners and the course content. This interactivity required online conversations with evidence of problem solving and student and teacher facilitated discussions (Fisher, 2009). Therefore it became necessary to identify instructional methods that could accommodate this interactivity and facilitate student discussion. Phillips (2005) asserted that problem solving assignments with real world problems such as PBL provided an effective active learning strategy in the online environment. Ortiz (2004) suggested that PBL could provide effective instruction in the online environment because of the constructivist nature of this method that requires student participation and interaction. Fisher (2009) indicated that PBL was an active learning strategy that could be used to promote collaboration among teams of students in the online environment. Fisher (2009) further argued that online PBL compelled students to use the Internet as a primary research tool and required them to critically evaluate information obtained from these sources. Fisher (2009) suggested that using and evaluating these resources could advance students' lifelong learning skills. The authentic problem provided in PBL also allowed students to apply didactic information to scenarios that mimic situations that might be encountered in professional practice. Therefore online PBL could be effective in allowing nursing students to develop skills in critical thinking, lifelong learning abilities and application of knowledge in a practice oriented situation. These skills have been documented as essential for effective nursing practice in today's health care environment. The increase in online course offerings in undergraduate programs and the potential for PBL to enhance online instruction emphasizes the urgent need to further study the effective use of PBL as a method of instruction in the online environment.

Theoretical Framework for PBL

This literature review supports the need to implement teaching strategies that establish links between theory and practice, increase critical thinking skills, promote lifelong learning and accommodate the needs of diverse learners. PBL has been demonstrated as a technique to accomplish these goals (Lowenstein, 2007; Rounds & Rappaport, 2008). The problems or scenarios provided in PBL allow learners to apply didactic information in situations they will encounter in professional practice. Ehrenberg and Haggblom (2006) suggested that separating the theoretical components of learning from application of learning occurred with traditional instruction. In contrast, the realistic problem provided in PBL is the stimulus for the learning and connects knowledge to application. PBL requires student participation and interaction in construction of the problem solution. This student centered instructional method provides for active learning and enhances student collaboration (Fisher, 2009). PBL involves the learner in the learning and requires students to be self-directed rather than passive in their pursuit of knowledge. The problem in PBL provides a cognitive apprenticeship for the learner. For this reason, this research uses cognitive apprenticeship theory as a basis for its design and theoretical framework.

Cognitive Apprenticeship Theory. This theory, advanced by Brown, Collins and Duguid (1989), suggested that didactic methods of learning separate the activities of knowing and doing. Brown et al. (1989) argued that didactic methods of instruction treat knowledge as an "integral, self-sufficient substance, theoretically independent of the situations in which it is learned and used" (Brown et al., 1989, p. 32). In this view the knowledge provided in didactic instruction was abstract and regarded as a separate entity apart from any relationship to actual practice. However cognitive apprenticeship theory challenged this position and held that the

activity in which knowledge is developed is inseparable from the actual learning and cognition. Brown et al. (1989) advocated that students learned best when they took on the role of the practitioner and entered the community in which the knowledge was utilized. This cognitive apprenticeship enabled the learner to participate in authentic activity thus providing meaning to the learning that took place. PBL, because of its ability to provide for an authentic problem as the stimulus for learning, potentially fulfills the requirements of a cognitive apprenticeship.

PBL also has the characteristics of a student centered learning environment (SCLE) advocated by Jonassen (2000), in which learners are provided with a question, issue, case, project or problem that they attempt to solve. A student centered approach replaces lectures with active learning and holds students responsible for their own learning advances. In addition, student centered learning allows the learners to pursue learning at their own pace and explore increasingly complex levels of content to meet their learning needs. PBL provides for an SCLE because the problem, not the instructor, directs the learning. Students learn content and apply it in an authentic situation to answer the question or solve the problem. Jonassen (2000) described PBL as an extension of case based learning (CBL), a method by which students develop knowledge by studying cases and preparing summaries or diagnoses. PBL differs from CBL in that it is a less guided and structured small group inquiry. Both CBL and PBL are consistent with a cognitive apprenticeship because the learning is situated in a context resembling one that might be encountered in actual practice. As an extension of CBL, PBL requires students to self-direct their learning in efforts to solve cases within the context of a course. The important characteristics of the problem presentation includes that it be interesting, engaging and relevant. This necessitates that the problem be ill-structured to allow students to take ownership of their learning as they engage in finding a solution (Jonassen, 2000). Research on PBL indicates that

students have a better ability to transfer information from the classroom to real life situations (Hung et al., 2003).

In addition to the importance of applying knowledge to practice and developing critical thinking skills, nursing education should seek to meet the needs of diverse learners which include both traditional and non-traditional students. Bradshaw (2007) stated that effective professional education is linked to principles of adult learning formulated by Knowles (1990). These principles included the need for the adult learner to assume responsibility for their own learning and to regard learning as meaningful and useful. Additionally, Knowles (1990) argued that the adult learner felt the need to receive the maximum benefit from their learning and achieved a sense of empowerment from taking control of the learning process. The combination of providing for application of knowledge to practice, developing critical thinking skills, promoting lifelong learning and meeting the needs of adult learners made PBL particularly suitable to nursing and health care professional education. It is imperative that PBL be further investigated as a method of instructional design in the education of health care professionals today.

Problem Based Learning. PBL, as previously stated, is an instructional method that involves the presentation of a clinical problem as a teaching strategy (Ridley, 2007). It was described as a form of education that allowed for information to be mastered in the same context in which it would be used (Donner & Bickley, 1993). The intent of PBL was to promote effective critical thinking and clinical reasoning skills (Rounds & Rappaport, 2008). PBL, because if its ability to elicit problem solving and critical analysis, endeavored to bridge the gap between theoretical knowledge and practical application.

Medical schools in the United States began utilizing PBL in the 1970s and since then it has been included as part of the curriculum in over 100 schools (Ridley, 2007). More recently, PBL has been incorporated as a teaching method in the education of other health professionals including nurses, physical therapists, and public health professionals (Dennis, 2008; Rideout & Carpio, 2001; Spinello & Fischbach, 2004).

PBL was described by Zubaidah (2005) as taking place in four phases. Phase one involves students reasoning through the problem and identifying their learning needs in groups. The next phase consists of learners engaging in self-directed learning as they explore the topic. In phase three, the group process takes over with each learner applying the results of individual research to the problem. Finally the fourth phase involves the summary of the information gathered and utilization of this information in problem solving (Zubaidah, 2005).

Learners are assisted in their pursuit of knowledge by an instructor who is more expert in the area than the learners (Wolff & Rideout, 2001). As is typical in the constructivist approach to learning, the instructor facilitates but does not direct or dictate learning. Learning is accomplished independently by the learner, but is greatly supported by the participation of the instructor who provides guidance in the discovery process. The learner also benefits from the pre-existing knowledge and research shared by other group members in pursuit of problem resolution (Rideout & Carpio, 2001).

Problem Based Learning in Application

PBL has been studied extensively in medical schools in the face to face environment and more recently has been examined in online settings and with other student populations (e.g. Anderson & Treadway, 2009; Choi, 2003; Donner & Bickley, 1993; Nathoo et al., 2005;

Pastirik, 2006; Rounds & Rappaport, 2008; Ryan et al., 2004; Schell & Kaufman, 2009; Siu et al.,2005; Spinello & Fischbach, 2004; Tiwari et al., 2006; Valaitis et al., 2005). Donner and Bickley (1993) indicated several strengths of the PBL curriculum in medical schools including increased motivation for learning, the ability to consult a variety of resources for learning and the development of critical thinking skills. Norman and Schmidt (1992) investigated the theoretical advantages claimed for PBL and found that the activation of prior knowledge facilitated processing of new information and that elaboration enhanced the use of this knowledge. Group discussion in PBL furthered this elaboration and resulted in increased retention of new knowledge. Norman and Schmidt (1992) argued that PBL stimulated contextual knowledge which enabled students to better transfer concepts to new problems. PBL stimulated self-directed learning skills evidenced by PBL students making more frequent use of the library to access information than students in a traditional curriculum (Norman & Schmidt, 1992). Similarly, Albanese and Mitchell (1993) reviewed studies conducted between 1972 and 1992 found that students were highly satisfied with PBL and felt better prepared in independent learning skills.

Successful implementation of PBL in the face to face environment along with the growth of distance education has led to the incorporation of this instructional strategy in online and blended learning environments. Woltering, Herrler, Spitzer, and Spreckelsen (2009) surveyed 185 third year medical students in a blended PBL environment. They utilized qualitative and quantitative questionnaires, standardized group interviews and students' test results to compare the blended online PBL design with a traditional PBL design. They found that medical students using online PBL had an increased motivation for learning and higher satisfaction with their learning gains over students in the traditional PBL environment. Students used the web based

learning modules frequently and were positive about the learning environment. The authors suggested that online support of the PBL process benefited the students and improved cooperation during the self-directed learning in PBL. Similarly, Nathoo et al. (2005) indicated that medical students benefited from participating in an online PBL experience. In their study, an Interactive Case-based Online Network allowed students to interact with each other, faculty and a virtual patient. Students and faculty were interviewed after completion of the course to determine their response to the online PBL experience. These students reported feeling urgency in caring for the virtual patient and experienced an increased sense of accountability to the tutorial group as they worked toward identifying learning needs and arriving at a problem solution. Students and faculty benefited from brainstorming online because they felt better connected and this improved their communication outside of the classroom (Nathoo et al., 2005).

As PBL transitioned from use in medical schools to education of other health care professionals, researchers studied its impact with diverse student populations including physical therapy, nursing and public health students (Dennis, 2008; Rideout & Carpio, 2001; Spinello & Fischbach, 2004). Siu et al. (2005) found that nursing students engaged in PBL reported more exposure to small group learning and self-directed work than students who participated in traditional instruction. The PBL students also experienced positive interactions with the teacher as a facilitator rather than a director of learning as compared to the traditional students. These characteristics of the PBL approach resulted in students having significantly higher perceptions of both structural and psychological empowerment than those in the traditional environment. Siu et al. (2005) found that the increased levels of empowerment felt by these students related positively to effective performance in the workplace.

Similarly, in a qualitative study, Pastirik (2006) found improved small and large group communication when PBL was implemented with 42 second year nursing students in a blended class. The course website was utilized to provide the PBL scenarios and facilitate correspondence between group members and the instructor. Students reported that the PBL method increased multiple perspectives about the subject matter and enhanced their autonomy and responsibility. They were able to acquire knowledge through the use of multiple resources and demonstrated increased application of their learning in a concurrent clinical experience (Pastirik, 2006).

Tiwari et al. (2006) compared PBL with a traditional lecture approach in 79 first year nursing students. Using the California Critical Thinking Disposition Inventory (CCTDI), they found no initial significant differences between PBL and lecture students in measures of critical thinking. After participation in the PBL learning environment, students scored higher in overall scores on the CCTDI inventory when compared to their contemporaries in traditional instruction. Specifically the PBL students showed greater improvement in Analyticity, Critical Thinking Self-confidence, Truthseeking, and Systematicity over the traditional lecture group (Tiwari et al., 2006).

Choi (2003) developed an online PBL Learning Module to utilize with undergraduate Korean nursing students and later assessed students' reactions to this module. The learning module consisted of three patient scenarios which included patient data and characteristics and provided a format for problem identification and resolution. Choi (2003) measured learning effectiveness of the module by conducting an online 4 point Likert survey with students where 1 was not at all satisfied and 4 was very much satisfied. Results from the 109 students who responded indicated moderate to high satisfaction regarding clarity of learning objectives, the

authenticity of the scenario, knowledge organization, motivation to learn, stimulation of interest, logical thinking, and fact based knowledge accumulation. Students also indicated that the online PBL process assisted in developing critical thinking skills and that solving the patient problem in the module helped students easily apply knowledge to practice (Choi, 2005).

Spinello and Fischbach (2004) designed and evaluated a PBL module that presented a virtual community involved in an infectious disease outbreak to an undergraduate public health behavior course. Twenty-eight students formed four groups of which two were randomly assigned to the PBL module and two were assigned the traditional class assignment. The PBL students indicated that the problem simulation and the realistic portrayal of a community enabled them to apply newly acquired skills. Students indicated that the dynamically changing community environment created online was motivating and interesting (Spinello & Fischbach, 2004). Moreover, all participants (100%) preferred the exercise to writing a traditional academic paper (Spinello & Fischbach, 2004).

Recently, Gabr and Mohamed (2011) found that undergraduate nursing students engaged in face-to-face PBL demonstrated improved content knowledge and problem solving abilities over peers who were engaged in traditional instruction. The PBL students felt that this instructional method increased their motivation to learn, improved critical thinking, enhanced group collaboration and integrated knowledge into practice.

Similarly, Pease and Kuhn (2010) studied undergraduate physics students in a cross-over design allowing the same students to experience PBL and traditional instruction on two distinct topics. They assessed students immediately after instruction and again after 12 weeks and found that students who participated in PBL produced greater understanding of instructional content for

both topics. Sendag and Obadasi (2009) found that undergraduate students in an online PBL course had similar changes in content knowledge to those in an online instructor led course. However, the students engaged in online PBL had an increase in their critical thinking skills that was more significant than those in the instructor led course.

King et al. (2010) studied online PBL with students enrolled in four sections of an interprofessional Health Sciences Course. The researchers used content analysis to evaluate the transcripts of online communications of 20 students across the four sections. The analysis revealed that the online learning environment facilitated small group collaborative interactions. They also suggested that conducting PBL online could be advantageous to increasing discipline specific skills, team skills and fluency with information technology (King et al., 2010).

Flexibility and convenience were cited by students as a major benefit to online learning by numerous investigators (Mazurak et al.,2005; Song, Singleton, Hill, & Koh, 2004; Tallant-Runnels et al., 2006; Wuensch, Aziz, Ozan, Kishore, & Tabrizi, 2008). A meta-analysis of 76 studies focused on online learning found that students preferred the ability to work at their own pace and enjoyed the autonomy that this environment offered (Tallant-Runnels et al., 2006). Students engaged specifically in online PBL also indicated that they preferred the ability to gather information at their own pace to construct problem solutions (Nathoo et al., 2005; Spinello & Fischbach, 2004; Valaitis et al., 2005).

The online environment allowed students to utilize a variety of resources beyond traditional text books to pursue self-directed learning, an essential feature of PBL as a constructivist method of instruction. Hill, Wiley, Nelson, and Han, (2004) stated that ‘learning with’ these internet resources allowed learners to actively construct something unique as they

used the internet for information gathering. Internet resources utilized in this manner became 'cognitive tools' that enhanced human thinking, problem solving and learning (Hill et al., 2004). The variety of resources available in online PBL implementation also helped support individual learning styles (Valaitis et al., 2005).

The literature reviewed suggests that PBL created a learning environment that resulted in an increased application of knowledge to practice, increased critical thinking, development of lifelong learning abilities, and increased collaboration and communication among students and faculty (Anderson & Treadway, 2009; Choi, 2003; Nathoo et al., 2005; Pastirik, 2006; Rounds & Rappaport, 2008; Ryan et al., 2004; Schell & Kaufman, 2009; Siu et al.,2005; Spinello & Fischbach, 2004; Tiwari et al., 2006; Valaitis et al., 2005). Online PBL had additional benefits related to students' perceptions of the advantages of the online environment including flexibility, convenience and the ability to pace learning (Mazurak, Whybrow, Varnhagen & Field , 2005; Nathoo et al., 2005). Song et al. (2004) indicated that student perception of online learning was dependent upon the quality of the learning design and Tallent-Runnels et al. (2006) suggested that quality design of online learning should be grounded in sound educational theory. Ortiz (2004) indicated that PBL, as a constructivist method of instruction, provided sound design and was an effective learning strategy in the online environment.

By offering these advantages PBL has been suggested as a method to improve learning outcomes particularly among health care professionals. In an attempt to determine the validity of this claim, Colliver (2000) reviewed the medical education literature from 1992 to 1998 and found that overall PBL neither improved knowledge acquisition or clinical practice in these studies. Furthermore, a review of 43 articles from 1992 to 2005 on critical thinking as an outcome of PBL conducted by Worrell and Profetto-McGrath (2007) showed inconsistent

evidence to support a change in critical thinking skills in either baccalaureate or post RN students during their educational programs. They noted however that difficulties related to assessing changes in critical thinking related to both the definition and the measurement of this characteristic in the studies they reviewed.

In addition, Kirschner, Sweller and Clark (2006) cautioned that PBL and other inquiry based methods of learning were inconsistent with what is known about cognitive architecture, cognitive load and expert-novice differences. They suggested that employing a minimally guided learning approach was less effective and efficient than more directed approaches to learning unless students have sufficient prior knowledge to provide 'internal guidance'. Their findings indicated that perhaps students in the beginning stages of professional study may not have the skills needed to effectively participate in PBL.

Levett-Jones (2005) argued that nursing students, particularly in the early stages of training, preferred teacher directed activities that had clear requirements and expectations. She suggested that this preference grew out of the past educational experiences of the students and the competitive academic environment in which learning typically occurs. Albanese (2000) has suggested that expecting students who were previously taught with traditional strategies to do better in their initial exposure to a PBL environment is unreasonable. Furthermore, Levett-Jones (2005) contended that nursing students are not adequately prepared for the SDL required in PBL as a result of these previous educational experiences. A lack of SDL ability in students resulted in frustration on the part of both the teacher and the learners that ultimately created problems in the PBL process (Levett-Jones, 2005). Students who did not understand the purpose and methods of PBL were unable to achieve learning with the minimal guidance provided by this instructional design. Levett-Jones (2005) contended that in order to be successful in the PBL

environment, students must be prepared for the minimal guidance provided in the PBL process and have adequate SDL skills to achieve desired learning outcomes.

Smedley (2007) found that younger students were less ready for SDL than older students. She suggested that students who are older and have work experience are more prepared for SDL than students who immediately enter higher education from secondary school. Similarly, Yuan, Williams, Fang, and Pang (2011) found that senior students had higher SDLR scores than junior students. This finding was also demonstrated in a review of literature conducted by O'Shea (2003) who suggested that students become more self-directed in their learning as they mature.

The arguments presented by Kirschner et al. (2006), Smedley (2007), Yuan et al. (2011) and Levett-Jones (2005) suggested that SDL approaches like PBL may not be appropriate for all students in all situations. Levett-Jones (2005) suggested that PBL requires a high degree of self-directed learning readiness (SDLR) while Kirschner et al. (2006) indicated that adequate prior knowledge is required to effectively participate in PBL. Smedley (2007), O'Shea (2003) and Yuan et al. (2011) suggested that age and life experience contributed to SDLR. Consideration of SDLR in students with minimal prior knowledge is needed when designing instruction that will achieve desired outcomes in PBL environments. For this reason, it is important to investigate the correlation between student SDLR and learning outcomes in a PBL learning environment.

Self-Directed Learning

Tough (1967, 1971) pioneered the concept of self-directed learning when he defined it as 'self-planned learning' after studying learning projects of 66 individuals and describing their deliberate efforts to learn. He indicated that learners utilized specific steps in deciding the content, location, timing, resources and barriers to learning. At around the same time Knowles

(1975) described self-directed learning as "a process in which individuals take the initiative, with or without the help of others, to diagnose their learning needs, formulate learning goals, identify resources for learning, select and implement learning strategies, and evaluate learning outcomes" (Knowles, 1975, p. 18). These early descriptions of self-directed learning held in common the goal that learners develop the ability to "plan, carry out and evaluate their learning needs" (Merriam, Caffarella & Baumgartner, 2007 p. 107).

Later models of self-directed learning suggested that learning is affected by the interaction of characteristics of the learner, the learning context and opportunities within the learning environment. For example in Brockett and Hiemstra's (1991) Personal Responsibility Orientation (PRO) model, self-directed learning consisted of the instructional process of self-direction itself and the self-directed characteristics of the learner. The PRO model suggested that SDL is a process in which learners take responsibility for planning, implementing and evaluating their experiences in the instructional process. The second dimension of the PRO model stressed personality characteristics of the learner. The self-directed learner had a desire to assume ownership for their thoughts and actions and responsibility for learning. The PRO model included the characteristics and learning process of the individual learner as well as the social setting or context of the learning (Brockett & Hiemstra, 1991).

Garrison's (1997) model of SDL combined the elements of self-management, self-monitoring and motivation. Self-management involved "learners taking control of and shaping the contextual conditions so that they can reach their stated goals and objectives" (Merriam, Caffarella & Baumgartner, 2007 p. 114). Self-monitoring was the ability of the learner to think about their learning and use a variety of learning strategies to accomplish learning. It involved both the cognitive and metacognitive processes that take place in the learning activity.

Motivation examined what enticed the learner to get involved and stay involved in the learning process (Merriam, Caffarella & Baumgartner, 2007).

These models of self-directed learning were developed based on learning that occurred in traditional face-to-face settings. With the emergence of online learning as an alternative setting for learning and because online PBL was the focus of this research it is important to describe a model directed at understanding SDL in the online environment. Song and Hill (2007) proposed a model that incorporates SDL as a personal attribute and a learning process as suggested by Brockett and Hiemstra (1991) and Garrison (1997) but added the third dimension of learning context. In this model personal attributes included learners' motivation, their ability to take responsibility for their learning, their resource use, and cognitive strategies. In this model learners brought characteristics such as intrinsic or extrinsic motivation, prior knowledge and experience and resourcefulness to the learning context.

The learners' autonomous learning processes within the learning context were described in this model for SDL in the online environment. This autonomy was exhibited by the learners' process of planning, monitoring and evaluating their learning. These strategies existed on a continuum from the learner exhibiting no control in a lecture situation to total control in an independent study experience.

Finally, the third dimension of the model proposed by Song and Hill (2007) included context. This dimension included the environmental factors in the learning context and how these factors influenced the level of self-direction provided to the learner. Both the design of the learning context and the instructor support provided within the learning context influenced learner self-direction. The resources, structure and nature of the tasks in the learning context

made up the design elements. Design elements that required and promoted a high degree of SDL included asynchronous online learning for example. Song and Hill (2007) also indicated that types of instructor support provided in the learning context worked to influence SDL. For example, they contended that constructive and informative feedback was helpful in facilitating the development of the learners' SDL.

The definition of self-directed learning has developed since initially presented by Tough (1967, 1971) and Knowles (1975). However, the essential characteristics described by Knowles of a learner taking initiative to define learning needs, select learning goals, choose learning strategies, research using self-selected resources, and evaluate outcomes was consistent across later models. The models developed by Brockett and Heimstra (1991) and Garrison (1997) were useful in gaining an understanding of the relationship between the personal attributes of the learner and the process of learning itself. The more recent model described by Song and Hill (2007) took into consideration these two factors as well as the specific context of the online environment that influences students SDL. The characteristics of SDL that were described in these models were essential for effective participation in PBL and these attributes were intricately woven into each step of the PBL process. This research therefore sought to examine the role of student SDLR and motivation in the online PBL learning environment. Gaining a better understanding of the correlations between student characteristics of SDLR and motivation to their learning outcomes in the online PBL environment is imperative to tailoring instructional design to meet student needs.

Problem Based Learning and Self-directed Learning Combined. An examination of the stages of PBL described by Zubaidah (2005) suggested that self-directed learning is an important aspect of this teaching methodology. Phase one of PBL as described by Zubaidah

(2005) presented the learner with an authentic problem that they might encounter in the work setting. In this phase the learner identified learning needs to move toward the problem solution. Once the needs were identified the learner constructed learning goals before engaging in steps needed to meet those goals. In PBL it is the responsibility of the learner to construct these goals without the aid of a list of predetermined objectives provided by the instructor. Both the PRO model (Brockett and Heimstra, 1991) and Garrison's model (1997) of SDL require that the learner take ownership and responsibility for learning. Song and Hill (2007) indicated that personal attributes of the learner such as their capability to take responsibility and motivation impacted SDL, while Knowles (1975) suggested that diagnosing learning needs and identifying learning goals independently were important steps in SDL and these steps were integral to the PBL process as well.

Phase two of PBL required that the learner consult resources to gather information to fulfill learning needs and goals (Zubaidah, 2005). As defined by Knowles (1975), the self-directed learner had the ability to identify resources and choose problem solving strategies to meet learning goals. Abdullah (2001) suggested that in SDL the control of learning shifted from the teacher to the learner. Reinforcing this belief, Williams (2001) indicated that in the second phase of PBL "students determine how they will learn the knowledge and skills that they have identified that they need to support or refute their hypotheses and what resources they will use to assist them" (Williams, 2001, p. 95). The learner decided what is important to learn and how to go about the learning process. Therefore PBL required SDL in that the learner determined the information needed to solve the problem with the teacher acting as the facilitator of the process. As students selected resources and strategies they developed a better understanding of how they went about acquiring information for effective problem solving. Brockett and Heimstra (1991)

stressed that it was important for the learner to implement and plan throughout the learning experience. Garrison suggested that self-monitoring, the ability of the learner to think about their learning and use a variety of learning strategies, is important for SDL. These metacognitive strategies were also stressed by Song and Hill (2007) who emphasized the importance of the learning process which consisted of planning, monitoring and evaluating in SDL.

Phase three of PBL as described by Zubaidah (2005) involved the learners bringing back the results of their research to the group and discussing their findings to work toward problem solution. Self-directed learning, while appearing to be independent in nature was highly collaborative since learners work with teachers and peers to further their learning (Abdullah, 2001). Instructors of self-directed learners were charged with modeling learning strategies and coaching students so that they utilized these strategies on their own. Regan (2003) surveyed 97 nursing students regarding what motivated them to SDL and found that 93. 8% of these students benefitted from clear guidance and feedback. This suggestion is in agreement with the observations of Song and Hill (2007) who stated that support in the form of instructor feedback and peer collaboration were important elements of SDL in the online environment. Lee, Mann and Frank (2009) also found that medical students' self-perceived self-directed learning abilities were positively influenced by discussion in which instructors provided feedback and peers collaborated to develop problem solutions. Williams (2001) suggested that group discussion allowed students to critique resources and personal research methods and that these skills were critical in the process of self-directed learning. These findings suggested that the nature of the group interaction and the actions of the instructor positively affected the learning process by providing constructive feedback that motivated learners and supported SDL.

Finally, phase four of PBL required that the learners use the results of their learning process to solve the real life problem (Zubaidah, 2005). This required that they apply the knowledge obtained in an authentic situation. Research on self-directed learning as in PBL, suggested that learners can more effectively connect conceptual knowledge to real life by utilizing methods that people use for learning in real life (Abdullah, 2001; Hung et al., 2003). As students developed a problem solution they recalled prior learning, reflected and elaborated on their learning and thus "integrate it into existing cognitive structures" (Williams, 2001 p. 95). Towle and Cottrell (1996) suggested therefore that PBL is one of the methods that can assist health care professions in acquiring self-directed learning skills that "may be the key between undergraduate education, postgraduate training, and continuing professional development" (Towle & Cottrell, 1996, p. 359). These findings, while not conclusive, suggested that the problem solution stage of PBL continued to involve students in self-directed learning as they revised and remodeled their findings in the process of problem solution. Development of these skills was felt to be instrumental for continued professional development.

The literature reviewed here suggested that the PBL process required the need for self-directed learning abilities. Levett-Jones (2005) suggested students who lack sufficient SDL abilities may become frustrated with PBL. For example in a study of undergraduate engineering students, Litzinger, Wise, and Lee (2005) found that some students increased in their SDLR after participating in PBL while others decreased in this ability. They suggested that perhaps decreases in SDLR after PBL occurred because "when students who are in the early stages of developing self-directed learning abilities are asked to perform as if they were self-directed the potential for frustration on the part of the student is high" (Litzinger et al., 2005, p. 220). However, the influence that PBL had on the development of SDL is inconclusive. For example,

Kocaman, Dicle and Ugur, (2009) found that nursing students enrolled in a PBL curriculum increased in their self-directed learning readiness as they progressed through the four year PBL curriculum. In contrast, Williams (2004) found insignificant differences in self-directed learning readiness at the end of one year in a PBL curriculum. Furthermore both studies (Kocaman et al., 2009; Williams, 2004) indicated that adequate facilitation, support and encouragement from instructors was crucial to developing self-directed learning skills. This finding reinforced the importance of the role of the instructor in adequately preparing students for self-directed learning as suggested by Levitt-Jones (2005). In fact Grow (1991) suggested that learners benefit from instructors tailoring their interaction with learners' based on their self-directed learning abilities. These studies suggested that there is limited research to document the relationship between SDL abilities and performance in the PBL environment. There is even less information available about this relationship in the online PBL environment. Therefore it is imperative to determine how SDLR and motivation at the onset of the online PBL process impacts knowledge gains and learning outcomes in order to achieve effective instructional design.

Problem Based Learning, Online Learning and Motivation. Students seemed to enjoy PBL online and responded positively when surveyed regarding their motivation for learning with this student centered instructional method (Nathoo et al., 2005; Woltering et al., 2009). PBL has been associated with increasing motivation for learning but student motivation may also influence the success of this instructional method. Arguing this perspective, MacKinnon (1999) stated that "few approaches to teaching and learning are more contingent upon student motivation than problem-based learning" (MacKinnon, 1999, p. 49). In fact students who performed well with PBL and in the online environment shared similar characteristics such as motivation and self-direction in learning (Boyd, 2004; MacKinnon, 1999). Song et al. (2004),

Boyd (2004) and Schrum and Hong (2002) found that student motivation was associated with satisfaction and success in online learning. Furthermore Boyd (2004) asserted that highly successful online students are self-disciplined and have the characteristics of self-directed learning which includes high levels of motivation and comfort with directing one's learning. Nagelsmith, Bryer and Yan (2012) measured the motivation and volition of nursing students in online learning environments and found that there was a significant relationship between these characteristics and student academic success.

Student motivation has been shown to influence success in both PBL and online learning (Boyd, 2004; MacKinnon, 1999; Nagelsmith et al., 2012; Schrum & Hong, 2002; Song et al., 2004). In contrast, Richardson (2007) and Chen and Jang (2010) found that motivation did not predict learning outcomes with students who were engaged in distance and online learning. Chen and Jang (2007) measured motivation and learning outcomes in 267 online students and found that the source of student motivation whether intrinsic or extrinsic did not determine student success in the course. They indicated that motivation may impact students' attitude and behavior in class thus affecting learning outcomes. They concluded that online instructors should seek to understand students' motivation to better tailor the learning experience to help students become more assured and self-determined learners (Chen & Jang, 2007). Similarly, Richardson (2007) surveyed 451 distance learning students and concluded that student motivation and attitudes have an effect on their study behaviors and these behaviors affect learning outcomes. Therefore he recommended that these characteristics be considered to enhance the quality of instruction. The conflicting findings of the literature reviewed suggested that it is important to determine the relationship between student motivation and learning outcomes in online PBL.

Summary

PBL has been utilized for over 30 years in medical education and more recently has been advocated as a teaching method for other health care professionals. With the advent of online learning environments, this student directed method of instruction has been advocated as an effective instructional design. PBL in face to face and online environments has been found to have advantages in relation to the development of critical thinking skills, application of learning to practice, motivation for learning and increasing self-directed learning abilities. These advantages have enabled students to perform better in work settings and develop life-long learning skills. However the literature also indicated that PBL in both online and face to face environments could be frustrating for individuals that were inadequately prepared to participate in this student directed learning environment. Self-directed learning ability and motivation have been documented as important aspects of the PBL process and also related to success in online learning environments. As suggested by Levett-Jones (2006) and Litzinger et al. (2005) not all students may possess the SDLR required for effective participation in PBL. This lack of SDLR coupled with lower levels of motivation may interfere with student success in online PBL. It is therefore important to determine whether student characteristics of SDLR and motivation influence their changes in content knowledge after participation in an online PBL module. Knowledge of the relationship between SDLR and motivation and learning outcomes is vital to determining whether PBL can be used effectively in online learning environments with students that differ in regard to these characteristics.

Chapter III. Methodology

Problem based learning (PBL) has been suggested as an instructional strategy that builds student critical thinking skills and improves their ability to become lifelong learners (Choi, 2005; Donner & Bickley, 1993; Schell & Kaufman, 2009; Spinello & Fischbach, 2004 & Tiwari, 2006). Because of these strengths, PBL has been implemented in the education of health care professionals. PBL has also been proposed as an effective method of interactive learning in the online environment (Ortiz, 2004). However both PBL and online learning appear to achieve greater learning gains when the learners have characteristics of Self-directed Learning Readiness (SDLR) and motivation (Levitt-Jones, 2005 & Litzinger et al., 2005).

This research was designed to compare the change in content knowledge after participation in an online PBL module versus a traditional learning experience. Student self-directed learning readiness (SDLR) and motivation were investigated to determine the relationship of these attributes to content knowledge change in both learning environments. This chapter describes the research methods for this study and includes the following sections: sample, research questions, research setting and procedures, instruments, limitations and assumptions, pilot study and results, and summary.

Sample

The research study used a sample of convenience. The participants were 124 students enrolled in four sections of a Nutrition for Health Professionals course (HLTH 331) at a Mid-Atlantic comprehensive university. The course is required for pre-nursing majors and is an elective for other health professional students. Two sections were randomly selected to serve as

the control group and receive traditional instruction. The remaining two sections served as the treatment group and participated in the online PBL module. All remaining instruction and grading for the four sections was identical. The only variable was the instructional strategy utilized in the diet and disease unit.

The course population varied in demographic and academic characteristics. Students ranged in age from 18 to 46 years with the majority of the learners (81.6%) in the 19 to 22 year old age range. There were 104 female and 20 male student participants. The majority of students, 74% had declared pre-nursing as their undergraduate major with students from other majors as follows: exercise science; 6.3%; health science, 3.1%; gerontology, 3.1%; pre-dental hygiene 1.6%, and other, 9.4%.

Students were required to take introductory biology and chemistry as prerequisites to this course. A previous nutrition course is not required for HLTH 331. The majority of the participants (61%) were enrolled in their second academic year at the university. The remaining participants were distributed as follows: first year, 5%; third year, 18%, fourth year, 11%, post baccalaureate or non-degree, 5%.

Effect size. In preparation for this study a review of the literature was conducted to determine effect size. This determination was necessary because detecting a small effect would require a much larger sample than a larger effect would require. This literature review produced a wide variability in effect sizes resulting from research on PBL, SDLR and learning outcomes. Because of this variability in effect sizes in the literature reviewed two methods were utilized to attempt to reasonably estimate an adequate sample size. Using two methods allowed the

researcher to better approximate the range of sample size that would be needed to detect the variety of effect sizes found in the literature.

Statistical results from this research review showed correlations ranging from r= 0.073 for SDLR scores and performance on national medical exams (Findley, B.W., 2012) to r= 0.51 for active learning effectiveness in the online environment. Scores related to learning outcomes and preceptor evaluation ranged from r= 0.43 to 0.51 (Nikitenko, G., 2009). Effect sizes for problem based learning versus traditional instruction ranged from d = 0.55 to d = 0.82 (Gabr, H. & Mohamed, N., 2011; and Sendag, S. & Odabasi, H.F., 2009). Converting these scores to r resulted in r = 0.27 and r = 0.38. The statistical tool G power was utilized to determine the sample size needed to achieve r scores ranging from .51 to .25. This analysis at the 0.05 level resulted in needing a sample size between 27 and 123 to produce similar correlations (Faul, F., Erdfelder, E.,Buchner, A., Lang, A.G., 2009).

An alternate method of determining effect size was also employed by averaging 11 correlation coefficients ranging from .07 to .51 producing an average of .288. Averaging the smallest effects and the largest effects provided an approximation of the true effect size. The statistical tool G power was again utilized to determine the sample size need to achieve an r = .30 (Faul, F. et al., 2009). This analysis at the 0.05 level resulted in needing a sample size of 84. Therefore the sample size of 124 achieved for this study of four sections was considered adequate.

Research Questions

This research was guided by the following questions:

1. Is there a statistically significant difference in student content knowledge after participation in an online PBL module as compared to traditional instruction?
2. Is the difference in content knowledge that results after participation in an online PBL module or traditional instruction correlated with student SDLR?
3. Is the difference in content knowledge that results after participation in an online PBL module or traditional instruction correlated with student motivation?

Research Setting and Procedures

The research took place during the fall semester of 2012 in a required course for pre-nursing majors in the College of Health Professions. The previously noted, HLTH 331course is an upper level, 3 credit course that is offered in spring and fall semesters in a 16 week hybrid format by the Department of Health Science. The goals of the course include providing an introduction to the relationship of nutrition to overall health as well as the development and treatment of disease. The course syllabus, which can be found in Appendix B, illustrates the course content and objectives.

Pre-nursing students enroll in the course prior to their formal application to the nursing program. The course must be completed successfully before students are admitted to the nursing program. Students from other disciplines take the course at various times in their undergraduate careers. As previously stated students are required to successfully complete introductory biology and chemistry prior to taking this course to allow them to have sufficient background to understand the structure and function of nutrients.

Students enrolled in HLTH 331 in the Fall of 2012 had the opportunity to choose between four class sections containing a maximum of 35 students. Students selected the section based on their individual scheduling needs. The students were informed of the research at the beginning of the semester and were invited to voluntarily participate. Students were assured that participation or non-participation would have no effect on their course grade.

Two of the class sections were randomly selected to be the control group (traditional instruction) and two were selected to be the treatment group (PBL). The only difference between the control and treatment group was the use of the online PBL module for the diet and disease unit instruction in the treatment group.

A traditional lecture with assigned readings and a PowerPoint presentation was conducted to provide didactic content to the control group. The PowerPoint presentation and lecture notes were adapted from those provided with textbook resources. Students in the control group used the course management system, Blackboard, to access the PowerPoint presentation associated with the lecture for this module. Only the students registered in the two control group sections could access the PowerPoint presentation on the specific Blackboard site for their section. The control group had no other Blackboard interaction related to this module and could not access the online PBL module used as the instructional strategy with the treatment (PBL) group.

The treatment group did not have access to the lecture, lecture notes, or PowerPoint presentation provided to the control group on their Blackboard sites. Their instruction consisted of group participation in the online PBL module. The course management system, Blackboard, was utilized to present information and resources related to the module for the treatment group

(PBL) and could only be accessed by students enrolled in the two PBL sections. Students in the treatment group also used Blackboard to share information that they gathered related to the project with their peers. Students were required to use a group blog and/or discussion board to post and share the results of their research and comment upon the research provided by other group members. The instructor also utilized the blog and discussion board areas to facilitate discussion between and interact with group members. The group file exchange area was utilized to post the final product.

Prior to beginning the module on diet and disease students in both the treatment (PBL) and control groups completed the informed consent (Appendix C), Diet and Disease Assessment content knowledge pre-test (DDA) (Appendix D) and the Self-directed Learning Readiness Motivation Assessment (SDLRMA) (Appendix E). The DDA pretest and PBL module were course requirements for students in the treatment group. The DDA pretest and Diet and Disease Lecture components of the traditional instruction unit were required for students in the control group. The SDLRMA was completed only by those students who consented to participate in the research. Students could complete the SDLRMA at the end of class or at home. After completing the PBL module or traditional instructional unit, students were required to complete the DDA posttest as a part of course assessment and were asked to voluntarily complete the SDLRMA in the manner described above.

The post instruction SDLRMA survey included additional questions aimed at determining other sources of information related to diet and disease which students may have encountered outside of the class environment. These questions (Appendix F) replaced the demographic questions in part one of the initial SDLRMA, The questions were designed to

assist the investigator in determining whether external experiences may have influenced the change in knowledge that occurred as a result of the PBL module or traditional instruction unit.

In order to assure that the data collected could be linked between the pre and posttest periods, students in both the treatment (PBL) and control groups received a packet coded with an identifying number. This packet contained the informed consent, DDA pretest and the SDLRMA. A master list of names and numbers was maintained by the researcher to assure that the data collected by individual participants at the pretest period could be matched with that collected at the posttest period. Upon completing the PBL module or traditional instruction students received a second packet coded by their identifying number. This packet consisted of the second SDLRSMA and the DDA posttest.

Institutional Review Board approval was granted by Towson University's Institutional Review Board (IRB) for Research Involving the Use of Human Participants under Exemption Number 12-A052 on March 8, 2012 (Appendix A).

Instruments

Two instruments were used to collect data for this study: the SDLRMA and the DDA pre/posttest. The first instrument focused on student SDLR and motivation and was created using two previously validated tools. The Self-directed Learning Readiness Scale for Nursing Education (SDLRSNE) and the Motivated Strategies for Learning Survey (MSLQ) are described below in more detail. A description of the second instrument, the DDA pre/posttest, which was designed to assess content knowledge, is also provided below.

Self-Directed Learning Readiness and Motivation Assessment. In order to measure SDLR and motivation, the SDLRSNE developed by Fisher et al. (2001) and a subset of the

Motivated Strategies for Learning (MSLQ) developed by Pintrich et al. (1991) were incorporated into one tool, the SDLRMA, constructed specifically for this study (Appendix E). The SDLRMA consisted of 57 items in three sections: a brief five question demographic questionnaire; a 40 item Likert scale survey to assess SDLR; and 12 additional items assessing student motivation. This instrument was administered to the sample at week 5 to determine student attributes in both groups prior to participation in instruction. The SDLRMA was administered again at week 9 to test for reliability of initial participant responses. A description of the SDLRSNE and the MSLQ detailing validity and reliability of these instruments follows.

Self-Directed Learning Readiness Scale for Nursing Education. The SDLRSNE was developed in 2001 by using the Delphi Technique with a panel of 11 nurse educator experts (Fisher et al.,2001). This process was used to assess the content and construct validity of a number of items to reflect self-directed learning readiness. After two rounds of the Delphi Technique, 52 items were selected for piloting based on expert consensus. The resulting instrument was administered to a convenience sample of 201 undergraduate nursing students and analyzed using principal components factor analysis with varimax rotation. In addition Cronbach's alpha, and item-to-total correlations, to measure construct validity, internal consistency, reliability and unidimensionality, were computed on the questionnaire. Items with item-total correlation coefficients greater than 0.30 were retained and 10 items were dropped from the scale. The factor analysis on the remaining items, using a traditional criterion of 0.30, indicated that most of the items loaded uniquely on one of three components. These three components and the associated number of items are as follows: Component I, Self-Management was defined by 13 items; Component II, Desire for Learning was defined by 12 items; and Component III Self-Control consisted of 15 items. Cronbach's coefficient alpha was computed

to determine internal consistency for each component. The following values were obtained: total item pool (n= 40), 0.92; self-management (n=13), 0.86; desire for learning (n=12), 0.85; and self-control (n=15), 0.83. The scales have an acceptable level of internal consistency since their values are greater than 0.70 (Fisher, King & Tague, 2001). Administration of the total item pool (n=40) in this study resulted in a Cronbach's coefficient alpha of 0.85; self-management (n=13). 0.70; desire for learning (n=12), 0.60; and self-control, 0.81. Additionally the 40 item motivation scale had a test/retest reliability of r = 0.82 in this study when administered at 5 weeks and 9 weeks to the study participants.

A factor analysis collected data from 227 first year nursing students and suggested that 11 items from the original scale were redundant and may not be theoretically essential. However due to the small sample size the authors recommend that the 40 item SDLRSNE should continue to be used until further research using much larger samples can determine item interactions across subscales (Fisher & King, 2010).

The SDLR items (questions 1-40) were based upon a 5 point Likert scale ranging from strongly agree to strongly disagree. A sample question follows:

I can be trusted to pursue my own learning.

1=Strongly disagree;

2=Disagree;

3=Neutral;

4=Agree;

5=Strongly Agree

Motivated Strategies for Learning Questionnaire. In order to measure student motivation the intrinsic and extrinsic goal orientation and control of learning beliefs subscales of the MSLQ was utilized (Pintrich et al., 1991). This questionnaire was developed with the intent that researchers could utilize it in its entirety or select specific subscales to serve their research purposes (Duncan & McKeachie, 2005). The Cronbach's alpha for each of these subscales are as follows: intrinsic goal orientation, 0.74; extrinsic goal orientation, 0.68; and control of learning beliefs, 0.60. Administration in this study resulted in Cronbach's alpha as follows: intrinsic goal orientation, 0.73; extrinsic goal orientation, 0.67; and control of learning beliefs, 0.72. The test/retest reliability in this study was as follows: intrinsic goal orientation, $r = 0.52$; extrinsic motivation, $r = 0.58$; and control of learning beliefs, $r = 0.41$.

Duncan and McKeachie (2005) stated that the "MSLQ was developed using the social-cognitive view of motivation and learning strategies" (p. 117). This view holds that motivation is contextually bound and can vary dependent upon course content. Motivation therefore is viewed as dynamic rather than being an innate characteristic of the learner (Duncan & McKeachie, 2005).

The MSLQ was developed in 1986. Data was collected in 1986 on 326 students; in 1987 data was collected on 687 students; and in 1988 data was collected on 758 students. After each collection point data was analyzed and the instrument was revised to construct the resulting scales. The MSLQ has been subjected to factor analyses and correlations with academic performance measures and revisions have been made as a result of these analyses (Pintrich et al., 1993). The factor analysis revealed that the motivational subscales represented a coherent conceptual and empirically validated framework for assessing student motivation in the college

classroom. Furthermore, the motivational scales demonstrated correlations with student academic performance in the expected direction.

Since its development the MSLQ has been used in different countries and languages to survey diverse samples across a variety of content areas. Results regarding motivation in these studies suggest that students with positive motivational beliefs such as intrinsic goal orientation tend to participate in deep processing strategies. In addition achievement motivation and self efficacy were shown to have a strong effect on college grade point average (Duncan & McKeachie, 2005).

A seven point Likert scale is used to score the MSLQ subscales with 7 being 'very true of me' and 1 being 'not at all true of me'. A score for each subscale is computed by summing the items in the scale and taking the average (Pintrich et al., 1991). A sample question follows:

> 43. The most satisfying thing for me in this course is trying to understand the content as thoroughly as possible. 1=Not at all true of me, 2, 3, 4, 5, 6, 7=Very True of Me

Content Knowledge Pre-Posttest. The DDA was administered to determine whether changes in knowledge occurred as a result of participating in the learning activities associated with the control and treatment groups (Appendix D). The multiple choice questions on the DDA were designed to reflect the learning objectives of the module. This instrument was reviewed by content area experts to determine question clarity and validity. Each reviewer completed an assessment sheet rating the consistency of the question on the DDA with the objectives in the course module. This assessment sheet is available in Appendix G. Revisions to the DDA were made as suggested by these experts prior to administration in the study. Questions that obtained inconsistent ratings by the reviewers were removed from the instrument resulting in a final

instrument composed of 21 items. The order of the questions was varied between pre and post administration of the DDA to prevent student recollection of responses and eliminate potential threats to validity in assessment of changes in content knowledge. The test-retest reliability on this instrument was calculated in SPSS resulting in a correlation coefficient $r = .42$, $p = .01$.

PBL Module Design

The Diet and Disease PBL module (DDPBLM), created for this study was presented online to the treatment group in place of two face-to-face class meetings during the fifth week of the sixteen week course. Students were expected to use study time outside of the allotted course time to complete the module requirements. This module replaced a portion of both in class and out of class time during the four weeks that students were given to work on the final product. A group area was provided on Blackboard for each small PBL group to facilitate sharing of resources and group communication. Each small group had access to a blog, discussion board, file exchange and email to communicate and post information related to the module as required. Students were required to post their individual contribution to the module as well as the final product to the file exchange in their designated group area. Data regarding the amount of time that each group member spent on the module was recorded by the student in the second SDLRMA.

The DDPBLM was designed to increase students' knowledge of the relationship between diet, diabetes and cardiovascular disease. The instructional goals of this module are to prepare students to provide nutrition assessment and education to patients who have blood lipid and blood glucose disorders. The DDPBLM and the desired learning objectives can be found in Appendix H.

The four phases of PBL, as described by Zubaidah (2005) and summarized in Table 1, were adhered to for the design of the DDPBLM. In the first phase of DDPBLM, student groups were presented with an ill-structured scenario that they might encounter in clinical practice. Information about a particular type of patient in a health care setting was provided in narrative form via the course management system. The scenario placed the students in a busy medical practice that was encountering an increase in patients with similar health issues. Students were required to act as health care professionals participating in an education task force charged with the mission of dealing with the education needs of patients. Medical, family and diet history, laboratory values and social setting of one patient was described to provide students with questions that will enable them to identify their learning needs to accomplish the task. Students were required to work in groups of four to research and arrive at the problem solution. The problem solution required the development of a teaching tool that could be utilized in the clinic setting for patient education.

Table 1

Zubaidah's Phases of Problem Based Learning

Phase	**Activity**
Phase 1	Student group reasons though problem and identifies learning needs.
Phase 2	Students engage in self-directed learning to explore the topic.
Phase 3	Students apply individual research to the problem in groups.
Phase 4	Students summarize information and solve problem.

Note: Zubaidah (2005)

In phase two, each student in the group was required to take on a specific role within the group to facilitate his/her research. The roles included: the medical history and lab expert, the

diet and disease expert, the food composition and menu planning expert, and the editor/summarizer. These roles enabled students to research information on the relationship between lab values and disease; medical history and disease; diet therapy and disease; and food composition as it relates to appropriate diet therapy. Students were expected to utilize a variety of online resources along with traditional print materials to complete their research.

In the third phase of the DDPBLM, the students were required to share the information they gathered that coincided with their assigned role to facilitate the development of the patient education material. As described by Zubaidah (2005), students needed to apply the information gathered during independent research to work towards generating a final product. The roles that they assumed during independent research were designed to be somewhat overlapping to facilitate the exchange of ideas in this third phase.

Finally, in phase four groups were required to summarize the information that they gathered to design a presentation, pamphlet or video designed to educate patients about diabetes, cardiovascular disease and diet therapy. Students needed to assemble and integrate their research in the creation of a product that could be utilized in an authentic patient care setting.

Student groups were given limited class time to work on the DDPBLM and group areas in the course management system allowed for online communication to facilitate group collaboration. These areas provided access to a group discussion board, group email, group blog and a file exchange. The instructor also had access to the group areas to provide guidance to students as needed.

Prior to use in this study, the DDPBLM was validated by experts in PBL, online learning and medical nutritional therapy. Experts were asked to review the module and make qualitative

comments regarding the content and structure of the module. Recommendations obtained from these experts were utilized to make changes to wording and structure to allow for an optimum student learning experience.

Traditional Instruction

Students in the two sections receiving traditional instruction were provided with unit learning objectives, textbook readings and a PowerPoint lecture. The lecture notes and the PowerPoint lecture were adapted from materials provided by the textbook publisher. These lecture notes and PowerPoint slides were reviewed by experts in medical nutritional therapy for consistency with the learning objectives of the instructional unit. The assessment sheet for this review can be found in Appendix I. Recommendations from the experts were utilized to make changes to the PowerPoint slides and lecture notes to increase clarity and understanding for students. The resulting PowerPoint, lecture notes and objectives can be found in Appendix J. The traditional lecture was conducted by the same instructor using the PowerPoint slides and lecture notes in both traditional sections during the same time period as the DDPBLM was being utilized in the PBL sections.

Pilot Study

A pilot study was conducted in Spring 2012 to test for administrative and logistical issues that could result in the implementation of this study design. Completing the pilot study in this semester allowed time for modifications to take place prior to the planned study time period in Fall 2012. Nutrition for Health Care Professionals was taught in four sections with two sections selected to serve as the treatment group (PBL) and two as the traditional instruction control group. Of the 93 students enrolled in the study, completed instruments were received from 86

students resulting in a response rate of 92%. Data was obtained from 43 students in the treatment group and 43 students in the control group.

The pretest DDA was administered during the fifth week of the semester and the posttest DDA was administered at the ninth week to determine the reliability coefficient of the test and to determine whether it adequately measured changes in student content knowledge. The first SDLRMA survey was administered prior to participation in either instructional strategy to determine if there were any issues with the instrument. It was administered again after participation to determine consistency and validity of the instrument with the study participants. Students were given the opportunity to complete the survey in the classroom in time provided at the end of class. Alternatively students could take the SDLRMA home and return the completed instrument at the next class session. This method of survey distribution resulted in a 92% return rate for the both SDLRMA instruments.

As a result of the pilot, changes to wording were made in the demographic questions to increase clarity. Changes were also made in wording to the second SDLRMA instrument to better capture the amount of time students spent studying the module materials.

Limitations and Assumptions

As with all studies, there are issues that need to be addressed regarding limitations and assumptions. This research was conducted with attempts to control as many factors as possible. For this study, the participants used the same syllabus, textbook, assignments, activities, lessons and tests throughout the semester. The only variable was the learning environment. The limitation and assumptions for this study are as follows:

- It is possible that outside sources and issues in the media surrounding diet and disease may have affected students' content knowledge. While data was collected to help shed light on the possibility of this occurrence, it was beyond the control of this research to keep participants from exposure to these influences.
- The selection of participants may also be a limitation of this study. Since this was a quasi-experimental design and subjects were not randomly assigned to either treatment of control group it was assumed that similar students would be distributed among the four sections of the course.
- Generalizability may be a limitation of this study. The characteristics of this group of students may be different from other undergraduate pre-nursing/health professions students. The sample size also limits the ability to apply the study's findings to a broader population because the study population may lack the variety found in other groups.
- The design of the PBL module may be a limitation. Knowing this limitation, attempts described above, were made to address validity and design. These steps included review of the module and learning objectives by PBL and content experts.
- The online PBL module was available to the PBL participants for a four week period. This time period may affect the influence that the PBL instructional strategy has on content knowledge change.
- Finally, as with all studies where the researcher is directly involved with the participants, existing biases have the potential to affect outcomes. The participant

researcher statement in Chapter 1 describes my background, experiences, and perspectives on teaching and learning.

Summary

This study sought to find out if there is a relationship between SDLR and motivation to changes in content knowledge after participation in an online PBL module. Students self-selected into four sections of a Nutrition for Health Professionals course. Two sections of this course were randomly selected to be the treatment (PBL) group and the other two sections served as the traditional instruction control group. Every effort was made to keep all other class materials the same leaving the instructional method for this module as the only difference. Survey instruments were used to measure student SDLR and motivation characteristics. A common pre/posttest of content knowledge (DDA) was used to measure student learning gains with both instructional methods. A pilot study was completed. Due to issues of clarity wording was changed in one question related to demographic characteristics and one related to study time. Participation in the study was voluntary. Across the four sections 125 students were registered, 63 in the treatment group and 62 in the control group, 124 participated in the study and complete data was collected for 124 participants.

Chapter IV. Results and Findings

The purpose of this research was to compare the change in content knowledge after participation in an online Problem Based Learning (PBL) module versus a traditional learning experience. In addition this research investigated student self-directed learning readiness (SDLR) and motivation to determine the relationship of these student attributes against content knowledge change in both learning environments.

The research was designed around data collected from participants who were enrolled in four sections of an introductory nutrition course for health professionals. Two sections were randomly selected to participate in a traditional instructional module and the remaining sections participated in an online PBL module. The traditional instruction and the PBL module were designed to accomplish the learning objectives of the diet and disease unit. Characteristics of participants across the two learning environments were studied. Two instruments were utilized to collect data: the Self-Directed Learning Readiness Motivation Assessment (SDLRMA) and the pre/posttest of content knowledge (DDA). The relationships between self-directed learning readiness, motivation and performance on the posttest of content knowledge were determined. This chapter consists of the following sections: descriptive statistics of the participants overall, and by learning environment, research questions, and a summary.

Descriptive Statistics

The Self-Directed Learning Readiness Motivation Assessment (SDLRMA) was used to assess the SDLR, intrinsic and extrinsic motivation and control of learning beliefs scores of the participants. This instrument also collected demographic information from all participants. Data were collected on gender, age, major, computer expertise and reason for taking the course. The SDLRMA was administered during the fifth week of class prior to participation in the learning

experience. The instrument was administered again at week nine to determine consistency of responses and measure validity of initial responses. The second administration of the instrument also collected data on participants' study habits including study hours, use of print and electronic resources, and factors that influenced participant knowledge of diet and disease. Data collected will be presented for both the sample as a whole and then grouped by learning environment.

Description of Respondents. Out of a total of 126 students registered in the course, 125 agreed to complete the surveys. One student withdrew from the course during the sixth week of the semester resulting in a final total of 124 participants and a 98% response rate.

The sample consisted of 104 (83.9%) females and 20 (16.1%) males. The average age was 20.4 years old with 96 (76.6%) between the ages of 18-20; 19 (15%) between the ages of 21-22; six (4.7%) between the ages of 23-30; and three (2.4%) age 30 and over. There were 94 (74%) pre-nursing students among the participants. Eight (6.3%) exercise science majors and 4 (3.1%) health education majors participated. The remainder of the participants consisted of 4 (3.1%) gerontology majors, 2 (1.6%) pre-dental hygiene students and 12 (9.4%) from other majors. One hundred participants (80.6%) indicated that they were taking the course to fulfill a major requirement. Of the remaining participants, 10 (8%) were taking the course as an upper level elective and 14 (11%) for other reasons. Ninety-six (77.4%) participants self-rated their computer expertise at the intermediate level; computer expertise for eleven (8.8%) participants was reported as novice and 16 (12.9%) as expert. A summary of demographic characteristics for participants is provided in Table 2.

Scores for SDLR, extrinsic and intrinsic motivation and control of learning beliefs were computed for each respondent. The mean SDLR score for the respondents overall was 160.9

(*SD* = 12.76) on a scale with a maximum value of 200. The intrinsic motivation mean was 5.04 (*SD* = 0.82); extrinsic motivation mean was 5.88 (*SD* = 0.96) and control of learning beliefs mean was 5.92 (*SD* = 0.91) on a seven point scale. A content knowledge pretest, the Diet and Disease Assessment (DDA) was administered to students in both learning environments at week five of the semester. This test assessed the prior knowledge of the participants regarding diet and disease content covered in the PBL module and traditional instructional unit. The participants had a pretest mean total score of 9.67 (*SD* = 2.64) out of a possible 21 points. The content knowledge posttest (DDA) was administered after instruction at week nine to both groups resulting in a mean total score of 15.13 (*SD* = 0.91) out of 21 points possible.

Description by Learning Environment. The instructional methods used for each section were randomly assigned. Two sections participated in the online PBL module and two received a traditional lecture as the instructional strategy for the diet and disease unit. The participants were unaware of the instructional method that would be used for this unit when they enrolled in the course. They were also unaware that a different instructional strategy was being employed in other sections. Of the 124 participants in this research, 50.8% (*n* = 63) were in the PBL group and 49.2% (*n* = 61) were in the traditional instruction control group.

Data collected from the participants indicated that there were numerous similarities between the groups. There were no significant differences in age, gender, student major, computer expertise or reason for taking the course between the PBL and traditional instruction groups. The SDLR and motivation scores were also similar between the two groups. Participant characteristics by group are presented in the following sections.

Problem based learning group. The PBL group participated in the online Diet and Disease PBL module (DDPBLM) as the instructional strategy for this unit. Participants had access to the DDPBLM through the course management site. As noted above, this group was made up of 63 (50.8%) individual participants.

Descriptive information. The mean age for the 63 participants in the PBL group calculated from an open ended survey item, was 19.9 years. The group had 51 (81%) participants in the 18-20 year range; eight (13%) in the 21-22 year range; and four (6%) in the 23-30 year range. There were 10 (16%) males and 53 (84%) females in the PBL group. Fifty (79%) pre-nursing students made up the majority of participants in this group. The remaining participants were three (5%) health education majors, three (5%) exercise science majors, one (2%) pre dental hygiene student, and six (10%) other majors. Intermediate computer expertise was reported by 49 (76.6%) participants in the PBL group. Four (6.3%) participants reported novice computer skills and nine (14.1%) expert skills. The course was a major requirement for 52 (81.3%) participants. Three (4.7%) participants were taking the course as an upper level elective and eight (12.5%) for other reasons. A summary of demographic characteristics for the PBL group is provided in Table 2.

Problem based learning attributes. The mean SDLR score for the PBL group was 159.76 (*SD* = 13.31) on a scale where the maximum score is 200. Values of 150 or greater on this instrument suggest that students are ready for self-directed learning activities (Fisher et al., 2001). The PBL group consisted of 52 (82.5%) participants with scores above 150 and 11(17.5%) participants with scores below 150.

Intrinsic, extrinsic motivation and control of learning beliefs scores are means of items scored on a seven point scale. The PBL group had a mean intrinsic motivation score of 4.95 (*SD* = 0.78). The extrinsic motivation mean for this group was 5.85 (*SD* = 1.06). The control of learning beliefs mean was 5.97 (*SD* = 1.04). A mean score of 3 or greater on these scales is considered predictive of academic success in post-secondary education (Pintrich et al., 1993).

The content knowledge pretest DDA total mean score was 9.21 (*SD* = 2.49) and the content knowledge posttest DDA total mean score was 14.78 (*SD* = 2.66). The maximum score for this assessment was 21. The mean difference between the pretest and posttest scores was 5.57 (*SD* = 2.83). The content knowledge pre/posttest, SDLR and motivation scores for the PBL group can be found in Table 3.

The PBL group reported a mean of 5.74 (*SD* = 6.33) study hours for the diet and disease unit. The suggested online resources were used by 54 (85.7%) participants. Additional online resources were utilized by 56 (88.9%) of the PBL group participants. The course text book was used as a resource by 36 (57.1%) of the participants and 13 (20.6%) used additional print resources.

Participants also reported previous and current influences on their knowledge of diet and disease. Fourteen (22.2%) participants reported taking a prior nutrition course. Television influenced the knowledge of 20 (31.7%) participants. Radio influenced three (4.8%) participants and magazines influenced 10 (15.9%) participants. Encounters with physicians increased diet and disease knowledge for seven (11.1%) participants. Other professionals influenced the knowledge of 14 (22.2%) participants. Family conversations affected the knowledge of 24 (38.1%) participants. Finally 42 (66.7%) participants indicated that other college courses

provided information that influenced their knowledge of diet and disease during the instructional period.

Traditional instruction group. The traditional instruction group received a PowerPoint lecture and textbook readings as the instructional strategy for the diet and disease unit. The lecture and readings had the same learning objectives as the DDPBLM. As noted above, this group was made up of 61 (49.2%) individual participants.

Descriptive information. The mean age, calculated from an open ended survey response, was 20.9 years for the 61 participants in the traditional instruction group. This group had 45 (74%) participants in the 18-20 year range, 11 (18%) in the 21-22 year range, two (3%) in the 23-30 year range, and three (5%) in the 30 and over age range. There were 10 (16%) males and 51 (84%) females in the traditional instruction group. Forty-four (72%) group participants were pre-nursing students. The remaining participants were one (2%) health education major, five (8%) exercise science majors, one (2%) pre-dental hygiene student and six (10%) other majors. Intermediate computer expertise was reported by 47 (74.6%) participants in the traditional instruction group. Seven (11.1%) participants reported novice skills and seven (11.1%) expert computer skills. The course was a major requirement for 48 (76.2%) participants. Seven (11.1%) participants in the traditional group were taking the course as an upper level elective. The remaining six (9.5%) participants had other reasons for taking the course. Table 2 provides a summary of the demographic characteristics for the entire sample and for the PBL and traditional instruction groups.

Traditional instruction attributes. The mean SDLR score at week 5 for the traditional instruction group was 162.08 (*SD* = 12.17) on a 200 point scale. Scores of 150 and above were

achieved by 51 (83.6%) traditional participants. The remaining 10 (16.4%) participants scored less than 150. The mean intrinsic motivation score for the traditional instruction group was 5.13 (*SD* = 0.85). The extrinsic motivation mean was 5.91 (*SD* = 0.87) and control of learning beliefs mean was 5.86 (*SD* = 0.76). The mean scores were obtained by averaging item values on a seven point scale.

The content knowledge pretest DDA total mean score was 10.15 (*SD* = 2.73) and the content knowledge posttest DDA total mean score was 15.49 (*SD* = 3.12). The maximum score on this assessment was 21 points. The mean posttest pretest score difference was 5.34 (*SD* = 3.09) points. The content knowledge pre/posttest, SDLR and motivation scores for the traditional group can be found in Table 3.

Participants in the traditional group reported 3.97 (*SD* = 2.78) study hours for the diet and disease unit. The course text book was used as a resource by 50 (82%) participants. Additional print resources were utilized by 27 (44.3%) participants and online resources by 38 (62.3%) participants in the traditional instruction group.

Survey responses indicated that 12 (19.7%) participants had taken a previous nutrition course. Television influenced the diet and disease knowledge of 27 (44.3%) participants and radio influenced eight (13.1%) participants. Thirteen (21.3%) participants reported that magazines influenced their diet and disease knowledge. Physician visits affected the knowledge of 12 (19.7%) participants and other health care professionals impacted the knowledge of 18 (29.5%) participants. Family discussions influenced 23 (37.7%) participants and other courses influenced 38 (62.3%) participants during the instructional period.

Table 2

Demographics

	All Participants (N = 124)	PBL (n = 63)	Traditional Instruction (n = 61)
Gender			
Male	20	10	10
Female	104	53	51
Mean age	20.4	19.9	20.9
Age range			
18-20	96	51	45
21-22	19	8	11
23-30	6	4	2
>30	3	0	3
Major			
Pre-nursing	94	50	44
Health education	4	3	1
Exercise science	8	3	5
Gerontology	4	0	4
Pre-dental hygiene	2	1	1
Other	12	6	6
Computer Expertise			
Novice	11	4	7
Intermediate	96	49	47
Expert	16	9	7
Reason for course			
Major requirement	100	52	48
Upper level elective	10	3	7
Other	14	8	6

Problem Based Learning and Traditional Instruction Groups Compared. The demographic characteristics of the participants in both groups were similar. There was no significant difference between the PBL and traditional groups in age, gender, major, computer expertise and reason for taking the course. It was essential to compare groups to look for similarities and differences. Showing that groups had similar attributes and demographics allowed the researcher to make an argument that differences in change in content knowledge were more a result of the instructional experience than dissimilarities in group characteristics.

The mean SDLR score at week 5 for the PBL group, 159.76 (*SD* = 13.31), was not significantly different from the mean SDLR score for traditional instruction, 162.08 (*SD* = 12.17). There was no significant difference between groups in intrinsic, extrinsic motivation or control of learning beliefs.

Paired t tests indicated that there was a statistically significant difference from the pre to post content knowledge test across both groups: PBL $t(62)= 15.6$, $p = .001$ and Traditional $t\ (60) = 13.47$, $p = .001$. This difference in the content knowledge DDA from pre to posttest administration indicated that learning took place with both instructional strategies.

There was also a statistically significant difference, $t(122) = 2.006$, $p = .047$ in the content knowledge pretest between the PBL group and the traditional instruction group. On a 21 point scale, the PBL group score was 9.21 and the traditional instruction group score was 10.15; showing that the traditional instruction group had greater prior knowledge of the diet and disease content than the PBL group. The posttest of content knowledge however was not significantly different between the two groups with the PBL group scoring 14.78 and traditional instruction 15.49. Effect sizes using Hedges' *g* indicated that the difference between the PBL and traditional group means were small on all measures. Data resulting from the pre/post test scores, SDLR, motivation and the correlating effect size for the PBL and traditional groups are presented in Table 3.

There were no significant differences between the PBL and traditional groups regarding influences such as exposure to information from television, radio, magazines, physicians, professionals, family and other courses. Twenty-six (21%) participants, 14 in the PBL group and

12 in traditional instruction, reported taking a previous nutrition course showing no significant difference between the two groups.

Table 3

PrePost Test, SDLR and Motivation Scores and Effect Sizes

	PBL M (SD)	Traditional M (SD)	t	P	Hedges' *g*
Content Knowledge Pretest	9.21 (2.49)	10.15 (2.73)	-2.01	.047*	-0.36
Content Knowledge Posttest	14.78 (2.66)	15.49 (3.12)	-1.37	.17	-0.24
SDLR score	159.76 (13.31)	162.08 (12.17)	-1.01	.31	-0.18
Intrinsic motivation	4.95 (0.78)	5.13 (0.85)	-1.22	.22	-0.22
Extrinsic motivation	5.85 (1.06)	5.91 (0.87)	-0.32	.75	-0.06
Control of learning beliefs	5.97 (1.04)	5.86 (0.76)	0.69	.49	0.12
Pre/posttest score difference	5.57 (2.83)	5.34 (3.10)	0.42	.67	0.08

Note. PBL group n = 63; Traditional group n = 61
*p<.05

There was a significant difference $t(122) = 1.99$, $p = .049$ between the two groups regarding study hours reported. The PBL group reported a mean of 5.74 (SD = 6.33) study hours while the traditional group reported a mean of only 3.97 (SD = 2.78) study hours. There was also a statistically significant difference in textbook use χ^2 (1, N = 124) = 8.99, $p = .003$, between the PBL group and the traditional group with the latter reporting to have used the textbook more

heavily. Print resource use was statistically different χ^2 (1, N = 124) = 7.92, p = .005 between the two groups as was the use of online resources χ^2 (1, N = 124) = 11.95, p = .001. The traditional group reported greater use of print resources and the PBL group used online resources more heavily. Online resource use data indicated that 54 (86%) of PBL participants used the suggested resources and 56 (89%) sought additional online resources to complete the PBL module. This resource use suggested that the PBL group participated as intended in the online module. The differences in study habits and resource use are reported in Table 4.

Summary of Descriptive Statistics. The sample for this study was taken from four sections of an introductory nutrition course for health professionals at a Mid-Atlantic public university. Two sections received an online PBL problem and two received traditional instruction for the unit on diet and disease. The groups were similar in age, gender, academic major, computer expertise and reason for taking the course. Participant SDLR scores and motivation scores in the PBL and traditional groups were also similar. There was no statistically significant difference between the PBL and traditional instruction group on these characteristics.

There was a statistically significant difference between the content knowledge pre and posttests in both groups. The pretest scores in the traditional group were higher than the PBL group but the posttest scores were not significantly different between the two groups. The traditional instruction group reported fewer study hours (M = 3.97, SD = 2.78) than the PBL group (M = 5.74. SD = 6.33) resulting in a statistically significant difference between the two groups. The traditional group relied on the textbook and print resources while the PBL group used online resources more heavily. This resource use indicated that the majority of participants in both groups performed as intended in the respective instructional strategies. There were no

differences between the two groups regarding previous nutrition courses or outside influences that affected their knowledge of diet and disease during the instructional period.

Table 4

Study Hours, Resource Use and Outside Influences

	PBL	Control	t	Chi Square	P
Mean Study Hours	5.74	3.97	1.99		.049*
SD Study Hours	(6.33)	(2.78)			
Text Use	36	50		8.99	.003*
Suggested Online	54	0		124	.001*
Print Resources	13	27		7.92	.005*
Additional Online	56	38		11.96	.001*
Prior Nutrition Course	14	12		0.12	.727
Television	20	27		2.06	.151
Radio	3	8		2.68	.102
Magazine	10	13		0.67	.436
Physician	7	12		1.75	.186
Family	24	23		0.002	.964
Health Professionals	14	18		0.86	.354
Other Classes	42	38		0.26	.661
No Influences	13	9		0.73	.391

*p<.05

Research Questions

This study focused on changes in content knowledge from pre to posttest as a result of the utilization of two different learning strategies - online PBL and traditional instruction. Data regarding motivation and SDLR were collected to assess the influence these characteristics might have had on changes in content knowledge. This section contains the results pertaining to the research questions for this study: (1) Is there a statistically significant difference in student content knowledge after participation in an online PBL module as compared to traditional instruction? (2) Is the difference in content knowledge that results after participation in an online

PBL module correlated with student SDLR? (3) Is the difference in content knowledge that results after participation in an online PBL module correlated with student motivation?

Research Question 1. *Is there a statistically significant difference in student content knowledge after participation in an online PBL module as compared to traditional instruction?* Data used to answer this question came from the content knowledge pre and posttests scores between the PBL and traditional instruction groups. A t test comparing the pretest scores in both groups indicated a statistically significant difference $t(122) = -2.006$, $p = .047$, between the traditional group and the PBL group prior to instruction. However, posttest means did not differ PBL = 14.78 (SD = 2.66) versus traditional mean = 15.50 (SD = 3.12, Hedges' $g = -0.24$). An ANCOVA testing the effect of PBL versus traditional instruction on posttest scores, in which pretest scores, SDLR, and motivation were statistically controlled was performed. This analysis was also not statistically significant, $F(1,116) = 2.23$, $p > .05$, PBL mean = 15.01 (SD = 2.74) versus traditional instruction mean = 15.25 (SD = 2.71, Hedges' $g = -0.09$). Indeed, partialling the effects of the pretest, SDLR and motivation from the content knowledge posttests resulted in a reduction of the difference between the PBL and the traditional groups. The effect size estimated using Hedges' g indicates a small difference in group posttest means both before and after accounting for SDLR and motivation. Further analysis of the data was conducted to determine the magnitude of the score change from pretest to posttest in each group. The mean gain in content knowledge from pre to post test for the PBL group was 5.57 points (SD = 2.83; $\Delta = 2.24$) and 5.34 (SD = 3.09; $\Delta = 1.96$) for the traditional instruction group. A paired t test on pre/post scores for the PBL group indicated that there was a statistically significant gain in content knowledge $t(62) = -15.61$, $p > .05$ as a result of instruction. The traditional group also had a statistically significant change in content knowledge from pre to posttest $t(60) = -13.47$, p

>.05. An independent t test for the difference between groups' gain scores was not statistically significant (t (122) = 0.426, p > .05, Hedges' *g* = 0 .08). This analysis showed no significant difference between the PBL and traditional instruction groups in changes of content knowledge score between pre to post test.

Research Question 2. *Is the difference in content knowledge that results after participation in an online PBL module correlated with student SDLR?* Data to answer this question were obtained from participant scores on the content knowledge pre and posttest and 40 SDLR questions. The mean score on the content knowledge pretest for the PBL group was 9.21 (*SD* = 2.49) and the mean score on the content knowledge posttest was 14.78 (*SD* = 2.66) on a 21 point scale. The mean content knowledge change from pre to post test for the PBL group was 5.57 (*SD* = 2.83). The mean SDLR score for the PBL group was 159.76 (*SD* = 13.31) on a 200 point scale. A SDLR score of 150 or greater indicated a readiness for self-directed learning activities (Fisher et al., 2001). Of the 124 participants who completed the study, 103 (83%) had SDLR scores of 150 or greater and 21 (17%) had lower scores. An ANCOVA $F(1, 116) = 0.001$, $p > .05$ that controlled for performance on the pretest showed no significant relationship between posttest scores and SDLR in either PBL or traditional groups. Because success in PBL has been related to SDLR, further analysis was conducted to determine the magnitude of the effect of SDLR on the change in content knowledge in this group. A one way ANOVA $F(1, 61) = 0.82$, $p > .05$, Hedges' $g = 0.30$ also showed no statistically significant relationship between high and low SDLR score groups and changes in content knowledge from pretest to posttest in the PBL group. This analysis indicated that while the relationship between SDLR score and content knowledge change was not significant, there was a moderate relationship of SDLR to the change in content knowledge

Research Question 3. *Is the difference in content knowledge that results after participation in an online PBL module correlated with student motivation?* Data to answer this question were obtained from the scores on the content knowledge pre/posttests and 12 questions designed to assess intrinsic and extrinsic motivation and control of learning beliefs. The scores for intrinsic, extrinsic motivation and control of learning beliefs were computed by averaging the four items that corresponded with each attribute. The mean motivation scores for each attribute were above 3 indicating that all participants had high motivation levels. The mean intrinsic motivation score was 4.95 (SD = 0.78), the mean extrinsic motivation score was 5.85 (SD = 1.06), and the control of learning beliefs mean score was 5.97 (SD = 1.04) on a seven point scale. An ANCOVA that controlled for the content knowledge pretest score was performed to determine the relationship that these covariates had with the content knowledge posttest score. The ANCOVA indicated that there was no statistically significant relationship of posttest score with intrinsic motivation F (1, 116) = 0.66, $p > .05$; extrinsic motivation F (1, 116) = 1.23, $p > .05$; or control of learning beliefs F (1, 116) = 0.02, $p > .05$.

As noted above the mean intrinsic, extrinsic motivation and control of learning beliefs scores exceeded three in both the PBL and traditional instruction groups. Only one participant in the PBL group had intrinsic and extrinsic motivation and control of learning beliefs scores lower than three on a seven point scale. In the traditional instructional group only one individual had an intrinsic motivation score lower than three. The lack of participants with low motivation scores made further ANCOVA analysis of the effect of high and low motivation levels on content knowledge change impractical. Therefore no further analysis was conducted because all motivation scores were high and there was no significant variability between participants and groups.

Summary

The participants in this study included 63 students in the PBL group and 61 students in the traditional instruction group. The participants were predominately female (84%) with an average age of 20.4 years. The majority of participants were pre-nursing majors (74%) with intermediate (75.6%) computer expertise. Analysis of demographics revealed that there were no significant differences between the PBL and traditional groups in terms of gender, age, major, computer expertise, or reason for taking the course.

The majority of the students in the PBL and traditional instruction groups had SDLR scores of 150 or greater suggesting that they were ready for self-directed learning activities. There were no significant differences in SDLR scores between the two groups. The intrinsic, extrinsic motivation and control of learning beliefs scores were also similar in both groups. The mean motivation scores indicated that the participants had potential for success in a post-secondary setting.

A series of paired t tests revealed that there were significant differences between the content knowledge pre and posttests in both the PBL and traditional groups. This result indicates that learning did take place as a result of both instructional strategies. However there was no statistically significant difference between the content knowledge posttest scores based on instructional strategy. SDLR and motivation scores did not have an effect on content knowledge posttest scores when the content knowledge pretest score was controlled. These results indicated that the learning strategy, SDLR and motivation scores had no statistically significant effect on the content knowledge posttest scores in either learning environment.

Participants in the PBL group reported more study hours (*M* = 5.74; *SD* = 6.33) than the traditional group (*M* = 3.97; *SD* = 2.78). PBL group participants utilized the suggested online resources and sought additional online resources for the module. In contrast, the traditional group used online resources less but used the course textbook and print resources more frequently than the PBL group.

Chapter V. Discussion

Health care professionals today must be equipped to function in an ever changing, complex medical environment. This environment demands that individuals become more active learners and be able to cultivate life-long learning ability, apply didactic knowledge to practice, and demonstrate critical thinking skills (Young & Maxwell, 2007). The traditional teaching strategy in the undergraduate health professional classroom has been lecture and while this method may be preferred by faculty and students, Cook (2007) suggested that it does little to promote critical thinking skills, application to practice, or to accommodate the needs of today's learner.

In 2003, the National League of Nursing released a position statement that called for a movement away from traditional nursing education. The board stated that traditional instruction emphasized content laden, highly structured curriculum with measureable objectives and emphasized what to teach rather than how to teach with the most effective instructional methods. This call to action and the need to develop the skills mentioned above, began to revolutionize nursing education and brought multiple methods of student centered instruction into the nursing classroom (Young & Maxwell, 2007).

Problem Based Learning (PBL) is a student directed approach that has been effective in facilitating the acquisition and development of the skills needed for professional performance. This instructional strategy has been studied extensively in medical schools in the face to face environment and more recently has been examined in online settings and with other student populations (e.g., Anderson & Treadway, 2009; Choi, 2003; Donner & Bickley, 1993; Nathoo et

al., 2005; Pastirik, 2006; Rounds & Rappaport, 2008; Ryan et al., 2004; Schell & Kaufman, 2009; Siu et al.,2005; Spinello & Fischbach, 2004; Tiwari et al., 2006; Valaitis et al., 2005). These studies have focused on changes in critical thinking, application to practice and student satisfaction. There is limited research however on changes in content knowledge related to participation in online PBL as compared to traditional instruction.

This research was conducted because PBL is proposed as an effective method of instruction in the online environment. Distance education programs for nursing have grown at a phenomenal rate (Hodson-Carlton, Siktberg, Flowers, & Scheibel, 2003) and determining the effectiveness of PBL as an instructional method in this environment is urgent in order to validate its use in nursing education.

Additionally self-directed learning readiness (SDLR) and motivation have been identified as attributes related to success in both PBL and online learning (Boyd, 2004; MacKinnon, 1999; Schrum & Hong, 2002; Song et al., 2004). These characteristics have not been measured to determine their correlation with changes in content knowledge. Understanding how these attributes impact learning is imperative in order to plan instructional strategies that meet student needs.

This study sought to gain an understanding of the effectiveness of online PBL in producing content knowledge change and how this change was influenced by participant SDLR and motivation. This chapter further describes and discusses the research results for this study and includes the following sections: research summary, including a discussion of the results, recommendations for future research, and a conclusion.

Research Summary

This study examined the change in content knowledge as a result of participation in online PBL or traditional instruction. Change in content knowledge based on learning environment and student attributes of SDLR and motivation were also investigated. Data were collected through survey instruments focused on pre and post content knowledge, SDLR and motivation attributes. Demographic characteristics and student study habits were also investigated to determine their impact.

The study participants were enrolled in an introductory nutrition course for health professionals. This course was a requirement for all pre-nursing majors and an elective for other health care professional students. The course was offered in a hybrid format with a combination of online and face to face activities. A total of 126 students were enrolled in four course sections and 124 completed the study. Two course sections (63 students) were randomly selected to receive an online PBL module for the diet and disease unit. The other two sections (61 students) received traditional instruction consisting of a PowerPoint, lecture and notes for the same unit. The students selected their course section based on convenience and were unaware of the difference in the instructional method for the diet and disease unit. All other instruction across the four sections was identical.

Two instruments were used to collect data for this study. The instruments were the Content Knowledge Pre-Posttest (DDA) and the Self Directed Learning Readiness Motivation Assessment (SDLRMA). The DDA pretest was administered the fifth week of class prior to instructional activities related to diet and disease. The DDA posttest was administered during week nine of the semester after completion of the unit. The SDLRMA was also administered at the same time as the DDA pre and posttests. Demographic information was collected on the first

administration and study habits information was collected on the second administration of the SDLRMA. Of the 126 participants enrolled in the course, 124 completed all of the instruments.

The demographic data for the participants showed similarities between those in the PBL and traditional groups. The average age and age distributions in each group were comparable with the greatest percentage of participants in the 18-20 year range. The distribution of males and females were consistent across groups as was student major. The majority of participants were female pre-nursing students who were taking the course as a major requirement. The self-rated computer expertise of almost ninety percent of participants was intermediate or expert in both groups. Further analysis of demographics between groups showed no significant difference in age, gender, student major, computer expertise or reason for taking the course between the PBL and traditional instruction groups.

The PBL and traditional groups shared similarities in study habits but there were notable differences in resource use and study time. There were no significant differences between the PBL and traditional groups regarding outside experiences that influenced diet and disease knowledge. These outside experiences included exposure to information from television, radio, magazines, physicians, professionals, family and other courses. There was no significant difference between the two groups in the number of students who reported taking a previous nutrition course.

There was a significant difference ($p = .049$) between the two groups regarding study hours reported. The PBL group reported a mean of 5.74 study hours while the traditional group reported a mean of 3.97 study hours. There was also a statistically significant difference in textbook use ($p = .003$), between the PBL group and the traditional group with the latter group

using the textbook more heavily. The use of print resources was higher in the traditional group versus the PBL group. This difference was statistically different ($p = .005$) between the two groups. Textbook and other print resource use by the traditional group suggested that these participants performed as expected in a traditional instruction environment. Eighty-six percent of the PBL group used the suggested online references provided as part of the PBL problem. In addition the PBL group utilized additional online resources at a higher rate than the traditional instruction group. This difference was statistically significant ($p = .001$), between the two groups. The use of online resources in the PBL group suggested that the majority of participants performed in the online PBL module as intended. Participants in the PBL group used the blog, discussion board and file exchange provided in Blackboard, to communicate, interact and post information related to the problem.

Discussion of Results

The results of this research supported areas of current research but also provided questions for further study. This section will discuss the results in relation to the research questions that were designed to guide this investigation:

1. Is there a statistically significant difference in student content knowledge after participation in an online PBL module as compared to traditional instruction?
2. Is the difference in content knowledge that results after participation in an online PBL module correlated with student SDLR?
3. Is the difference in content knowledge that results after participation in an online PBL module correlated with student motivation?

Research Question 1. *Is there a statistically significant difference in student content knowledge after participation in an online PBL module as compared to traditional instruction?* To answer this research question a t test comparing the pretest scores in both groups was performed prior to instruction. This test indicated a statistically significant difference $t = -2.006$, $p = .047$, between the traditional group and the PBL group with the traditional group having higher initial content knowledge. However, an ANCOVA designed to analyze posttest scores while controlling for performance on the pretest indicated that there was no significant difference between groups regarding changes in content knowledge. An independent t test also showed no significant difference between groups on changes in content knowledge from pre to posttest. These results suggest that both PBL and traditional learning environments were equally successful in improving content knowledge from pre to posttest. Therefore using online PBL was as effective as traditional instruction for these study participants.

The reviews of Albanese and Mitchell (1993), Colliver (2000) and Norman and Schmidt (1992) who examined the use of PBL in the face to face environment in medical education concluded that PBL performed neither better nor worse than traditional instruction in regards to changes in content knowledge. Dennis (2003), using a posttest-only comparison, found that online PBL was as effective as face to face PBL with regards to learning outcomes. Albanese (2000) further suggested that expecting students who were previously taught with traditional strategies to do better in their initial exposure to a PBL environment is unreasonable. Therefore the results of the current study can be interpreted as positive, in agreement with existing PBL research, and in support of using online PBL as at least as an effective instructional strategy in an online learning environment.

Recently, Gabr and Mohamed (2011) found that undergraduate nursing students engaging in face to face PBL demonstrated improved content knowledge and problem solving abilities over their peers who were engaged in traditional instruction. In contrast, Sendag and Odabasi (2009) found that students in an online PBL course had similar changes in content knowledge to those in an online instructor led course. However the students engaged in online PBL had an increase in their critical thinking skills that was more significant than those in the online instructor led course. The findings of these two studies share both similarities and differences with the results of the research reported here. However these studies and the current study all indicate that PBL was as good as traditional instruction in improving content knowledge. Furthermore it may be effective in improving problem solving and critical thinking, two areas that were not examined in the current study.

Finally, Hung (2011) suggested that there are various models of PBL that when implemented with different populations could impact the effect on learning outcomes. Additionally, Hung (2011) suggests that human factors that influence the students' learning processes can also impact research results. Attempts were made in this study to control as many human factors as possible but further research should be conducted in this area. Further research may also be warranted to examine the strategies used in PBL implementation and their impact on student content knowledge. For example in this study the online PBL module was implemented in a hybrid course. Students utilized an online blog and file share to complete the PBL module in this study, but also had the opportunity for face-to-face discussions. Their use of the blog, file share and online resources suggested that they implemented PBL as intended. However further research should examine how to improve this implementation to increase content knowledge change.

Additionally, this module took place over a four week period which may have been too short a time period to assess the effects PBL as an instructional strategy to improve content knowledge. Further research should examine the effect of online PBL on content knowledge over longer periods of time in both hybrid and fully online settings.

Research Question 2. *Is the difference in content knowledge that results after participation in an online PBL module correlated with student SDLR?* To answer this research question the scores from the pre/post DDA and the first 40 questions of the SDLRMA were utilized. These 40 questions made up the SDLRNE designed by Fisher et al. (2001) to assess self-directed learning readiness for nursing education. A score of 150 or greater on this instrument suggests that the student is prepared to undertake self-directed learning activities.

One way ANOVAs were performed to test the relationship between high SDLR scores and low SDLR scores and changes in content knowledge from pretest to posttest. As seen in these data there was no significant relationship between high or low SDLR and differences in content knowledge from pre to posttest.

The mean SDLR scores for the participants in this study were higher than anticipated by this researcher. However these scores were consistent with scores generated using the same instrument with Chinese baccalaureate nursing students (Yuan, Williams, Fang, Pang, 2011). Yuan et al. (2011) suggested that student attributes such as a strong sense of responsibility, perseverance and self-discipline enabled these students to take initiative for their own learning. The participants in the study may have shared similar characteristics with the students Yuan et al. (2011) studied, resulting in their high scores on the SDLR scale. Students in pre-nursing programs are often aware of the highly competitive nature of nursing school admission and

therefore those that do not have the characteristics described above may choose to no longer pursue this major. Therefore due to this competitive environment, the participants in this study had attributes that enabled them to succeed either with a self-directed learning strategy such as PBL or in a traditional learning environment.

Yuan et al. (2011) also found that students with previous experience in small group learning or PBL had higher SDLR scores. It is possible that the current study participants may have had previous learning experiences that also impacted their SDLR. Further study is needed to determine how prior learning experiences affect SDLR and learning outcomes with online PBL.

Additionally, Yuan et al. (2011) found that senior students had higher SDLR scores than junior students. This finding was also demonstrated in a review of literature conducted by O'Shea (2003) who suggested that students become more self-directed in their learning as they mature. In Smedley's (2007) implementation of the SDLRNE she found that younger students were less ready for SDL than older students. Smedley suggested that students who are older and have work experience are more prepared for SDL than students who immediately enter higher education from secondary school. In the current study, 75.6% of participants were in the age range of 18-20 suggesting a fairly homogeneous sample with regard to age. Therefore based on age alone it would seem that a greater number of students would have SDLR scores lower than 150 and would be challenged by self-directed learning strategies. Of the 124 participants who completed this study, only 21 (17%) students had SDLR scores less than 150. These lower scores were distributed in each of the age groups with the exception of the 30 and over group. An ANOVA comparing age groups with SDLR showed no statistical difference in the current study. This suggests that for these participants age did not affect SDLR scores.

As previously mentioned, an ANOVA comparing participants lower SDLR scores with the posttest/pretest score difference did not show statistical significance. This finding suggests that in this particular group of students, a lack of SDLR did not have an effect on their ability to increase content knowledge with either instructional strategy. It is possible that other factors, such as the design of the instruction, influenced students' ability to increase content knowledge from pre to posttest. For example, the participants had access to learning objectives for the diet and disease unit. Romito and Eckert (2011) suggested that students utilized learning objectives for PBL cases to study for assessments and that this positively impacted their performance. The use of learning objectives rather than student interaction in the PBL group was related to achievement scores in their study. In the current study, all participants, and particularly those with low SDLR, may have benefitted from access to learning objectives to prepare for the posttest. Therefore student SDLR may not have impacted posttest scores because students were not totally dependent on the PBL process to uncover the knowledge essential for improvement on the posttest.

In their model of SDL for online environments, Song and Hill (2007) suggested that SDL is made up of the following three components: personal attributes; learning process and learning context. Perhaps those participants with lower SDLR benefitted from the resources that were available within the learning context. These resources consisted of the availability of learning objectives, suggested online resources and instructor interaction during the PBL process. Further research is needed to determine how the resources above were beneficial for student learning.

Research Question 3. *Is the difference in content knowledge that results after participation in an online PBL module correlated with student motivation?* Data used to answer this question were collected through the content knowledge pre/posttests and the 12 SDLRMA

questions designed to assess intrinsic and extrinsic motivation and control of learning beliefs. These questions were subscales of the Motivated Strategies for Learning Questionnaire developed by Pintrich et al., (1991) and were based on the social cognitive view of motivation. This view holds that motivation is contextually bound and can vary dependent upon course content. Motivation therefore is viewed as dynamic rather than being an innate characteristic of the learner (Duncan & McKeachie, 2005). Intrinsic, extrinsic motivation and control of learning beliefs were measured in this study. The motivation and control of learning belief scores generated by the participants in the current study were similar to those obtained by Pintrich et al. (1991) suggesting that these students had moderate to high levels of motivation and felt that their efforts to learn would result in positive outcomes. The scores for extrinsic motivation in this group were also consistent with those obtained by Salamonson, Everett, Koch, Wilson and Davidson, (2009) who found that first year nursing students had a high mean extrinsic motivation score. Intrinsic, extrinsic and control of learning beliefs scores were also similar in distance learning students surveyed by Richardson (2007) at the Open University.

An ANCOVA that controlled for pretest performance indicated that there was no statistically significant relationship between the change in content knowledge from pre to posttest and intrinsic and extrinsic motivation and control of learning beliefs scores. Participants in this study had high levels of both intrinsic and extrinsic motivation and felt responsible for their own learning. As a result, it is impossible to determine the outcomes that might have resulted with students who had lower motivation scores. However Richardson, (2007) and Chen and Jang (2010) found that intrinsic and extrinsic motivation scores did not predict learning outcomes with students who were engaged in distance and online learning. Chen and Jang (2007) suggested that students may have differing motivation levels but still achieve success in

the course. Richardson (2007) indicated that student motivation and attitudes have an effect on their study behaviors and these effect learning outcomes. In the current study students in the PBL group studied longer than traditional students and used online resources more frequently. Obtaining more detailed information about these and other study behaviors would be beneficial to further determine the effect of motivation on content knowledge.

Recommendations for Future Research

The results of this study showed that online PBL was as effective as traditional instruction in improving content knowledge regardless of student SDLR and motivation. The student attributes of SDLR and motivation were not correlated with their content knowledge change in either learning environment. During the analysis it was determined that the majority of the students had high levels of SDLR, intrinsic and extrinsic motivation and responsibility for their learning. These findings provide a positive outlook for student directed learning strategies in nursing education and give insight into student's preparedness to succeed in online learning environments.

PBL vs. Traditional Instruction. Online PBL resulted in the same improvement in content knowledge as traditional instruction suggesting that this student directed instructional method is effective for this group of students. Additional research on student study habits and the implementation of online PBL is needed to determine why PBL students reported more study hours than traditional students. Further research could determine whether additional study hours are required when using online PBL or whether this instructional method motivates students to spend more time with the material. A detailed investigation of how students utilized the resources provided for online PBL would give insight into how the PBL environment was implemented. This information could increase the understanding of student behaviors in each

phase of PBL. Gaining an understanding of these behaviors would be beneficial in determining effective practices and additional resources that could be provided to enhance the learning experience.

This study examined content knowledge change as a measure of student learning. However PBL has been suggested as being an effective method to improve other important student learning outcomes. Further investigation regarding critical thinking, problem solving and application of knowledge to practice would also shed light on the effectiveness of online PBL. Additionally a follow-up study of student recall of information would help determine whether online PBL has increased effectiveness in retention of knowledge over that achieved with traditional instruction.

Self-Directed Learning Readiness. The majority of students in this study had SDLR scores of 150 or greater suggesting a high degree of SDLR in the sample. Further investigation is needed to determine whether these students are representative of all pre-nursing and health professional students. Additional research is needed to determine whether online PBL is effective in changing content knowledge in student groups with much lower SDLR scores.

In this study the level of SDLR was not correlated with changes in content knowledge since students with low SDLR performed as well as those with high SDLR in both learning environments. The reason for this finding requires further investigation. Additional research is needed to determine if the interaction of the PBL group or resources in the PBL environment such as access to learning objectives were related to student learning outcomes.

Intrinsic, Extrinsic Motivation and Control of Learning Beliefs. Students in this study had high levels of intrinsic and extrinsic motivation and felt responsible for their learning.

The intrinsically motivated students did as well as the extrinsically motivated students regarding changes in content knowledge. This finding suggests that additional research is needed to determine how each type of motivation effects students' study habits and implementation of online PBL. For example do students with higher levels of intrinsic motivation generate more learning issues than those with extrinsic motivation? Do extrinsically motivated students depend more upon the learning objectives provided to focus their study and research? Additional research could provide information about how intrinsic and extrinsic motivation is related to the amount of time spent and how students structure their time in online PBL.

Conclusion

This research showed that online PBL and traditional instruction were equally effective in increasing content knowledge in health professional students. The change in content knowledge obtained in both learning environments was not correlated with student SDLR and motivation. Based on an SDLR score of 150, the majority of participants in this study were ready for self-directed learning activities such as PBL. These SDLR scores indicated that this group of students was well prepared to succeed in changing learning environments. This attribute may partially explain the successful learning outcomes obtained with online PBL. However students with low SDLR scores showed the same improvement in content knowledge as those with high SDLR scores. The change in content knowledge regardless of student SDLR indicates that online PBL was an effective instructional strategy that should be more widely implemented in nursing education.

Previous research in this area found that nursing students exhibit high SDLR scores in general. Scores were higher in older students and those who had previous experience with group and self-directed learning activities. It had been suggested that SDLR was correlated to learning

outcomes when students engaged in self-directed learning activities. The current study did not find a correlation between SDLR scores, age and learning outcomes as measured by changes in content knowledge. This finding suggested that factors other than SDLR may have contributed to successful learning outcomes in online PBL. Perhaps student interaction or resources within the PBL environment contributed to successful learning outcomes. The findings indicated that success of this online instructional strategy was not dependent on student characteristics but instead on the instructional context. An opportunity exists to further define the features of effective online PBL implementation based on the outcomes of this research.

Intrinsic and extrinsic motivation scores obtained in this study were also high. Control of learning beliefs scores obtained indicated that the participants felt that they controlled their learning. Research in this area suggested that both intrinsic and extrinsic motivation and learner control can lead to successful learning outcomes in the online environment. This study found no correlation between motivation scores, control of learning beliefs scores and changes in content knowledge. However since participant scores were high and there was little variability of scores this study was unable to demonstrate the effect that low scores would have on changes in content knowledge. The high motivation and control of learning beliefs scores obtained by this group of health care professional students indicate that they were prepared to be successful in an academic environment. Therefore this student population should be offered more opportunities to engage in these student-directed instructional strategies.

Online PBL can be an effective instructional strategy with pre-nursing and health care professional students. Students in this learning environment achieved changes in content knowledge similar to those in the traditional environment. SDLR, motivation and control of learning beliefs did not impact changes in content knowledge gained in PBL. The results of this

research suggested that online PBL could be successfully incorporated into a hybrid course as an alternative to traditional instruction. Furthermore the findings of this study support a wider implementation of online PBL with nursing and health care professional students because the majority of these students possessed the attributes for success in these learning environments. However success was attained even in the absence of these attributes suggesting that the learning environment can be designed to effectively support all students.

Appendices

Appendix A - IRB Approval

TOWSON
UNIVERSITY

APPROVAL NUMBER: 12-A052

To: Kathleen Gould
8000 York Road
Towson MD 21252

From: Institutional Review Board for the Protection of Human Subjects, Marcie Weinstein, Member

Date: Wednesday, March 07, 2012

RE: Application for Approval of Research Involving the Use of Human Participants

APPROVED
MAR – 8 2012
TOWSON IRB

Office of University Research Services

Towson University
8000 York Road
Towson, MD 21252-0001

T 410 704-2236
F 410 704-4494

Thank you for submitting an Application for Approval of Research Involving the Use of Human Participants to the Institutional Review Board for the Protection of Human Participants (IRB) at Towson University. The IRB hereby approves your proposal titled:

The Relationship between Self-Directed Learning Readiness and Student Motivation on Learning Outcomes in an Online Problem Based Learning (PBL) Module

If you should encounter any new risks, reactions, or injuries while conducting your research, please notify the IRB. Should your research extend beyond one year in duration, or should there be substantive changes in your research protocol, you will need to submit another application for approval at that time.
We wish you every success in your research project. If you have any questions, please call me at (410) 704-2236

CC: W. Sadera
File

Appendix B - Course Syllabus

Towson University
Health Science Department

Nutrition for Health Care Professionals

Health 331

Fall 2012

Instructor: Kathy Gould, M.A., R.D., L.D.N.
Clinical Assistant Professor

Office Hours: 11-12 Tuesday and Thursday; Wednesday afternoon by appointment.
Office: Linthicum Hall 101D
Office Phone: 410-704-5937
E-Mail: kgould@towson.edu

Course Description: This course explores the metabolism of nutrients and the incorporation of nutritional principles into practical guidelines for health, weight management and sound food choices throughout the human life cycle. Emphasis is placed on evaluating dietary intakes and nutritional practices for achieving wellness and treatment of chronic disease. This course is a required prerequisite for admission into the nursing program. The prerequisites for this course are BIOL 190 and CHEM 121/121L or the equivalent.

Course Learning Outcomes: As a result of taking this course, the student will be able to

- Describe the structures, classifications, functions and dietary sources of the essential nutrients.
- Compare and use guides such as ChooseMyPlate, U.S. Dietary Guidelines, and Nutrition Facts labels for calculating and assessing nutritional intake.
- Relate digestive tract anatomy to mechanical/enzymatic nutrient digestion and absorption, including hormonal regulation of these functions.
- Apply research-based standards and concepts of nutritional adequacy to analyze and improve dietary intake, given specific dietary intake information.
- Describe the metabolic pathways used to convert nutrients into useable body energy and factors influencing pathway use.
- Relate the factors that determine body energy needs to the diagnosis, causes and safe treatment of eating and/or weight issues.

- Identify the causes of vitamin and mineral deficiencies and their effects on the human body.

- Explain the relationships between nutrient intake and common chronic diseases and/or malnutrition, when given a list of nutrients.

- Describe appropriate dietary recommendations to prevent and treat common chronic diseases.

Required Text and Diet Analysis Software:

1) Whitney, Ellie, Rolfes, Sharon R., Understanding Nutrition, 12th edition.
2) Diet Analysis Plus 10.0 Software required.

A package which includes both the Diet Analysis Software and the Textbook is available at the Towson Bookstore ISBN # 9781111290283. Used and new texts may also be purchased online (12th edition) or at the Towson Book Exchange. Rental of this book is also available. The book is available in its entirety or by the chapter in digital format online at Digital Textbook.

If you purchase the textbook separately, you will need the Diet Analysis Software to complete a required project. Please do not purchase a used copy of this software because it is an access code to online software and access codes may only be used once. New access codes are available immediately by selecting the following item at the link below:
Diet Analysis Plus 2-Semester Instant Access Code, 10th Edition
Wadsworth ISBN:10 0-538-49509-X, ISBN:13 978-0-538-49509-7
Diet Analysis Plus 2-Semester Instant Access Code

College of Health Professions Vision Statement: To be a preeminent leader in the education of health, human service, and sport-related professionals for practice, education, management, and research and in the provision of initiatives that support the integration of health, well-being, and education for a diverse population in Maryland and the United States.

College of Health Professions Mission: The College of Health Professions is a major educational, research, and outreach resource for health and well-being in the University, the community, and the State of Maryland.

The College of Health Professions develops outstanding professionals at undergraduate and graduate levels in a wide range of health care, human service, and sport-related fields that promote and enhance health and human performance to assure well-being in a diverse world.

Expectations: Students are expected to come to class on time having read the assigned readings and completed assignments. They should be prepared to contribute to the class discussion individually and as members of their assigned discussion groups. Excessive absence from class will be reflected in the class participation grade at the discretion of the instructor. Acceptable reasons for class absence include documented medical concerns, documented court appearances, and religious holidays.

The use of cell phones and other electronic devices is not appropriate during the class period. This activity will be regarded as an absence from class in terms of class participation. It is desirable that students be present in both mind and body. Cell phone calculators may be not be used during an exam. If calculators are needed during an exam, the instructor will provide one for class use to students who do not have one available.

Academic Dishonesty is unacceptable. The Towson University policy for academic integrity will be followed for any behaviors that constitute fraud during the course. The Academic Integrity Policy is available on the university website at the following link Academic Integrity Policy

Special Needs Accommodations*:* This course is in compliance with Towson University policies for students with disabilities. Students with disabilities are encouraged to register with Disability Support Services (DDS) at 7720 York Road, Suite 232 [(Phone 410-704-2638) (Voice or TDD)]. Students who suspect that they have a disability but do not have documentation are encouraged to contact DSS for advice on how to obtain appropriate evaluation. An accommodation can be made.

Attendance and Tardiness: Attendance will be taken either by roll call or attendance sign in sheet at every class. Student participation and behavior will be monitored during class. Texting during class, using the internet for activities unrelated to class, reading material unrelated to class during class will be considered a class absence. Class absence and the behaviors described above will be noted and result in a deduction from the class participation grade. Students who miss more than 10% of class time (4 classes) for any reason will receive an immediate 10 point deduction in their total point score for the semester. Exceptions to this policy will be dealt with on a case by case basis and only if proper documentation of the need for the absence is provided. For example, in order for an absence related to illness to be considered excused, proper written notification must be provided (i.e. note from doctor, etc.) and the instructor may request a copy of the documentation.

Students who miss class are responsible for obtaining class notes from a classmate and making up missed work by the scheduled due date. All assignments must be posted by the due date indicated in the syllabus or in class. Assignments will not be accepted for credit beyond the due date. There will be **no make-up exams**. A missed exam becomes the dropped exam grade. Students who anticipate the necessity of being absent from class due to the observation of a major religious holiday must provide notice of the date(s) to the instructor, in writing, by the *third* class meeting in order for this absence to be excused. Students who will be absent due to a sports commitment must provide appropriate documentation of the event.

Grade Determination: The semester grade will be based on the total number of points accrued from the exams, assignments, class activities and class participation. The student is responsible for completion of the assignments by the due date.

Exams	300 points (50%)
ChooseMyPlate/Dietary Guidelines	30 points (5%)
Diet Analysis 10 Labs:	135 points (22.5%)
Group Diet/Disease Diet Therapy Problem	100 points (16.6%)

In class activities/case studies/homework 50 points maximum (8.3%)

Grading Criteria

The course grade will be determined based on the number of total points earned from all of the assignments described below. The point totals that correspond with a specific letter grade are as follows:

Points	Letter grade	Points	Letter Grade
550-600	A	465-484	C+
535-549	A-	441-464	C
515-534	B+	421-440	D+
500-514	B	391-420	D
485-499	B-	390 or less	F

Assignments

ChooseMyPlate/Dietary Guidelines (30 points)

The purpose of this project is to become familiar with evaluating dietary intake based on the Dietary Guidelines for Americans and the ChooseMyPlate Guidelines. Detailed instructions for this project may be found on Blackboard in the ChooseMyPlate Folder.

5 points	Dietary Guidelines summary and your analysis of its relationship to the ChooseMyPlate Guidelines
15 points	Completed ChooseMyPlate Worksheet
10 points	Food Group and Calories Report for an improved 24 hour intake

Diet Analysis 10 Required Labs (135 points total)
Each student will use his or her own three-day food and beverage record to complete the assigned labs in Diet Analysis 10. These labs are to be posted to the Diet Analysis 10 Software on the dates indicated in the tentative syllabus. You must register in the Diet Analysis Course for your section with the number provided by the instructor to post these labs.

Grading for Diet Analysis Labs

Label Reading I	**15 points**
Label Reading II	**20 points**
Carbohydrate Analysis Lab	**25 points**
Lipid Analysis Lab	**25 points**
Protein Analysis Lab	**25 points**
Perfect Day Lab	**25 points**

Exams (100 Points each for a total of 300 points)

Four exams will be given during the course. The lowest exam score from the **first 3 exams** will be dropped at the end of the semester. The exams will consist of objective and short essay case study type questions. Each exam will cover the information listed in the Class Schedule. Questions on the exams may be from the lecture, readings, activities, case study discussions, multimedia, or other presentations.

Group Diet/Disease Diet Therapy Problem (100 Points)

This problem requires you to work in groups to investigate the appropriate dietary and lifestyle recommendations for patients with specific chronic disease symptoms or at a particular stage in the lifecycle. You will need to research recommendations to develop an education plan for patients. Further details on this project will be available on Blackboard.

Case Study Activities/Assignments (50 maximum Points)

Most chapters have an assignment or case study to accompany them. These Case Studies are highlighted in yellow on the tentative schedule and may be moved if needed based on class progress. These case studies will be discussed in groups in class on the dates indicated in the tentative schedule or announced in class. Attendance for all case studies will provide for a maximum of 50 class discussion points. This total provides for 15 points of extra credit if students have completed their rough draft answers for class and are prepared for discussion. Students must attend class prepared for discussion to receive points for the case study discussion and the assignment will not be accepted in any other manner. Students should prepare for discussion in class as follows:

1. Read the Case Study prior to class and identify what you need to learn to answer the questions as you read the assigned readings and review other materials on Blackboard.
2. Utilize the posted references (videos, articles, etc.) and your textbook to develop your “rough draft” answer to the case study and bring this rough draft to class for discussion with your group.
3. Each group will compose a group answer and be called upon to present their answers to the rest of the class for further discussion.

Tentative Class Schedule

Dates	**Topic**	**Reading Assignments**
8/30	Introduction to Course An Overview of Nutrition	Chapter 1 pg. 3-11; 17-26
9/4	Planning a Healthy Diet Label Reading	Chapter 2 pg. 35-59
Register in Diet Analysis Course with number provided by this date for extra credit		
9/6	Planning a Healthy Diet Label Reading **ChooseMyPlate Project** **Post to BB by 11:59 PM**	Chapter 2 pg. 35-59
Label Reading Lab I & II Due in Diet Analysis 10		
Begin recording 3 day diet intake on 9/9 and include 9/10 and 9/11		
9/11	Digestion	Chapter 3 pg. 69-87
Enter your 3 day diet intake into the Diet Analysis Program and post 3 day average report on BlackBoard by 11:59 on 9/13.		
9/13	Digestion/Absorption ***Digestion Case Study***	Chapter 3 88-94
9/18	**Unit I Test**	**Chapters 1-3**
9/20	Carbohydrates	Chapter 4 pg. 97-123
9/25	Carbohydrates Diabetes ***Carbohydrate Case Study***	Chapter 18 pg. 620-625
Complete Carbohydrate Analysis Lab in Diet Analysis Program **Post in Diet Analysis 10 by 11:59 PM**		
9/27		

Begin Online Group Diet and Disease Problem/No In Class Meeting Today

10/2	Lipids	Chapter 5 pg. 133-170
	Complete Lipid Analysis Lab in Diet Analysis Program **Post in Diet Analysis 10 by 11:59 PM**	
10/4	Lipids Heart Disease ***Lipid Case Study***	Chapter 18 pg. 608-620
10/9	Protein ***Vegetarian Case Study***	Chapter 6 pg. 173-196 pg. 62-67
	Complete Protein Analysis Lab in Diet Analysis Program **Post in Diet Analysis 10 by 11:59 PM**	
10/11	Metabolism	Chapter 7 pg. 205-228
10/16	Metabolism ***Metabolism Case Study***	Chapter 7 pg. 230-239
10/18	Water Soluble Vitamins	Chapter 10 pg. 311-351
	Diet and Disease Group Problem Due **Post in Group area on BB at 11:59 PM**	
10/23	**Unit II Test**	**Chapter 4-7** **Diet and Disease**
10/25	Water Soluble Vitamins ***Water Soluble Vitamin Case Study***	Chapter 10
10/30	Fat Soluble Vitamins ***Fat Soluble Vitamin Case Study***	Chapter 11 pg. 355-380
11/1	Major Minerals	Chapters 12 pg. 383-419

11/6	Trace Minerals ***Sodium Case Study***	Chapter 13 pg. 423-453
11/8	Trace Minerals **Complete Perfect Day Lab in Diet Analysis 10 by 11:59 PM** ***Iron Deficiency Case Study***	
11/13	**Unit III Test**	**Chapters 10-13**
11/15	Energy Balance	Chapter 8 Pg. 241-258
11/20	Weight Management ***Energy Balance Case Study***	Chapter 9 pg. 271-299
11/27	Energy Balance and Weight Management	Chapters 8-9
11/29	**Pregnancy** ***Pregnancy Scenarios***	Chapter 15 pg. 493-527
12/4	**Lactation** ***Lactation Scenarios***	Chapter 15
12/6	**Infancy/Childhood** ***Infancy and Childhood Scenarios***	Chapter 16 Pg. 529-572
12/11	**Senior Nutrition** ***Senior Nutrition Scenarios***	Chapter 17 Pg. 575-602
Finals Week	**Final Exam (Chapters 8 and 9;1 5-18)** **Section 002: Thursday, December 13; 12:30-2:30** **Section 003: Tuesday, December 18; 3:00-5:00**	
Important Dates:	**9/7 Change of schedule ends** **11/7 Last day to withdraw**	

Appendix C - Informed Consent

Letter of Invitation

February 2012

Dear Participants:

My name is Kathy Gould. I am a Clinical Assistant Professor in the Department of Health Science at Towson University and I am interested in investigating the effectiveness of instructional design. I would like to invite you to participate in a study involving the use of a particular instructional method to teach diet and disease. This study will require you to complete a survey that assesses your self directed learning readiness and motivation. This survey should take approximately 15 minutes to complete and your results will be kept confidential. The survey will be coded with an identifying number to allow information from the initial survey to be linked to the subsequent survey to be administered later in the semester. Only group results will be reported.

Your participation in this study is completely voluntary and you are not obligated to answer the survey questions in their entirety. You may participate in this study only if you are 18 years of age or older. You may choose to withdraw from this study at any time. Should you choose to withdraw, this will have no impact on your continued participation in class or grade in this course. Your participation in this research will benefit future development of various instructional methods and technology support in the education of health care professionals. You have the right to have your questions regarding this study answered completely. Please contact Professor Gould at 410-704-5937, my faculty advisor Dr. Bill Sadera at 410-704-2731, or the Chairperson of Towson University's IRB, Dr. Debi Gartland at 410-704-2236. The results of this study will be available from the investigator upon request.

Thank you in advance for your time.

Thank you,

Kathy Gould

Doctoral Student

Student Signature_____

Dr. William Sadera

Towson University

Appendix D - Pre/Posttest (DDA)

Diet and Disease2

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. Which of the following blood pressure readings first signifies a diagnosis of hypertension?
a. 110 over 50
b. 120 over 70
c. 130 over 80
d. 140 over 90

____ 2. Which of the following sources of lipids should be substituted for saturated fats to help lower blood cholesterol levels?
a. Butter
b. Canola oil
c. Coconut oil
d. Stick margarine

____ 3. What is believed to be the primary cause of type 1 diabetes?
a. Defect in insulin sensitivity
b. Excessive body weight gain
c. Defect of the immune system
d. Excessive intake of simple carbohydrates

____ 4. Beverly is a 48-year-old woman with a strong family history of atherosclerosis. She eats a diet high in fat, smokes, and doesn't exercise much because she typically works 12-hour days. Beverly visits her doctor because she has recently been having chest pains. Her doctor suspects she is at risk for a heart attack. Which of the following would be the most definitive predictor of this suspicion?
a. Platelet count
b. C-reactive protein concentrations
c. LDL cholesterol serum concentrations
d. HDL cholesterol serum concentrations

____ 5. To lower a high blood cholesterol level, all of the following are recommended **except**
a. consume 2 servings/week of fish.
b. consume 300 mg or less of cholesterol per day.
c. lower the saturated fat intake to ≤7% total energy.
d. decrease the carbohydrate intake to <50% of total energy.

____ 6. Which of the following risk factors for disease may be modified by diet?
a. Age
b. Gender
c. Heredity
d. Low HDL level

____ 7. Which of the following is a feature of diabetes?
   a. Many people with type 2 diabetes are obese
   b. Most people who have diabetes require insulin therapy
   c. Diabetes results chiefly from excess dietary intake of simple carbohydrates
   d. People with type 1 diabetes fail to respond to the insulin made by the pancreas

____ 8. What is the highest total blood cholesterol concentration (mg/dL) that falls within the desirable range?
   a. 50
   b. 101
   c. 199
   d. 299

____ 9. The role of diet for people with diabetes includes all of the following **except**
   a. sugar and sugar-containing foods need not be avoided.
   b. the glycemic effect of foods should be a primary consideration.
   c. diets should provide a consistent carbohydrate intake spaced throughout the day.
   d. the dietary amount of carbohydrate is more important than the source of carbohydrate.

____ 10. What is a normal range (mg/dL) for blood glucose?
   a. 60-80
   b. 70-110
   c. 120-140
   d. 140-180

____ 11. Ronnie eats a fairly balanced diet, but wants to include a good source of omega-3 fats. Which of the following should be your recommendation?
   a. Eggs
   b. Salmon
   c. Low fat cheeses
   d. Lean chicken breast

____ 12. Which of the following foods contains cholesterol?
   a. Corn
   b. Olives
   c. Roasted turkey
   d. Roasted peanuts

____ 13. Your roommate Bob has just come back from the doctor where he was subjected to a blood lipid profile analysis. The doctor provided him with dietary changes because the cholesterol results put him at increased risk for cardiovascular disease. Which of the following results is consistent with the diagnosis?
   a. Low LDL and high HDL
   b. Low HDL and high LDL
   c. Low DLD and high DHD
   d. Low LDH and low HDL

____ 14. Among the following, which should be the first action taken to lower blood cholesterol?
a. Begin drug treatment
b. Consume a high-protein diet
c. Consume large amounts of fish and fish oils
d. Achieve and maintain appropriate body weight

____ 15. All of the following disorders are influenced strongly by genetics **except**
a. diabetes.
b. hypertension.
c. diverticulosis.
d. atherosclerosis.

____ 16. All of the following are characteristics of diabetes mellitus **except**
a. type 1 diabetes can occur at any age.
b. type 2 diabetes develops primarily when people reach adulthood.
c. the two major forms are variations of the insulin-dependent type.
d. the most common form is characterized by resistance to insulin by body cells.

____ 17. Which of the following is **not** considered a diet-related risk factor for coronary heart disease?
a. Obesity
b. High sugar intake
c. Glucose intolerance
d. High blood cholesterol

____ 18. What blood cholesterol carrier is of greatest concern in atherosclerosis?
a. HDL
b. LDL
c. HDK
d. VLDK

____ 19. A person who produces a normal amount of insulin but whose cells show suboptimal response is said to be
a. polydipsic.
b. insulin resistant.
c. hyperglucagonemic.
d. pancreatic beta-cell deficient.

____ 20. What is the term given to mounds of lipid material mixed with smooth muscle cells and calcium that develop in the artery walls?
a. Plaques
b. Angina streaks
c. Arterial thickening
d. Pre-thromboemboli

____ 21. Brooke is a 42-year-old obese person who seems to be always hungry and thirsty. She is constantly drinking sodas and likes to end her dinner every night with a piece of chocolate cake and ice cream. After going to the doctor, Brooke is diagnosed with diabetes. Which of the following types of diabetes does Brooke most likely have?

a. Type 1 diabetes
b. Type 2 diabetes
c. Juvenile diabetes
d. Polydypsia diabetes

Appendix E - Self-Directed Learning Readiness Motivation Assessment (SDLRMA)

SDLRMA

Directions for Respondents:

The purpose of this survey is to evaluate student self directed learning readiness and motivation in different teaching environments. Self-directed learning readiness and motivation are felt to influence how students learn when different instructional methods are utilized. Understanding of these factors can help plan instruction to better fit students' needs.

This questionnaire contains statements related to aspects of self directed learning readiness and motivation. There are no "right" or "wrong" answers. Your opinion and personal feelings are what matter most. Please try to answer all questions in relation to your personal learning experiences.

Section 1 – Demographics

This section is designed to collect general information about you. Please answer the questions by checking the appropriate blank after the correct response.

1. What is your age range? 18-20____21-22_____23-30____ 30 and over____

2. Please indicate your age in years here_____

3. What is your gender? Male_____ Female_____

4. What is your major? Pre-nursing ___ Health Education ___ Exercise Science____

   Gerontology _____ Pre-Dental Hygiene _____ Other _____please specify_____

5. How would you rate your level of computer

   expertise? Novice_____Intermediate_____Expert_____

6. Why are you taking this course?

7. Required for major____ Upper level elective for major ____Other____please

   specify_____

   ____

Please continue with Section II on the next page.

Section II. Please answer the following questions (#1-40) by circling the number that best reflects your opinion using this scale: 5 = Strongly agree (SA); 4 = Agree (A); 3 = Neutral (N); 2 = Disagree (D); 1 = Strongly disagree (SD).

Criteria	SD	D	N	A	SA
1. I manage my time well	1	2	3	4	5
2. I am self disciplined	1	2	3	4	5
3. I am disorganized	1	2	3	4	5
4. I set strict time frames	1	2	3	4	5
5. I have good management skills	1	2	3	4	5
6. I am methodical	1	2	3	4	5
7. I am systematic in my learning	1	2	3	4	5
8. I set specific times for my study	1	2	3	4	5
9. I solve problems using a plan	1	2	3	4	5
10. I prioritize my work	1	2	3	4	5
11. I can be trusted to pursue my own learning	1	2	3	4	5
12. I prefer to plan my own learning	1	2	3	4	5
13. I am confident in my ability to search out new information	1	2	3	4	5
14. I want to learn new information	1	2	3	4	5
15. I enjoy learning new information	1	2	3	4	5
16. I have a need to learn	1	2	3	4	5
17. I enjoy a challenge	1	2	3	4	5
18. I do not enjoy studying	1	2	3	4	5

Criteria	SD	D	N	A	SA
19. I critically evaluate new ideas	**1**	**2**	**3**	**4**	**5**
20. I like to gather the facts before I make a decision	**1**	**2**	**3**	**4**	**5**
21. I like to evaluate what I do	**1**	**2**	**3**	**4**	**5**
22. I am open to new ideas	**1**	**2**	**3**	**4**	**5**
23. I learn from my mistakes	**1**	**2**	**3**	**4**	**5**
24. I need to know why	**1**	**2**	**3**	**4**	**5**
25. When presented with a problem I cannot resolve I will ask for assistance	**1**	**2**	**3**	**4**	**5**
26. I prefer to set my own goals	**1**	**2**	**3**	**4**	**5**
27. I like to make decisions for myself	**1**	**2**	**3**	**4**	**5**
28. I am responsible for my own decisions/actions	**1**	**2**	**3**	**4**	**5**
29. I am not in control of my life	**1**	**2**	**3**	**4**	**5**
30. I have high personal standards	**1**	**2**	**3**	**4**	**5**
31. I prefer to set my own learning goals	**1**	**2**	**3**	**4**	**5**
32. I evaluate my own performance	**1**	**2**	**3**	**4**	**5**
33. I am logical	**1**	**2**	**3**	**4**	**5**
34. I am responsible	**1**	**2**	**3**	**4**	**5**
35. I have high personal expectations	**1**	**2**	**3**	**4**	**5**
36. I am able to focus on a problem	**1**	**2**	**3**	**4**	**5**
37. I am aware of my own limitations	**1**	**2**	**3**	**4**	**5**
38. I can find out information for myself	**1**	**2**	**3**	**4**	**5**
39. I have high beliefs in my abilities	**1**	**2**	**3**	**4**	**5**
40. I prefer to set my own criteria on which to evaluate my performance	**1**	**2**	**3**	**4**	**5**

Section III. Please answer the following questions (#40-52) by circling the number that best reflects your opinion using this scale: 7=Very true of me; 4=Neutral; 1=Not at all true of me

Criteria							
41. In a class like this I prefer course materials that really challenge me so that I can learn new things	**1**	**2**	**3**	**4**	**5**	**6**	**7**
42. In a class like this, I prefer course material that arouses my curiosity even if it is difficult to learn	**1**	**2**	**3**	**4**	**5**	**6**	**7**
43. The most satisfying thing for me in this course is trying to understand the content as thoroughly as possible	**1**	**2**	**3**	**4**	**5**	**6**	**7**
44. When I have the opportunity in this class I choose course assignments that I can learn from even if they don't guarantee a good grade	**1**	**2**	**3**	**4**	**5**	**6**	**7**
45. Getting a good grade in this class is the most satisfying thing for me right now	**1**	**2**	**3**	**4**	**5**	**6**	**7**
46. The most important thing for me right now is improving my overall grade point average so my main concern in this class is getting a good grade	**1**	**2**	**3**	**4**	**5**	**6**	**7**
47. If I can I want to get better grades in this class than most of the other students	**1**	**2**	**3**	**4**	**5**	**6**	**7**
48. I want to do well in this class because it is important to show my ability to my family, friends, employer, or others	**1**	**2**	**3**	**4**	**5**	**6**	**7**
49. If I study in appropriate ways then I will be able to learn the material in this course	**1**	**2**	**3**	**4**	**5**	**6**	**7**
50. It is my own fault if I don't learn the material in this course	**1**	**2**	**3**	**4**	**5**	**6**	**7**
51. If I try hard enough then I will understand the course material	**1**	**2**	**3**	**4**	**5**	**6**	**7**
52. If I don't understand the course material it is because I didn't try hard enough	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Appendix F - Study Habit Questions

Study Habits Questions

Directions for Respondents:

The purpose of this survey is to evaluate student self directed learning readiness and motivation in different teaching environments. Self-directed learning readiness and motivation are felt to influence how students learn when different instructional methods are utilized. Understanding of these factors can help plan instruction to better fit students' needs.

This questionnaire contains statements related to aspects of self directed learning readiness and motivation. There are no "right" or "wrong" answers. Your opinion and personal feelings are what matter most. Please try to answer all questions in relation to your personal learning experiences.

Section I: Study Habits

The purpose of the following questions is to provide information about the resources you used for learning and the time you spent working on this unit. Please check the response that best fits your experience in the module.

1. During the Diet and Disease project I utilized the following resources (Check all that apply):
    a. Course Text Book_____
    b. Suggested Online Resources_____
    c. Additional print resources_____
    d. Additional online resources_____

2. During this module I was exposed to additional information about diet and disease in the following ways (check all that apply)
    a. Television_____
    b. Radio_____
    c. Magazine_____
    d. Doctors visit_____
    e. Family conversations_____
    f. Conversations with other professionals_____
    g. Course content in other classes_____
    h. None of the above settings or situations_____

    If you checked yes to any of the above choices please explain your experience

    here_____

    _____

_____

_____

3. Approximately how much total time outside of in class time did you spend working on this unit. Please fill in the blanks below with the amount of hours/minutes you spent studying Diet and Disease.

   _____Hours_____Minutes

4. Did you have any additional external experiences that affected your knowledge of diet and disease while completing this project.
   a. Yes_____
   b. No_____

   If yes please explain the nature of these experiences

   below_____

   _____

   _____

   _____

   _____

   _____

   _____

5. Have you taken a previous college level nutrition course?

   a. Yes_____

   b. No_____

   If yes please indicate where and approximately when you took this nutrition course.

   _____

Appendix G – Pre/posttest Content Validity Score Sheet

Pre/posttest content validity score sheet

Directions: The attached score sheet contains a table of objectives and question numbers that correspond with the questions on the Content Knowledge Pre/Posttest. The purpose of this score sheet is to rate the relationship of the pre/posttest questions to the learning objectives of the planned instruction. Establishing this relationship will allow me to ensure that the pre/posttest is accurately assessing these learning objectives. Please rank each question according to the learning objective that you believe it is best associated with using a scale of one to three, with three being the highest. If necessary, each question can be marked with as many as three objectives (one for each level of the scale). Please do not assign the same number score (1-3) to more than one question for the same objective.

Example:

Objective	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Distinguish between different dietary fats																				1				3	
Indicate food sources of fat																				3				2	1

Thank you for taking the time to complete this score sheet.

Objective	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Distinguish between different dietary fats																				2		3		3	2
Indicate food sources of fat																									
Indicate food sources of cholesterol																				3					
Understand relationship between fat intake and blood cholesterol				1						2	2											2		2	
Identify the dietary and lifestyle factors that contribute to diabetes												2			2		3		2						
Identify the dietary and lifestyle factors that contribute to elevated blood lipids																							3		
State acceptable levels of blood pressure						3																			
State acceptable levels of blood sugar																		3							
State acceptable levels of blood cholesterol/lipids																					3				
Identify elements of a heart healthy diet								3		3	3														3
Identify risk factors for disease	3	2	2	3	3		2		2			1	3												
Distinguish between type 1 and type 2 diabetes												3		3	3	1									

Appendix H – Diet and Disease Problem Based Learning Module

Diet and Disease Problem

Purpose and Learning Objectives

The purpose of this case study is to increase your knowledge and understanding about diet and disease so that you can become effective patient educators. In order to effectively prepare you for this role it is important that you acquire the following competencies:

1. A thorough understanding of the relationship of dietary fat intake to blood lipids and heart disease risk.
2. An understanding of the relationship between diet, lifestyle and blood sugar and blood pressure control.
3. A working knowledge of food composition in relationship to types of fat as well as dietary recommendations for a Heart Healthy Diet as defined by the American Heart Association .
4. An understanding of the relationship between dietary treatment for lipid disorders and for elevated blood sugar based on the recommendations of the American Heart Association and the American Diabetes Association.
5. The ability to access relevant online resources that you can utilize in clinical practice.

The learning objectives for the module are as follows:

1. The learners will distinguish between the different types of fat in the diet and indicate food sources of these fats.
2. The learners will identify the relationship between dietary lipid intake and blood levels of cholesterol.

3. The learners will identify the relationship between diet and lifestyle factors to changes in blood sugar and blood pressure.
4. The learners will be able to state acceptable levels of blood glucose, blood lipids and blood pressure as defined by the American Diabetes Association and the American Heart Association.
5. The learners will be able to state acceptable levels of blood lipids in a blood lipid profile.
6. The learners will describe the basic elements of a Heart Healthy Diet for achieving/maintaining healthy blood lipid levels and minimizing the risk of cardiovascular disease.
7. The learners will be able to plan an acceptable menu for an individual following a heart healthy diet in a restaurant and home setting.
8. The learners will be able to create a teaching tool that could be used to convey the knowledge obtained to patients.

Diet and Disease Problem

Introduction and Instructions

You are a member of the nursing staff at a busy family practice in a suburban area. The staff at the clinic has noticed an increase in patients with similar medical problems. At a recent staff meeting you begin discussing, M.G., one of these patients. The consensus among the staff is that M.G. lacks information regarding her disease risk and how it relates to her lifestyle. The group decides that this patient and others like her would benefit from education to help them understand how lifestyle and other factors affect their medical problems. For this reason you and your colleagues decide to form an Education Task Force to develop an educational tool to use

with patients like M.G. in the clinic. The Task Force decides to use M.G. as the model for designing the educational tool. First however you must gather information to design the tool. As a group you decide that you will need to explore information about diet, lifestyle, heredity and disease using M.G.'s medical, diet and personal history as a starting point for your search. Gathering more information in these areas will allow you to design a tool (pamphlet, video, PowerPoint) to use for educational purposes in the clinic.

It is important that you be as thorough as possible in completing this assignment with your group members. In order to facilitate communication with your group members I will create a group area for each group on Blackboard. This area can be used to share information and resources as you work to complete the case study. It is the responsibility of each group member to show evidence of their contribution to the project by sharing resources in this group area. I will use the group area to evaluate the individual contributions of each group member.

As previously stated, the final product of this case study is a teaching tool that your group designs. Your group should submit the completed case study and the teaching tool to the group area on Blackboard by midnight on the due date. Each individual should submit their individual contribution to the final product to the group area file exchange by the designated due date as well.

Process

Your group will act as the Education Task Force that needs to make a plan to develop an educational tool to help patients like M.G. The members of your task force should each take on one of four separate roles-a medical history and lab expert, a diet and disease expert, and a food composition/menu planning expert and a summarizer/editor. If your group consists of four

individuals you may each assume one of the roles described below. If you are a group of two each of you will need to assume one primary role and divide up the responsibility for the remaining role.

Role Responsibilities

Medical History and Lab Expert-this role has the primary responsibility of researching information about the relationship between the patient's medical history and the development of heart disease and diabetes. This role is also responsible for identifying normal and abnormal lab values and how they relate to the development of disease.

Diet and Disease Expert-this role has the primary responsibility of researching the characteristics of the diet that is used to treat the medical problems being experienced by M.G. and patients like her. This role will bring information to the team regarding the best diet for these individuals to follow to achieve optimal health.

Food Composition/Menu Planning Expert-this role has the primary responsibility of researching the specific types of foods that are appropriate to be consumed on the diet identified above. It will also be necessary to determine what foods need to be avoided or consumed very infrequently. This role will work on developing a specific sample meal plan for use by patients in the clinic.

Summarizer/Editor-This role is responsible for working with the other three group members to coordinate and assimilate the information that each individual has gathered. The ultimate goal of the role is to put together a cohesive end product and not simply a "cut and paste" of the information that the other group members have gathered.

Each expert should bring the results of their research back to the group for discussion, planning and development of the final teaching tool.

Before you can design the teaching tool your task force needs to complete the other tasks listed below. In the process of completing these tasks you will need to do the following:

1. Discuss learning issues related to the problem in your group. Here you can share any prior knowledge related to diet, lipids, heart disease, blood pressure and blood glucose.
2. Identify additional learning needs to complete the tasks and produce the educational tool for the clinic.
3. Use the resources provided and additional resources as desired to research the problem individually in your assigned role and in your groups to work toward your completed product.
4. Discuss your research findings in your group and come up with a plan to create your final product. Remember the goal of your research and the tasks is to find the information necessary to create an instructional tool of your choice (pamphlet, video, PowerPoint) that could be utilized in patient education. The tool that you create must be an original tool and not simply an adaptation of another educational material that is currently available. You must also cite all references used in the construction of your final product.

Patient Medical History

M.G. is a 38 y/o African American female who presents to her primary care physician with a complaint of being “tired all the time”. It’s been going on for several months, and she doesn’t report any concerns with nighttime sleep except for getting up frequently to use the bathroom.

She feels that this is happening because she has been drinking more during the day due to increased thirst. She doesn't note any new stress or other life changes, and denies depression or anxiety. Alcohol consumption is limited to one to two drinks per week, and she quit smoking a few years ago. Family history is notable for type 2 diabetes in an older sister and her mother had "heart disease." She walks about 20 minutes three times weekly when the weather allows. She has been told on previous visits that her blood pressure is elevated and has been advised to limit her sodium intake. On this visit the following information was recorded for M.G.:

Height:5'4"
Weight:212 lbs.
BMI:36
BP:135/86

Labs:

Fasting Blood Sugar:	200mg/dl
Total Cholesterol:	250mg/dl
HDL Cholesterol:	35mg/dl
LDL Cholesterol:	170mg/dl
Triglycerides:	180mg/dl

As part of your research for developing an educational tool you will need to find out more information about the following:

1. The symptoms that the patient is exhibiting.
2. The importance of her family history.
3. The significance of her lab values.
4. The relationship of her lab values to her problem and to her lifestyle choices.

Patient Diet History

Your group realizes that there is some relationship between a patient's diet and their overall health but you need more information to help them better understand this relationship. The typical patient, M.G., should be your guide as you explore the characteristics of her diet given below. Suggest the changes she might want to make in her restaurant meals and explain the

rationale for the suggested changes. Your group should use the tables provided to gather information about her intake.

M.G. is single and works full time in sales. Her job makes it necessary for her to travel often and she frequently eats out.

A recent day consisted of the following meals:

Breakfast at Hardees

Hardees Low Carb Breakfast Bowl , Coffee with Cream and Sugar

Lunch at Chick-fil-A

Chick-fil-A Chicken Salad Sandwich Large Lemonade, Small Serving of Waffle Fries

Dinner at Chili's

Hot Spinach and Artichoke Dip with Chips, Boneless Buffalo Chicken Salad, Red Wine

Complete the chart below using nutrition facts from these restaurants and food composition tables. Place NA in a box if the information is unavailable.

Food Item	Calories	Fat	Saturated Fat	Transfat	Cholesterol	Carbohydrate
Low carb breakfast bowl						
Coffee with 2 tsp. of sugar and ¼ cup of half and half						
Chicken Salad Sandwich						
Waffle Fries						
Lemonade						
Hot Spinach						

Dip & Chips						
Boneless Buffalo Chicken Salad						
Red Wine 8 ounces						
Totals						

http://www.hardees.com/menu/
http://www.chick-fil-a.com/#nutrition
http://www.chilis.com/EN/menu/Pages/home.aspx (you can download nutrition information by clicking on a link on the lower left hand side of the page)

New Restaurant Choices

You may choose healthier choices at the restaurants above or select alternate restaurants to select meals that would be more consistent with the American Heart Association Heart Healthy Guidelines.

Food Item	Calories	Fat	Saturated Fat	Transfat	Cholesterol	Carbohydrate

Totals						

Your group would like to help patient learn more about planning healthy meals at home. In order to do this you decide that you will need to explore more information about heart healthy eating and balanced nutrition. To help you convey this information to your patients you will need to plan a balanced and healthy menu that could be prepared easily at home.

Breakfast Lunch Dinner

The Education Task Force has gathered a wide variety of information about diet and disease as they have worked through the sample case of patient M.G. Now it is time for the group to assemble all of this valuable information into a teaching tool that can help M.G. and other patients have a better understanding of the relationship between diet, lifestyle and disease and the changes they could make to benefit their health. As a group prepare this tool being sure to include all of your findings in a way that would be helpful to the patients in your clinic. You may design a pamphlet, video or PowerPoint as the vehicle for this tool. Please refer to the rubric below to help you include all of the required areas in your final product.

The following is a list of resources that you may want to utilize as you complete this problem. This is a good place to start your research but please remember to look for other sources and cite your sources in your final project.

Suggested Resources

Websites

American Heart Association http://www.heart.org/HEARTORG/

American Diabetes Association http://www.diabetes.org/

National Heart Lung and Blood Institute http://www.nhlbi.nih.gov/

National Cholesterol Education Program http://www.nhlbi.nih.gov/about/ncep/index.htm

Centers for Disease Control http://cdc.gov/

Videos

Cholesterol and Fats in Your Blood http://www.uctv.tv/search-moreresults.aspx?catSubID=70&subject=health

Lipoprotein Physiology on You Tube http://www.youtube.com/watch?v=xAqL9fLwnDs

http://www.youtube.com/watch?v=9u8YSD6StOg&feature=channel

http://www.youtube.com/watch?v=4D6CqHpvVz8&feature=channel

http://www.youtube.com/watch?v=4nXPQo4FdL8&feature=channel

There are many other resources related to diet and disease on the internet that you might want to investigate. When viewing websites it is important to make sure that they are accurate, scientifically based and legitimate. You can use the following guidelines to assist you in this determination.

http://webquest.sdsu.edu/processguides/HowToPrimaryS.html

Grading Rubric

Objectives	Criteria				Points
	1	2	3	4	
The educational tool will distinguish between different types of fat in the diet and indicate food sources of these fats.	Learners were able to indicate the fat composition of one food group.	Learners were able to indicate the fat composition of two food groups..	Learners were able to indicate the fat composition of three food groups.	Learners were able to indicate the fat composition of four food groups..	____
The educational tool will identify the relationship between dietary lipid intake and blood lipid levels.	Learners will explain the relationship of one type of dietary fat to blood lipid levels.	Learners will explain the relationship of two types of dietary fat to blood lipid levels.	Learners will explain the relationship of three types of dietary fat to blood lipid levels.	Learners will explain the relationship of four types of dietary fat to blood lipid levels.	____
The educational tool will state acceptable levels of blood lipids in a blood lipid profile.	Learners will state normal and abnormal levels of one element of the blood lipid profile.	Learners will state normal and abnormal levels of two elements of the blood lipid profile.	Learners will state normal and abnormal levels of three elements of the blood lipid profile.	Learners will state normal and abnormal levels of four elements of the blood lipid profile.	____
The educational tool will describe the elements of a heart healthy diet for decreasing heart disease risk.	Learners will describe one parameter of a heart healthy diet.	Learners will describe two elements of a heart healthy diet.	Learners will describe three elements of a heart healthy diet.	Learners will describe four elements of a heart healthy diet.	____
The educational tool will provide an example of acceptable menu for an individual following a heart healthy diet in a restaurant	Learner's menus fit the criteria of a heart healthy diet by being low in total fat and saturated fat.	Learner's menus fit the criteria of a heart healthy diet by being low in total fat, saturated fat and cholesterol.	Learner's menus fit the criteria of a heart healthy diet by being low in total fat, saturated fat, cholesterol and high in fiber.	Learner's menus fit the criteria of a heart healthy diet by being low in total fat, saturated fat, cholesterol and high in fiber and omega 3 fats.	____
The educational tool will provide an example of acceptable menu for an individual	Learner's menus fit the criteria of a heart healthy diet by being low in total fat and	Learner's menus fit the criteria of a heart healthy diet by being low in total fat, saturated fat and	Learner's menus fit the criteria of a heart healthy diet by being low in total fat, saturated	Learner's menus fit the criteria of a heart healthy diet by being low in total fat, saturated	

following a heart healthy diet in a home setting	saturated fat	cholesterol.	fat, cholesterol and high in fiber.	fat, cholesterol and high in fiber and omega 3 fats	
The educational tool will provide evidence of an understanding of appropriate diet for control of blood sugar	Learner's menus the criteria of a diet appropriate for blood glucose management by being low in simple sugar.	Learner's menus fit the criteria of a diet appropriate for blood sugar management by being low in sugar and high in fiber.	Learner's menus fit the criteria of a diet appropriate for blood sugar management by being low in sugar and fat and high in fiber	Learner's menus fit the criteria of a diet appropriate for blood sugar management by being low in sugar and fat, high in fiber and adequate in calories.	
The educational tool will provide evidence of understanding normal blood sugar, blood pressure and BMI and how these relate to disease risk	Learners state the range of at least one normal lab value	Learners state the range of at least two normal lab values	Learners state the range of at least three normal lab values	Learners state the range of at least three normal lab values and the relationship to disease risk	
The educational tool will include an explanation of family and medical history to disease risk	Learners include at least one accurate explanation about family and medical history risk.	Learners include at least two accurate explanations about family and medical history risk	Learners include at least three accurate explanations about family and medical history risk	Learners include at least four accurate explanations about family and medical history risk	
The educational tool includes an explanation about the symptoms that the patient is experiencing	Learners include an explanation of at least one symptom	Learners include an explanation of at least two symptoms	Learners include an explanation of at least three symptoms	Learners include an explanation of at least four symptoms	
				Total	_____

Comments:_____

_____

_____

Appendix I - Lecture Content Score Sheet

Lecture Content Score Sheet

Directions: The attached score sheet contains a table of objectives that need to be covered by the proposed PowerPoint and lecture notes. The purpose of this score sheet is to rate the content of the PowerPoint and lecture notes to each learning objective. Establishing this relationship will allow me to ensure that the content of the PowerPoint and lecture notes include and adequately address these learning objectives. Please rank the PowerPoint and lecture notes with a score of 1-3 for each learning objective. Please use the following score values when rating each objective: 1=learning objective not addressed; 2=learning objective marginally addressed; 3=learning objective adequately addressed.

Example:

Objective	PowerPoint	Lecture Notes
Distinguish between different dietary fats	2	3
Indicate food sources of fat	3	3

Thank you for taking the time to complete this score sheet.

Objective	PowerPoint	Lecture Notes
Distinguish between different dietary fats		
Indicate food sources of fat		
Indicate food sources of cholesterol		
Understand relationship between fat intake and blood cholesterol		
Identify the dietary and lifestyle factors that contribute to diabetes		
Identify the dietary and lifestyle factors that contribute to elevated blood lipids		
State acceptable levels of blood pressure		
State acceptable levels of blood sugar		
State acceptable levels of blood cholesterol/lipids		
Identify elements of a heart healthy diet		
Identify risk factors for disease		
Distinguish between type 1 and type 2 diabetes		

Comments:

Appendix J - Learning Objectives, Lecture Notes and PowerPoint Outline for Traditional Instruction

Learning Objectives, Lecture Notes and PowerPoint Outline for Traditional Instruction

Learning Objectives

1. The learners will distinguish between the different types of fat in the diet and indicate food sources of these fats.
2. The learners will identify the relationship between dietary lipid intake and blood levels of cholesterol.
3. The learners will identify the relationship between diet and lifestyle factors to changes in blood sugar and blood pressure.
4. The learners will be able to state acceptable levels of blood glucose, blood lipids and blood pressure as defined by the American Diabetes Association and the American Heart Association.
5. The learners will be able to state acceptable levels of blood lipids in a blood lipid profile.
6. The learners will describe the basic elements of a Heart Healthy Diet for achieving/maintaining healthy blood lipid levels and minimizing the risk of cardiovascular disease.

Lecture Notes

Nutrition and Chronic Diseases

Four of the top ten causes of death are related to diet. There are also genetic and lifestyle risk factors that are important and related to chronic disease. Many of the nutritional factors in the treatment of chronic disease are interrelated.

I. **Cardiovascular Disease (CVD)**

Atherosclerotic plaques can raise blood pressure, cause abnormal blood clotting, and cause heart attacks and strokes. There are many recommendations for prevention and treatment including dietary interventions, quitting smoking, and engaging in regular physical activity. The most common form of CVD is **coronary heart disease (CHD)**, which develops due to atherosclerosis in the **coronary arteries.**

A. How Atherosclerosis Develops

1. **Atheromatous plaque** builds on artery walls and leads to **inflammation**.
2. Inflammation
   a. Cells lining the blood vessels incur damage.

b. Inflammatory response using **macrophages** that become the cells of plaque.

c. Blood clots form and minerals harden the plaque.

d. Fibrous connective tissue.

e. **C-reactive protein (CRP)** is a sign of inflammation of the artery walls.

3. Plaques – Fibrous coating can be torn away with a surge in blood pressure.

4. Blood Clots

a. **Platelets** cover the damaged area and form a clot.

b. **Thrombosis** is a blood clot that sticks to an artery and grows large enough to restrict or close off a blood vessel.

c. **Embolism** is when a blood clot breaks free, travels, and lodges in a small artery and shuts off blood flow to tissues.

d. Platelets are under the control of eicosanoids, made from omega-3 and omega-6 fatty acids.

5. Blood Pressure and Atherosclerosis

a. Arteries are narrowed due to plaque, clots, or both.

b. The heart must generate more pressure to deliver blood to the tissues.

c. Higher blood pressure results in further damages.

6. The Result: Heart Attacks and Strokes

a. **Angina** – pain or pressure feeling around the area of the heart.

b. **Heart attack** – restricted blood flow to the heart.

c. **Transient ischemic attack** or **stroke** – restricted blood flow to the brain.

B. Risk Factors for Coronary Heart Disease

1. Diet and physical activity are modifiable risk factors.

2. Age, Gender, and Family History

a. Cannot change these factors.

b. Men higher risk than women.

c. Men older than 45 years of age.

d. Women older than 55 years of age.

e. Immediate family history of premature heart disease.

3. High LDL and Low HDL Cholesterol

   a. LDL

      1. Excess **LDL (low-density lipoproteins)** become available for oxidation, high risk.

      2. Risk factors for LDL cholesterol

         a. Desirable: <100 mg/dL.

         b. Above optimum level: 100-129 mg/dL.

         c. Borderline: 130-159 mg/dL.

         d. High: 160-189 mg/dL.

         e. Very High: >190 mg/dL.

   b. HDL

      1. **HDL (high-density lipoproteins)** represent cholesterol being carried back to the liver, reduced risk.

      2. Risk factors for HDL cholesterol

         a. Desirable: ≥60 mg/dL.

         b. Borderline: 59-40 mg/dL.

         c. High: <40 mg/dL.

   c. Total cholesterol

      1. Desirable levels at < 200 mg/dL.

      2. Borderline levels at 200-239 mg/dL.

      3. High levels at ≥ 240 mg/dL.

4. High Blood Pressure (**Hypertension**)

   a. Injures artery walls and accelerates plaque formation, which in turn increases blood pressure.

   b. Blood pressure (systolic and/or diastolic pressure)

      1. Desirable: <120/<80.

      2. Borderline: 120-139/80-89 (**prehypertension)**.

3. High: ≥140/≥90 – stage one hypertension.
4. Stage two hypertension: ≥160/≥100.

5. Diabetes
   a. Risk similar to people with established CHD.
   b. **CHD risk equivalents**.
6. Obesity and Physical Inactivity
   a. Obesity, especially abdominal obesity, and physical inactivity increase risk.
   b. Body mass index
      1. Desirable: 18.5-24.9.
      2. Borderline: 25-29.9.
      3. High: ≥30.
   c. Weight loss and regular physical activity are protective.
7. Cigarette Smoking
   a. Powerful factor for increased risk.
   b. Increases blood pressure and the workload of the heart.
8. Atherogenic Diet
   a. A diet high in saturated fats, *trans* fats, and cholesterol and low in fruits and vegetables elevates LDL cholesterol. Saturated fats are found in animal foods and Coconut and Palm oils; trans fats are found in products that contain partially hydrogenated vegetable oils; cholesterol is found in animal foods.
   b. Antioxidants and omega-3 fatty acids lower the risk of CHD.

      Fruits and vegetables are high in antioxidants; omega-3 fatty acids are found in fish and flax seeds.
9. Other Risk Factors
   a. **Emerging risk factors** and predictions.
   b. Elevated triglycerides are a marker for other risk factors and being studied in relation to CHD.
      1. Desirable levels of fasting triglycerides: <150 mg/dL.
      2. Borderline levels of fasting triglycerides: 150-199 mg/dL.

3. High levels of fasting triglycerides: 200-499 mg/dL.
4. Very high levels of fasting triglycerides: ≥ 500 mg/dL.

c. Diabetes and overweight.

10. **Metabolic Syndrome** – also called **Syndrome X** or **insulin resistance syndrome**.

a. **Insulin resistance** is a risk factor.

b. Any three of the following factors

1. Abdominal obesity

a. Men: Waist circumference >40 inches.

b. Women: Waist circumference >35 inches.

2. Triglycerides: ≥150 mg/dL.
3. HDL: <40 mg/dL in men, <50 mg/dL in women.
4. Blood pressure: ≥130/85 mm Hg.
5. Fasting glucose: ≥100 mg/dL.

C. Recommendations for Reducing Coronary Heart Disease Risk

1. Cholesterol Screening – at least two times at least one week apart.
2. Lifestyle Changes

a. Balance energy intake with energy needs.

b. Include lean meats, vegetables, and low-fat milk products.

c. Limit foods with high concentrations of saturated fatty acids (< 7% of total kcalories) and *trans*-fatty acids (< 1% of total kcalories).

d. Limit foods with a high content of cholesterol (< 300 mg/day).

e. Choose foods high in soluble fiber: vegetables, fruits, and whole grains.

f. Choose high-potassium, low-sodium foods.

g. Limit sodium to 2,300 mg/day.

h. Limit intake of added sugar.

i. Consume fatty fish at least twice a week for omega-3 fatty acids.

j. Consume foods with plant sterols or stanols added.

k. Use soy products in place of animal foods that are high in saturated fat and cholesterol.

l. If alcohol is consumed, it should be limited to 1 drink/day for women or 2 drinks/day for men.

m. Exercise at least 30 minutes most days of the week to expend 2,000 kcalories weekly.

n. Reduce exposure to tobacco smoke.

II. Hypertension

Hypertension with accompanying atherosclerosis can cause heart attacks and strokes. Weight control is the most effective dietary strategy for treating hypertension.

A. How Hypertension Develops

1. Blood flow to the kidneys is reduced so the kidneys expand blood volume and constrict peripheral blood vessels, resulting in **peripheral resistance** and thus raising blood pressure.

2. Cardiac output increases, increasing the work of the heart.

B. Risk Factors for Hypertension

1. Age – risk increases with age.

2. Genetics – family history, African-American.

3. Obesity – 60% of those with hypertension are obese.

4. Salt sensitivity.

5. Alcohol may raise blood pressure and is associated with strokes.

C. Treatment of Hypertension

1. Weight control is the one of the most effective treatments.

2. Physical activity will help – moderate aerobic for 30-60 minutes most days.

3. The DASH Diet – Dietary Approaches to Stop Hypertension

a. Grains: 6-8 ounces.

b. Vegetables: 2-2 ½ cups.

c. Fruits: 2-2 ½ cups.

d. Milk (low-fat or fat-free): 2-3 cups.

e. Meat (lean): 6 ounces or less.

f. Nuts, seeds, legumes: 4-5 ounces per week.

g. 2000 kcalories.

4. Salt/Sodium Intake

a. Restricting sodium is important for preventing or reducing hypertension.

b. The greater the sodium restriction, the greater the reduction in blood pressure.

5. Drug Therapy

a. Diuretics and antihypertensive agents.

b. Watch potassium.

III. **Diabetes Mellitus**

Diabetes is characterized by high blood glucose (**hyperglycemia)** and either insufficient insulin, ineffective insulin, or both. Diabetes treatment involves the coordination of diet and/or drugs and physical activity to control blood glucose fluctuations and control or lose weight.

A. How Diabetes Develops

1. **Impaired glucose tolerance** or **prediabetes**.
2. **Type 1 Diabetes**

a. 5-10% prevalence in diabetic population.

b. **Autoimmune disorder**.

c. Usually diagnosed in childhood or adolescence.

d. Relatively severe symptoms.

e. Associated with viral infection and heredity.

f. Insulin is required.

3. **Type 2 Diabetes**

a. 90-95% prevalence in diabetic population.

b. Occurring in children and adults.

c. Relatively moderate symptoms.

d. Cells are resistant to insulin.

e. Associated with obesity, heredity, and aging.

f. Sometimes insulin is required.

B. Complications of Diabetes

1. Diseases of the Large Blood Vessels
    a. Atherosclerosis tends to develop early and is more severe.
    b. Long-term, intensive intervention targeting multiple factors can reduce risk.
2. Diseases of the Small Blood Vessels
    a. **Microangiopathies**.
    b. Affect kidney function and retinal degeneration.
3. Diseases of the Nerves
    a. Hands and feet.
    b. Careful of injuries and infections.
    c. **Gangrene** may develop and amputation may be required.

C. Recommendations for Diabetes

1. Total Carbohydrate Intake
    a. Consistent intake helps to regulate blood sugar.
    b. Too little carbohydrate consumption can lead to hypoglycemia.
2. Carbohydrate Sources
    a. Glycemic effect of a food needs to be considered.
    b. Avoid foods and beverages with added sugar.
3. Dietary Fat
    a. Saturate fat: <7% of total kcalories.
    b. Cholesterol: <200 mg/day.
4. Protein
    a. No need to modify intake as long as there is normal kidney function.
    b. 15-20% of total kcalories.
5. Alcohol
    a. Alcohol should be used in moderation.
    b. One drink/day for women; two drinks/day for men.
6. Recommendations for Type 1 Diabetes

a. Adjust insulin doses.

b. Optimal nutrition status.

1. Control blood glucose with consistent carbohydrate intake at meals and snacks.

2. Achieve desirable blood lipids.

3. Control blood pressure.

4. Prevent and treat complications.

c. Physical activity

1. Be careful of hypoglycemia.

2. Monitor blood glucose.

7. Recommendations for Type 2 Diabetes

a. Moderate weight loss is helpful (10-20 pounds).

b. Regular, long-term physical activity.

PowerPoint Outline

Nutrition and Chronic Diseases

- Leading causes of death in U.S.

Relationship with diet

- Chronic diseases
- Interrelationships among chronic diseases
- Numerous disease associations with various nutrients
- Multiple risk factors for each chronic disease
    - Modifiable risk factors
    - Nonmodifiable risk factors

Ten Leading Causes of Death in the U.S.

Interrelationships among Chronic Diseases

Risk Factors and Chronic Diseases

Cardiovascular Disease

- Major causes of death around the world
- Family history
- Lifestyle factors
- Coronary heart disease (CHD) is most common form
    - Usually caused by atherosclerosis

Cardiovascular Disease

- Atherosclerosis development
    - Accumulation of fatty streaks along inner arterial walls
    - Streaks enlarge and harden
    - Encasement in fibrous connective tissue
    - Plaques stiffen arteries and narrow passages
    - Well-developed plaques by age 30
- Dietary factors

Cardiovascular Disease

- Atherosclerosis development
- Inflammation
- Damage to cells lining the blood vessels elicits inflammatory response
- Immune system sends in macrophages
- LDL cholesterol becomes trapped and engulfed by macrophages
- Macrophages swell; eventually become cells of plaque

Cardiovascular Disease

- Atherosclerosis development
- Inflammation
    - Aneurysm
    - C-reactive protein (CRP)
    - Lipoprotein-associated phospholipase A(2) or LP-PLA(2)
- Plaques
    - Plaque stability – rupture

Cardiovascular Disease

- Atherosclerosis development
    - Blood clots
    - Platelets and other factors form blood clots
    - Prostaglandins and thromboxanes
    - Omega-3 fatty acids
- Blood pressure
    - Plaques increase pressure
    - Atherosclerosis is a self-accelerating process

Cardiovascular Disease

- Atherosclerosis development
- The results
    - Heart attack
    - Transient ischemic attack (TIA)

Risk Factors for Coronary Heart Disease (CHD)

- By middle age, most adults have at least one risk factor
- Regular screening and early detection

Risk Factors for Coronary Heart Disease (CHD)

- Age, gender, and family history
    - Nonmodifiable risk factors
    - Older vs. younger people
    - Men vs. women
    - Early CHD in immediate family members

Risk Factors for Coronary Heart Disease (CHD)

- High LDL and low HDL cholesterol
    - Total cholesterol
    - LDL – most atherogenic lipoproteins
        - Plaque instability

        - Inflammatory process
- HDL indicate a reduced risk of atherosclerosis

Standards for CHD Risk Factors

Risk Factors for Coronary Heart Disease (CHD)

- High blood pressure (hypertension)
    - Relationship with heart disease risk holds true for men, women, young, and old
    - Injures artery walls
    - Accelerates plaque formation
- Diabetes
    - Increases risk of death from CHD

Risk Factors for Coronary Heart Disease (CHD)

- Obesity and physical inactivity
    - Increase risk for CHD
    - High LDL, low HDL, hypertension, & diabetes
- Cigarette smoking
    - Smoking damages the heart directly
    - Toxins in cigarette smoke damages vessels
- Atherogenic diet
    - Elevates LDL cholesterol

Health Dangers of Excessive Trans Fatty Acid

- Raises LDL
- Lowers HDL
- Increases risk for heart disease
- Current intake is~3% of total kcals

Risk Factors for Coronary Heart Disease (CHD)

- Other risk factors
- Elevated triglycerides
    - VLDL
    - Measurement of triglycerides
- Metabolic syndrome
    - Cluster of health risks
    - Markers of inflammation and thrombosis

Recommendations for Reducing CHD Risk

- Screening
    - Cholesterol screening
    - Total cholesterol, LDL, HDL, triglycerides

    - Two measurements at least 1 week apart
- Intervention
    - Lifestyle changes
    - Physical activity, dietary changes, lose weight, reduce exposure to cigarette smoke
    - Medications

Hypertension

- Systolic and diastolic pressure with risk of death from CVD
- Physiological factors of hypertension
    - Cardiac output
        - Heart rate or blood volume increases
    - Peripheral resistance
        - Diameters of arterioles
    - Regulated by nervous system & hormones
        - Kidneys

Hypertension

- Risk factors
    - Aging
    - Genetics
    - Obesity
    - Salt sensitivity
    - Alcohol
- Treatment
    - Weight control
    - Physical activity
    - DASH diet
        - Lowers LDL & total cholesterol
    - Salt/sodium intake
    - Drug therapy

Diabetes Mellitus

- Incidence has risen dramatically
    - Prediabetes
- Sixth among leading causes of death
- Underlies or contributes to several other major diseases
    - Heart disease is leading cause of diabetes-related deaths

Prevalence of Diabetes among Adults in the United States

Diabetes Mellitus

- Diabetes development
- Characteristics
    - High blood glucose concentrations
    - Disordered insulin metabolism
- Two main types
    - Type 1
    - Type 2

Features of Type 1 and Type 2 Diabetes

Diabetes Mellitus

- Type 1 diabetes
    - Less common type
    - Autoimmune disorder
    - Pancreas loses ability to synthesize insulin
    - Commonly occurs in childhood & adolescence
    - Energy metabolism changes
    - May threaten survival
    - Need insulin injections or external pump

Diabetes Mellitus

- Type 2 diabetes
    - Most prevalent form of diabetes
    - Exact cause is unknown
- Risk factors
    - Insulin resistance
    - Hyperinsulinemia
    - Amount of insulin is insufficient to compensate for diminished effect in cells
    - Chronic inflammation

Diabetes Mellitus

Complications

- Acute
- Chronic
    - Conversion of glucose to sugar alcohols
    - Loss of circulation and nerve function
    - Infections
    - Diseases of large blood vessels
    - Diseases of small blood vessels
    - Diseases of the nerves

Metabolic Consequences of Untreated Diabetes

Diabetes Mellitus

- Recommendations for diabetes
    - Total carbohydrate intake
    - Carbohydrate sources
    - Fiber and sugar
    - Glycemic index
    - Dietary fat
    - Protein
        - Kidney function

Diabetes Mellitus

- Recommendations for diabetes
    - Alcohol
        - Moderation
- Type 1 diabetes
    - Adjust insulin to accommodate meals, physical activity, and health status
    - Nutrition therapy
- Type 2 diabetes
    - Diet and regular moderate physical activity

Dietary Guidelines & Recommendations for Chronic Diseases Compared

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Curriculum Vitae

Curriculum Vitae

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Professional Experience

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Public Health Nutritionist	2001 -2003
National Clinical Research, Inc.	Richmond, VA
Research Dietitian	1999- 2001
Newwellness, Inc.	Richmond, VA
Nutrition Consultant	1994- 1999
Medical College of Virginia Hospital	Richmond, VA
Clinical Coordinator	1990-1994
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Regional Public Health Nutritionist	1984-1986
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Presentations

Gould, K. (2012) Evaluation of online problem based learning in health education. Presentation for the Research Consortium Conference of the 2012 AAHPERD National Convention and Exposition in Boston, MA. March 13-17.

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Gould, K. (2009) Fact or fiction: Evaluating dietary supplements. Presented at the Eastern District AAHPERD Conference in Lancaster, Pennsylvania on February 6.

Gould, K. (2009) Athletes: Fueling for performance. Presented at the Maryland Dietetic Association Meeting April 24.

Gould, K. (2008) Female Athletes: Fueling for performance presented at the National AAPHERD convention in Fort Worth April 10.

Gould, K. (2008) Fueling for performance: Meeting an athletes' nutrition needs. Presented at the AAHPERD National Conference in Fort Worth, Texas April 10

Gould, K. (2007) Using MyPyramid to avoid diet dilemmas in dance. Presented at the National AAPHERD convention in Baltimore March 15.

Gould, K. (2007) Using sports specific information to teach nutrition to students in a kinesiology course" presented at the Maryland Dietetic Association Meeting March 13.

Gould, K. (2007) Promoting positive food messages in a multicultural environment Presented at the Mid-Atlantic College Health Association (MACHA) Conference in Maryland November 5.

Gould, K. (2007) Fueling for performance: Meeting the athletes macronutrient needs. Presented at the Maryland Association for Health, Physical Education and Dance, October 19.

Gould, K. (2007) Heart healthy grocery shopping. Presented at the Maryland Department of Health and Mental Hygiene "When I'm 64: A Conference on Aging and Disabilities" September 25.

Publications

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