2009

Instruction in a clinical phlebotomy class using a problem-based learning approach

Karen Carmon
California State University, Monterey Bay

INSTRUCTION IN A CLINICAL PHLEBOTOMY CLASS USING A PROBLEM-BASED LEARNING APPROACH

By

Karen Carmon

May 2009

A thesis submitted in partial fulfillment of the
Requirements for the Degree of
Master of Arts in Education
At California State University Monterey Bay

INSTRUCTION IN A CLINICAL PHLEBOTOMY CLASS USING A PROBLEM-BASED LEARNING APPROACH

By

Karen Carmon

May 2009

Approved by the Graduate Advisory Committee

Dr. Teresa Arámbula-Greenfield
Graduate Advisor

5 May 2009
Date

Dr. Dorothy Lloyd
Instructor, MAE 670 Capstone

May 5, 2009
Date

Abstract

My study incorporated problem-based learning (PBL) into my curriculum to improve my own teaching and to enhance learning and critical thinking in students from a largely minority group. My literature review revealed that PBL can be a useful technique to improve critical thinking and problem-solving skills in students, although its benefits have not been completely confirmed. To investigate PBL's potential benefits for my own students, I used qualitative methods to collect and analyze data. I found that, overall, my students were mixed in their responses to this new teaching method: about half favored PBL and working in small groups, and about half favored lecture and working individually, possibly because neither the students nor I were experienced in the new method. My Action Plan is a semester course plan that incorporates and integrates both lecture and PBL in hopes of enhancing student learning.

Acknowledgments

When I started my graduate study at CSUMB, I never thought that research would be my companion in the incredible journey toward my deepest passion about improving my teaching practice with a student-centered method, problem-base learning. This research has helped me grow as a person and a scholar in establishing my sense of identity. I am truly blessed to have some caring people in my life who have helped me along the way. My deepest thanks go to the following people.

First, my thanks go to my thesis advisor Dr. Terry Arámbula-Greenfield for all the guidance, patience and advice you granted me during the preparation of this thesis. You have been a mentor and a navigator model to me and there are so many ways that I admire you. Thank you for helping me find my own voice, and I hope to share our voices the years to come.

I thank my co-advisor, Dr. Nicholas Meier for all the guidance and teachings and for going above and beyond the call; you are greatly appreciated. Thank you for being the kind of teacher who makes a difference.

I thank my capstone advisory Dr. Dorothy Lloyd, for always being willing to work with me, even "remotely" (on-line) and for the time she devoted to my work. Thank you for your interest and encouragement of my work over the year and during the capstone course.

My thanks also go to my significant other in life, Rick Ongaro, for every intellectual discussion we had. Thank you for your whole-hearted support and for always being yourself to me. You have never doubted that I could do this, even when I was not sure myself.

In deepest appreciation to my two sons, Jacob and Cole, who have given me nurturing support and love.

Thanks also to my fellow students in the MAE program who supported me. We shared anxiety and laughs and supported each other during the last two years. You have meant more to me than you could ever know. Also thank you to all of the faculty members at CSUMB for your teachings, guidance, and patience.

The hosts during my time of data collection travels also deserve, and receive, my thanks. Thank you to Dr. Ryan and fellow faculty members at my school, for their guidance and support, their trust, and their time during study. Thanks to my students whose active participation enabled me to complete my thesis. I hope that I treated them with respect and care.

Finally, special gratitude to my mother, Delores Carmon, for being proud of me and for her support and love. She is and always will be my inspiration.

Contents

Chapter 1

Introduction

The focus of this research and thesis was to revise a clinical phlebotomy curriculum and improve my own teaching methodology using creative teaching methods. Phlebotomy, which focuses on collecting and processing specimens (e.g., blood) for laboratory testing, is usually the first course that Medical Laboratory Technician (MLT) students take during their first year in the program. For this reason, I decided this class would benefit the most from revision at this time. I have taught clinical phlebotomy for ten years and feel that I am qualified to revise the course material.

My overall goal was to conduct research on a teaching method known as problem-based learning (PBL), which I hoped would aid in improving this course curriculum. PBL is an education technique that uses problems or cases in health and science to allow students to investigate and answer questions about their problem. For example, problems can have patient medical history, laboratory, and treatment data to explain a patient's disease or condition, and students then conduct research to answer the questions about the patient's condition or treatment provided in each problem. I chose PBL in particular over other potential teaching and learning strategies because it has been used extensively in medical curriculum for many years.

Background of the Study

A phlebotomist is important in the first or preanalytical (prior to testing) phase in laboratory testing. Laboratory testing is performed to provide doctors with a picture of a patient's body in a unique way. Laboratory testing gives the doctor a picture of how the body is functioning on a biochemical level. Laboratory testing is used to diagnose diseases, monitor a treatment plan, therapy, or disease status.

In recent years, the pressures placed on the clinical laboratory to evolve have been enormous and these pressures are impacting many different areas of medicine. One of these changes has had a direct impact on the laboratory. That is, the State of California began certifying phlebotomists beginning in April 2003 to 2006. The new regulations require all phlebotomists to fulfill the new requirements.

The new regulations required that all phlebotomists must comply with the requirements, which means that every phlebotomist, whether having worked in the laboratory for years or being a new graduate of a phlebotomy programs, was required to fulfill the new requirements. Prior to April 2003, phlebotomists were not required to complete a specific training program and most did not have board examination certification. Many had completed some type of clinical training, but each individual program varied considerably.

Today each individual phlebotomy program also must be approved the state. A phlebotomy program director is required to be a nurse, doctor, or clinical laboratory scientist and have a master's degree. Each director is required to have clinical and educational experience within

the last 2-5 years. Further, the state has mandated the phlebotomy curriculum be divided into two areas: basic and advanced. After a phlebotomist has completed the basic requirements and been certified by the state, s/he still has to renew the license every two years and is also required to complete six contact hours of continuing education which may include advanced concepts in phlebotomy.

Due to the new regulatory requirements for phlebotomy, each phlebotomy program has had to evaluate curriculum, staffing, requirements, etc. In this context, I examined my own curriculum to ensure it complied with the state's curriculum. In the process, the analysis of my own teaching practices led me to strive to improve my own teaching, which in turn led me to inquire into a variety of options for improving teaching and curriculum practices. I found that within education there are many different methods that can be used to improve teaching practices. Ultimately, I selected problem-based learning due in part to its extensive use in medical education and due largely to its effectiveness in other teaching situations. The education of medical doctors is not the same as that of a phlebotomist but I believe that the PBL technique can be beneficial to both sets of students.

Personal Background

I have been a teacher at a local college for the past eleven years, and have worked as a Clinical Laboratory Scientist (CLS) at the local Community Hospital for seven years. At the college, I have taught many courses in the Medical Laboratory Technician (MLT) associates' degree program. During my years of experience with teaching, I have come to realize the need to revise and review my own teaching methodologies, redesign course material and reevaluate the MLT program curriculum.

I selected problem-based learning, or PBL, as a mechanism of action in the phlebotomy class because I believe it can be effective for not only teaching students academic content but also for helping them learn to use critical thinking in their work. By utilizing PBL teaching methods in this phlebotomy class I hope to provide meaningful and thorough course material to students that enlightens them and increases understanding and critical thinking about clinical phlebotomy.

My phlebotomy class is a three-hour evening lecture class. Each lesson has a teacher-centered lecture component due to the level of difficulty of the material we must cover. I already use some hands-on methods to teach things like tourniquet application, routine venipuncture, capillary venipuncture, and arterial puncture procedures, and students also watch videos or solve medical puzzles on occasion. In the past I also had required students to do a presentation on the last night of our formal class. Each student could create a poster or picture and a report on a laboratory test. I let students pick their own topic but no two could be same. Although this was a good way to promote learning about laboratory tests and develop some oral presentation skills, it lacked formality.

When I first read about problem-based learning I was intrigued, and became interested in it for several reasons. One is because it has the potential to be a powerful form of instruction and to engage students, and I was looking for something more powerful and engaging than the educational tools and strategies I was already using. PBL also has a formal structure embedded into it, which some of my teaching tools did not. Another feature that attracted me to PBL is the fact that it is used with groups of students. I have always enjoyed group

activities where students could get to know one another better. For these reasons, I decided PBL was the route I would take towards redeveloping my course and improving my teaching as well as my students' learning.

One of the more important reasons to improve my teaching was to promote learning in a diverse population of students who primarily represent minority groups. At my college the student body is multicultural with the largest demographic group being of Mexican descent and consisting of both immigrants and Mexican Americans; this group comprises approximately fifty percent of the student body. Following at a close percentage of forty percent is the ethnic group of European descent. The smallest percentage of ten percent is comprised of Asian Americans and other ethnic groups. The student body is a truly multicultural representation of the population of the community as a whole.

By improving my own teaching methods, I aimed to empower my students' learning in a meaningful way. Since my students are primarily from minority groups it is even more important to increase learning and knowledge for them. My students are working toward the goal of becoming part of the healthcare team. By giving them the best chance at success I am promoting social justice for them. As they become members of the healthcare team many different aspects of their life may change and those include improved economic status, professional recognition, opportunities to become part of a community of workers, and learning about effective communication in healthcare, public relations and client interaction. Any one of those could dramatically improve the life of one of my minority students.

Overall, I plan to grow in my teaching abilities as I use problem-based learning techniques to improve the core curriculum of this phlebotomy course. By utilizing this alternative to the more traditional lecture format of teaching I hope to expand, enlighten and inject creativity into this core class while also generating a student participation component. With the addition of student participation I hope to increase students' learning of the core phlebotomy curriculum with activities that promote learning within an active environment (Gross, 2001).

In the next chapter, literature research will be described to enable me to evaluate my research plan for problem-based learning and to address my research questions.

My overall research questions were as follows:

1) How can problem-based learning be used to improve a phlebotomy course?
2) How can I as a teacher improve my own pedagogical skills?

The following abbreviations will be used consistently throughout this thesis.

- PBL = problem-based learning
- MLT = medical laboratory technician.

Chapter 2

Literature Review

My review of relevant literature is structured around my research questions: (1) How can problem-based learning be used to improve a phlebotomy program? and (2) How can I as a teacher improve my own pedagogical skills? Therefore, I will discuss the nature of problem-based learning, including its advantages and limitations; within that context I will also describe examples of how PBL has been used to improve pedagogical skills in other teaching situations.

The nature of problem-based learning

Problem-based learning is a type of teaching strategy wherein:

> "...course content is not presented by the instructor, but rather it is researched and constructed by students, under the tutelage of the instructor, as they attempt to clarify and then respond to problem situations. Classically, collaborative student work groups are presented with a complex and ill-structured problem...that they must analyze, probe, and expand in order to clarify and better understand. Problems are selected to reflect real-life situations of direct relevance to students" (Arámbula-Greenfield, 1995, p. 112).

Problem-based learning has been around for the past 25 years and has been used mainly in medicine for the instruction of physicians (De Grave, Dolmans, Jacobs, Van Der Vleuten, Visschers-Pleijers, et al. 2006; Haidet, Levine, McMahon, Perkowski, Richards, Schneider, et al., 2007; Sweeney, 1999). Sweeney (1999) defined PBL in medical education as follows.

> The essence of PBL is that problems in human health and disease define both learning objectives arising from a specific problem, and non-objectives, which can be excluded from learning because they are not relevant to the problem under study. Both the new and old information is integrated into the definition, analysis and correction of the problems presented (Sweeney, 1999 pg. 6).

One conceptual framework developed for constructing problems that can be used in PBL (Brock, Keary, Kim, Phillips, & Pinsky, 2006, p. 867) is comprised of five main attributes: *Relevant, Realistic, Engaging, Challenging, and Instructional*, which although individually defined, all share some common content areas between them. This framework can serve as a menu of case development options that educators and researchers can pilot and evaluate in their local setting. Figure 1, on the following page, summarizes Brock et al.'s conceptual framework.

Figure 1

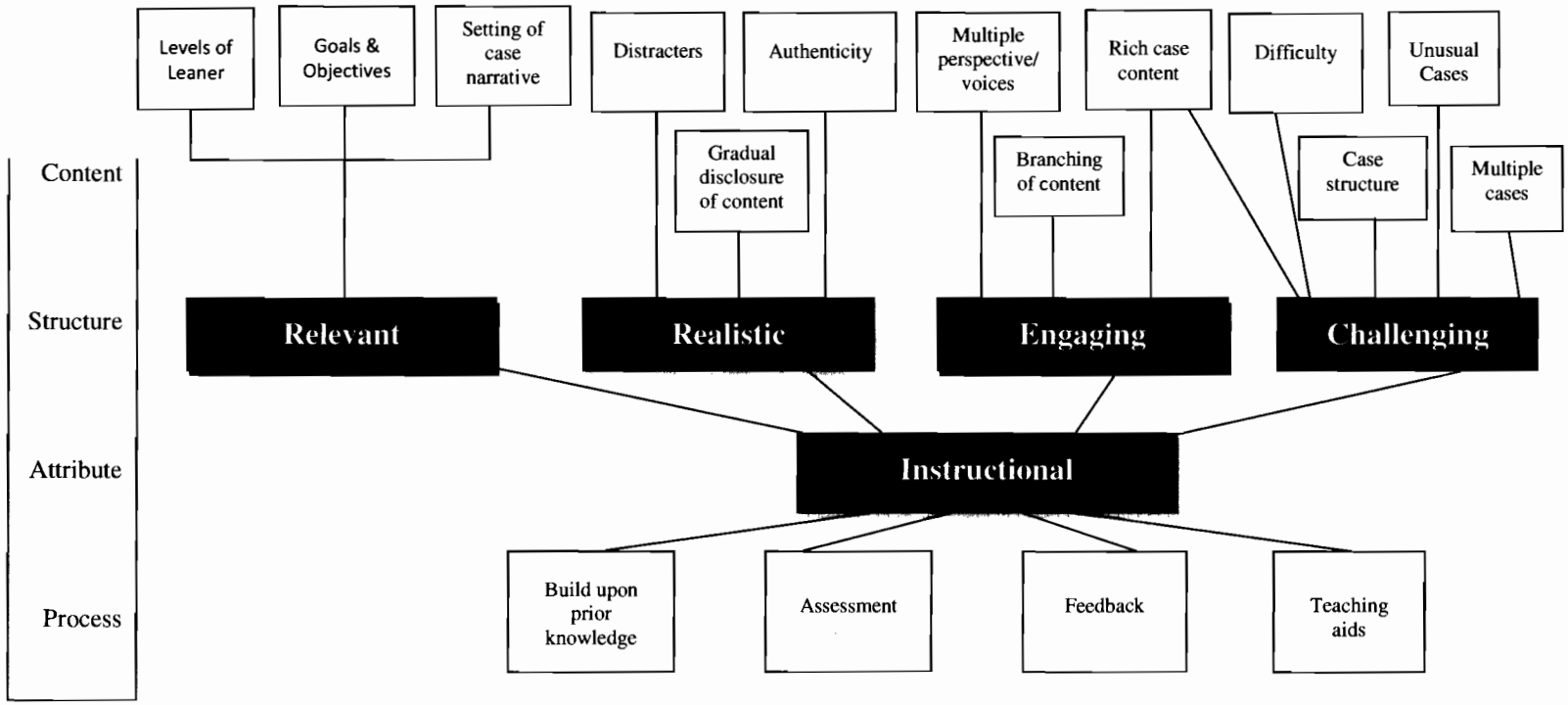


Figure 1: Conceptual framework of teaching case development. From "A Conceptual Framework for Developing Teaching Cased: a Review and Synthesis of the Literature across Disciplines", by D. Brock, J. Keary, S. Kim, K. Phillips, W. Phillips, and L. Pinsky, 2006, *Medical Education,* 40, p. 867. Copyright 2006 by Blackwell Publishing Ltd. Adapted from Brock (Ref. 6).

Each dimension of this conceptual framework is explained below; the entire discussion is taken from Brock et al. (2006).

Relevant refers to connecting the different levels of learners, goal and objectives of the course, and the setting of the problem or case study. Educators need to pay close attention to problem details and insure they have interest or motivate student learning. Each problem needs to have a realistic setting that is commonly seen in medicine today to give it real-life quality.

Realistic deals with lifelike or graphic in nature implying a real-world setting. The attribute would include authentic material and distracter features, and disclose the content gradually. Using actual clinical cases to build problem cases would make the models for teaching more authentic. Cases should include pertinent information and eliminate unnecessary information. Gradually presenting the material instead of using an all at once format would help to increase students' interest and provide areas for feedback or added teaching, or assessment time. To present the case gradually is more like life because rarely does a patient present with all symptoms at once or receive a diagnosis on one visit to a doctor.

To *engage* implies providing material that is interesting enough to hold a student's attention. Problems must be developed with extensive detail and rich content to remain attractive. One way to accomplish this would be to add multiple voices or perspectives on the issue being presented.

Challenging in case development refers to paying close attention to not making the problems so complex as to lose students' attention or make them feel overwhelmed or, worse yet uninterested. Students must be allowed adequate time to process, research, and solve the problems during class time so they may work collaboratively or individually on each individual problem.

Overall, this conceptual framework is important because each of its individual attributes can be used to aid in the development of each individual PBL problem. .

Proposed benefits of PBL as a teaching strategy

PBL can occur in a variety of ways. Written problems can range from a short sketch used to illustrate a theoretical point to elaborate problems, presented in sections, with questions to help students develop critical thinking patterns and integrate theoretical content (Albert, Boutain, Brandt, O'Connor & Thomas). The short sketch could be used to explain or highlight a biological process, whereas a complex problem can increase critical thinking of the core content.

One of the primary reasons to change from traditional teacher-based lecture format to the student-based (PBL) format is to increase students' critical thinking skills and contribute to students' self-directed learning. Problem-based learning (PBL) is assumed to have a positive effect on student learning (DeGrave et al., 2006; Livingston, McParland & Noble, 2004).

Another aspect is the increased learning that occurs within student group work (Dolmans, Scherpbier, Van Luijk & Wolfhagen, 2006). PBL has been proven useful in medical curricula for physicians, pharmacists, nurses, biomedical workers and many other allied healthcare workers (Dai, Malkani & Smith, 2005; De Grave et al., 2006; Lai, So, Tiwari & Yuen, 2006; Martínez-González, Morales-Lopez, Petra, Piña-Garza, Rojas-Ramirez, et al., 1999; Sweeney, 1999).

Although most researchers and practitioners of problem-based learning agree that it enhances students' critical thinking there is still the question of how much of a benefit is observed. Whereas some are convinced that problem-based learning is beneficial (Lai et al., 2006), others maintain that the differences seen in students' critical thinking is too slight to be considered significant (Lonka, Nieminen & Sauri, 2006). Students' performance on standard multiple choice type of questions does not show much of a difference. Rather it is essay and short answer assessments that demonstrate the difference due to problem-based learning (Aaron, Basualdo, Cook, Crocket, Kovithavongs, & Meilke, 1998). This is the premise for the claim that PBL enhances students' critical thinking skills, since essay and short answer types of questions rely on increased depth of understanding (Lai et al., 2006).

The majority of research was primarily descriptive in nature and lacked data. It is difficult to validate the widely accepted belief that problem-based learning contributes to critical thinking skills in learners (Brock, 2006). Many researchers have found that problem-based learning instruction can help students become more reflective thinkers by encouraging them to consider critically the decisions of actors in a problem and to use evidence (theory, data, or feedback) to support their assumptions about the case as described by the Merseth study

(as cited in Dai, 2005). This study found that students who had learned with PBL left a class with a more integrated understanding of the course material. For example, Haidet et al. (2007) and Lonka et al. (2005) studied team or group functioning and success with problem-based learning in medical schools and concluded that the instructors' positive attitude, familiarity with PBL techniques, and continual professional development were important factors for team-based learning success. Meddar, Steele, and Turner, (2000) and Manning and Olmesdahl, (1999) compared learning outcomes and perceptions of facilitator behavior and small-group process in problem-based learning groups led by students and those led by faculty. Both studies examined the importance of professional development on faculty when changing from a teacher-centered to a facilitator role. Student performances and differences in the development of students' critical thinking between those who took the PBL and lecture courses were examined, respectively, by Lai et al. (2006) and Martínez-González et al. (1999).

Research has also been conducted on PBL curriculum use to enhance self-directed and lifelong learning habits of medical students. Medical practice for all medical workers requires them to continually learn about new medical diseases, testing methods, equipment, and treatment options in an ever-changing world. Campbell, Miflin, and Price (2000) looked at how problem-based learning can increase self-directed learning as a lifelong habit in medical education. The paper described a conceptual framework developed by them to guide the achievement of self-directed, lifelong learning in a graduate entry level, problem-based curriculum which is similar to the conceptual framework developed by Brock et al. (2006).

Problem-based learning has thus been used most extensively by professional schools such as colleges of medicine, nursing and education in an effort to help students develop good diagnostic and problem-solving skills along with content knowledge. To date, evaluation data are mixed, but, overall, PBL appears to be as or more effective than traditional programs for student learning (Arámbula-Greenfield, 1995).

Proposed criticisms of PBL as a teaching strategy

Critics of PBL point out that student's will use more easily understood material over more difficult or complex scientific information to answer problems or questions. Yet, students need to be able to handle complex situations to be successful in the medical field (Sweeney, 1999).

The quality of the structure and complexity of problems is another issue to address. Students are able to distinguish PBL problems that are too simple or too well-structured, but have difficulty in distinguishing problems that are too complex or too ill-structured. Students find structuredness a more important characteristic of PBL problems than complexity (Dolmans, Jacobs, Scherpbier, & Wolfhagen, 2003).

Another criticism about PBL is the issue of the content of PBL. There is an inherent flaw in problem-based learning in medical schools due to the focus on acute and curable disease states. Critics say that most PBL ignores problems concerning chronic illness and difficult to diagnose diseases that plague the elderly population (Finucane & Nair, 2002).

In this section, the some of the critisms of PBL were discussed. The critisms elaborated on were students use of simple material over complex content, differences in complexity of

structure, inherent flaw to concentrate PBL on curable diseases, and the variety of types of PBL used.

Summary

My literature review examined PBL and its usefulness in education as well as some of the most important critical issues surrounding PBL as a teaching method. It also presented literature related to how PBL can enhance teaching practice. Overall, the majority of the literature on PBL suggests that it can be effective in promoting critical thinking, although as with other teaching methods it needs to be well structured and implemented. In the next chapter I describe the methods I used to investigate my research questions.

Chapter 3

Methodology

Overall, I conducted my study using action research. Action research is simply explained as a systematic inquiry conducted by teacher researchers to gather information about how their particular schools operate, how they teach, and how well their students learn. This information is gathered with the goals of gaining insight, developing reflective practice, effecting positive changes in the school environment, and improving student outcomes and the lives of those involved (Mills, 2007). I used action research to investigate whether or not problem-based learning would enhance students' learning

My investigative methods were structured around answering my research questions: (1) How can problem-based learning be used to improve a phlebotomy course? and (2) How can I as a teacher improve my own pedagogical skills? Methods are described for each of the following aspects: problem development, PBL implementation, school setting, course participants, data collection sources, and data analysis procedures.

Problem Development

I used the conceptual framework of Brock et al. (2006) to aid in the development of sound and meaningful problems. The framework helped me review in detail each of the problem's developmental attributes including Relevant, Realistic, Engaging, Challenging, and Instructional. Each problem created was examined carefully to ensure that it would accomplish what it was intended to do.

To address the research-identified PBL criticism that problems be based on complex information over that which is more easily understood, I attempted to design each problem with different levels of difficulty. To address the criticism that problems tend to under-represent the elderly or chronic illnesses, I developed PBL situations that represent disease states and chronic illnesses that are common in the elderly, and attempted to represent different types of patient populations and diseases that are irremediable.

Each problem was developed using the educational concepts and criticisms explored earlier. The core concept for each individual problem was centered on the broad topic of heart disease. By developing each individual problem on heart disease each student had the opportunity to increase their understanding of heart disease and heart attacks. The student PBL project was planned to coincide with the cardiovascular chapter in our textbook, which enhanced the relevance of the lesson. The main topics of the problems were centered on high blood pressure, stroke, heart attack, and heart attack with subsequent death of the patient. In my phlebotomy class, we study the cardiovascular system in detail. Students must understand the circulatory, lymphatic, coagulation, and fibrinolytic systems and processes. Students must understand the components, functions, and diseases of each system. Thus, as the chapter ended, I hoped that this cardiovascular curriculum would enhance their understanding of the cardiovascular system and prepare them for the certification exam that they are required to take by the State of California health department.

PBL Implementation

Students were randomly assigned to groups of three or four students, and each group was assigned a specific problem consisting of a scenario plus questions. Each group was responsible for answering the problem questions using research: individually, students had to write reports on a selected question; as a group, students had to prepare a presentation on all the questions. Students were allowed time to read each individual problem and ask questions about the project requirements. After all student questions were answered, students then decided who in each group would be assigned each individual question of the problem for their individual report.

Each group had from 40-50 minutes of class time during the next five weeks to conduct research via the Internet or library, and to ask questions I also distributed related reading material for each group concerning their particular problem. I was always available to aid students as they conducted research, and to explain how to conduct a search using their school's library as a source of information.

Students also had time to work on their presentation piece of the assignment, consisting of a poster or a PowerPoint presentation. Each student had to contribute to the presentation part of the assignment and the presentations were worked on during classroom time. I allowed three to four weeks for them to develop their presentation, which left each student with approximately two to three weeks to work on their individual report assignment.

Concurrent Heart-Healthy Curriculum

To coincide with the PBL lesson I also developed a lesson on how to live a heart-healthy lifestyle. The purpose was for me to conceptualize and ascertain the pedagogical benefits of investigating the differences observed in cardiac disease and heart attack risk factors due to ethno-cultural identity. The ethnic groups included in my study were African Americans, Mexican Americans, and Asian Americans. Along with the above mentioned groups, some research also included comparisons to European Americans. The main reason for selecting these ethnic groups was to include the ethnic groups represented in my class, providing the benefit of examining differences in lifestyle, dietary habit, smoking habit, genetic difference, or other tangible differences by ethnic group.

This focus on ethnic groups is important because, in the Nursing and Health Professions department of my college, very little cultural awareness lessons and/or assignments occur. In general, medical practice presents material with no indication of race or socioeconomic class because all human bodies are the same on all levels except sex. We present material on the human body and functions, speaking about function at a biochemical level. In our training for health careers we are trained to use no racist or sexist or any other inappropriate language or action, and all medical career tracks have a chapter of a textbook that addresses diversity and cultural awareness. Professionalism is taught and students are encouraged to maintain a professional attitude with patients and patients' families. Students are made aware of patients' rights, communication skills, effective communication in healthcare, elements in healthcare communication and different healthcare settings. But a real awareness of how cultural diversity can impact on and be impacted by health, health practices, and health professionals is not generally discussed. Therefore, I hoped that

researching this topic would increase not only my own understanding of heart disease, stroke, and heart attacks, but also that my students and we would learn about lifestyle changes that would benefit us ultimately in making better health and health care choices and possibly preventing heart disease for ourselves and our extended family. The knowledge and experience I hoped to gain from this work, combined with what I learned from using PBL, would then lead into the development of my action plan.

School setting

The college where I work is located on California's central coast, and is one of the oldest institutions of higher education in California. The college is accredited by the Western Association of Schools and Colleges, the American Veterinary Medical Association, the California Board of Registered Nursing, and many others boards. The college has technologically advanced facilities and offers many different vocational and academic programs that offer associate degrees including vocational nursing, emergency medicine, veterinary technician, early childhood education, psychiatric technician, computer technology, engineering, administrative justice, agriculture, and dramatic arts.

The program with which I am affiliated is medical technology (MLT) and phlebotomy. The MLT and phlebotomy program prepares students to be members of the healthcare team which provides clinical information for disease prevention, medical diagnosis, and patient treatment by collecting and processing specimens, and performing laboratory testing. The MLT program was developed to address the needs of the community and the laboratory related industry. The first year of studies typically prepares students in the areas of general biology, chemistry, and microbiology while also completing the necessary general

education requirements for the Associate of Science Degree. The second year courses provide specific theoretical and laboratory experiences in clinical chemistry, immunology/immunohematology, microbiology, and hematology.

The phlebotomy program was developed to prepare students to collect and process specimens for laboratory testing. The phlebotomy program includes introductory laboratory, phlebotomy lecture, and clinical practicum. Students receive a certificate of completion upon fulfilling the requirements with a passing grade. (Information retrieved from college website, Academic Programs, Math and Science, MLT and Phlebotomy program [data file]: Retrieved October 26, 2008 from http://www. [college].cc.ca.us.)

Course participants

Participants in this study consisted of the students in my college phlebotomy class which traditionally enrolls about 75 % females and 25% males. Ethnicities of students traditionally include 70% Mexican Americans, 20% European Americans, and 10% Asian Americans, most of whom range in age from 20-30 years but some of whom can be in the 40-50 year-old range. All students have high school diplomas and all have taken some college courses in addition to this phlebotomy class including the prerequisite course *An Introduction to Laboratory Science*. Overall, students represent the college at large but there are some differences. In the college as a whole the sex of students is more evenly represented at 45% females and 55% males. The ethnic ratio is 75% Mexican Americans, 10% Asian Americans, 8% European Americans, 3% African Americans, and 4% other ethnic groups. The average age of students also is a little younger, with 90% of the students falling into 18-

25 years and only 7% of students falling into the 25-35 range. (Retrieved August 13, 2008 from http://www.[college].cc.ca.us.)

Data Collection Sources

In order to address my research questions adequately I used multiple measures to collect my data: personal interviews, class observations, student questionnaires, student artifact data, and my own reflective teaching journal. Each of these is described below.

Interviews

I interviewed nine students. I selected students to be interviewed by their enrollment in my phlebotomy class. Students were allowed to decide to participate freely without consequences for nonparticipation. The individual interviews were approximately 30 minutes in length. The types of questions asked are listed in Appendix I, and covered topics such as students' perceptions of level of learning, difficulty, application to real-life, relationship to course content, and whether students preferred group over individual work. During each interview in-depth notes were taken, but the interviews were audio-taped and transcribed verbatim as well for clarification and verification purposes.

Questionnaires

I administered an open-ended questionnaire to students with inquiries about their overall learning preferences to help determine whether the PBL method was preferred over the more traditional lecture format. The questionnaire is included in this proposal as Appendix II, and asks students to compare their preference for direct vs. independent instruction, the value of group work vs. competition, etc. Questions deliberately did not include direct

reference to PBL because I hoped to get a fairer appraisal of PBL and receive a more unbiased opinion from students.

Reflective Teaching Journal: Student Observations

I kept a teaching journal, and wrote in it as quickly after each class as possible. The entries included my perspectives of students, coursework, class activities, and some self reflection. I also recorded observations of students as they were using PBL in the classroom, which means they were working in their groups. Each observation was for the duration of 45-60 minutes. During the observations literature-based student behaviors typical of PBL activities, including collaborative and self-directed learning, discussion and analysis of possible answers, research and reflection on information obtained, etc. were recorded. As I observed students I recorded how often—and how well—they engaged in the behaviors. I hoped to use my notes and reflections to create an in-depth analysis of my teaching and evaluate the activities that I used.

Student Artifact Data

Student artifact data consisted of individual student reports, group presentations, and student test score data. The individual report requirement was for a narrative report answering one or two of the questions posed in a particular problem, and each student within the group will be allowed to select which question they would attempt to answer in their student report and displayed in Appendix IV. These reports provided information on what each individual student had learned about the heart and its functions as a result of my teaching. For the group presentations, which consisted of posters or PowerPoint slide presentations, each student in each group was assigned to bring a particular item for their group's poster or

PowerPoint slide show creation, such as relevant pictures, data, or information and displayed in Appendix V. Group presentations provided further information about what students had learned about the academic content of the heart unit. A third artifact consisted of student test scores on the phlebotomy certification examination, which has a major focus (ca. 34%) on the topics covered in my heart unit. My students have taken the same examination each year, but I taught entirely through lectures prior to 2008, at which time I began using PBL in combination with lecture.

Data Analysis

The interviews, questionnaires, my teaching journal, and most student artifacts were qualitative in nature and yielded similar kinds of data, although from different perspectives; thus data from these sources were analyzed in essentially the same manner. To begin, interviews were transcribed, questionnaire responses were studied individually, student reports and presentations were examined for evidence of student knowledge about the academic content, and each entry in my teaching journal was searched for data relating to my research question. Next, I analyzed all data for commonalities and themes, especially with respect to my research questions. To do this, each important piece of data was first coded on a 3" X 5" index card so the data would be manageable and could be sorted easily. The data were then analyzed for similarities and differences, and pieces of data that were related or had sufficiently common characteristics to be grouped together were compiled into related categories or themes. The cards were reorganized many times to arrive at a series of logical themes, each of which would provide some answer to my research questions.

The only quantitative measure used was student scores on the phlebotomy certification examination. I was able to isolate the scores of my own students over the past several years, which were compared for the four years prior to and the single year following my initial PBL implementation. However, it was not possible to analyze them statistically such as with a χ^2 test as cell sizes were too small. Therefore, data from over the five-year period were displayed and compared only graphically.

Summary

In this chapter, I described the methods I used to collect and analyze data to answer my research questions. Overall, I used qualitative methods to collect data including student interviews, student written questionnaires, my own reflective teaching journal, and student artifacts including individual research reports, group presentations, and student test scores. I also used qualitative methods to analyze all data for common themes. In the next chapter I present the findings derived from these data sources.

Chapter 4

Findings

In this chapter, each individual theme that emerged through each of my individual data collection methods—interviews, observations, questionnaires, student artifacts, and reflective teacher journal—will be explained within the themes to see if they answer my research questions. As most of my findings directly addressed both of my research questions, which concerned the potential benefits of PBL to both student learning and my own teaching, the discussion below will encompass responses to both questions.

The major themes to emerge from my research data were:

1) Student preferences for PBL vs. lecture were mixed;
2) Student preferences for working in groups vs. by themselves were mixed;
3) PBL can increase student knowledge about the curriculum;

1) Student preferences for PBL vs. lecture were mixed

The first theme that emerged from my data was that student preferences for PBL vs. lecture were mixed, but preference seemed to vary by how students were questioned. Seven of the nine interviewed students preferred problem-based learning over lecture. For example, one student said "I would say I liked PBL and learned a lot about the heart." Another student said "I agree with her; I liked PBL also and learned about heart disease." However, one student stated that he preferred lecture more, saying, "I personally prefer lecture because you, I mean, you take things as they come and you interpret the information as it comes. If

you don't interpret the information it that way, you can write it down—that is always the good part about lecture and you can review it later, um I don't know, I think lecture is best." Some of these students liked both methods. As one student said, "it was helpful both ways, you know lecture and then the project we did—it was helpful from both of those". Another student interjected, "I learn visually and audio...by hearing, and lecture, ah, I learn all those ways. And, if you're only lecturing I'm going to write it down and review it later". Overall, these students appeared to have a preference for PBL over lecture.

In contrast, four of the five students who answered the questionnaire said that they preferred lecture to PBL. One student explained, "I prefer lecture because it allows me to listen and absorb the information. I also like it `cause I feel in control of how I learn". Another student stated, "I prefer lecture. I take information in better when someone is speaking to me". Yet another student said, "I prefer lecture because it is more direct." Therefore, the suggestion that students prefer PBL over lecture was not confirmed by this data.

My reflective teaching journal noted possible reasons why some students might have preferred lecture to PBL. One reason is that the students did not initially understand the PBL assignment and what was expected of them. Therefore, I needed the ability to be flexible and knowledgeable about how to teach them to conduct research. In addition, students did not know how to write the required narrative report to address their particular question in the problem. It became obvious that students lacked the writing skills to complete the written report assignment. I had to explain that the report was not a book report but more like a story or summary of what they had learned from the research they

conducted. I spent a lot of time answering their questions and made a note to have student examples to show them in the future.

Yet another problem I noted was that students initially were not used to conducting research, and struggled with where to look for information. To assist them, I directed them to some websites to help them find information. They also didn't know how to use the college library to request journal articles, so I instructed them regarding where to look for information and how to request it from the college's library. A further problem concerned the use of technology in research. I found that I really needed to be flexible because some students were technologically advanced and others were not, and I needed to present help on many different levels. Fortunately, students assisted each other during the Internet searches; I was only one person and could not be everywhere at once so some of the more techno-skilled students' aided the less techno-skilled students with their research.

As students became more comfortable with the material and expectations they became more actively engaged in their PBL research and their group work. For example, while they were conducting research I noted that they were eager to use Internet sources, laboratory textbooks and their own phlebotomy book to answer their PBL questions. In one session I saw two students using a laboratory textbook to find the answers to laboratory test reference ranges, as each problem contained laboratory results that students were required to interpret regarding possible abnormalities. Another student was reading her research paper, taking notes from the report and working on her question about what other testing would be done on the patient in the problem. Two other students wanted to make copies of an Internet article to share; they had been discussing how the research could be useful for both of them

to answer their questions about possible therapy options. I also observed each student contributing to their group. I even observed two groups of students exchanging research material with other group members, and groups sharing the textbook with another group.

Overall, then, student preferences for teaching method were mixed, with slightly more than half preferring problem-based learning and the others preferring lecture possibly due to their lack of familiarity with the PBL method and the resulting problems they encountered. These are factors that I will need to address in future PBL implementations as I work to improve my teaching, as the extent to which a lecturer is able to make the transition to PBL is a major factor in the successful implementation of any PBL curriculum (Manning & Olmesdahl, 1999).

2) Student preferences for working in groups vs. by themselves were mixed

The next theme that emerged from analysis of my data sources was that some students preferred working in groups and some did not. For interviewed students, preferences for group work vs. individual work were somewhat evenly distributed for both perspectives. Two students said they had liked working in a smaller group comprised of 3 or 4 students. One of them said, "Some people have different ideas, and that can help the group." The other said "That's exactly what I would say;' we had different types of information from each other and so it was helpful." The students who had worked in a larger group of 5 students commented more negatively about the group work overall. One student said, "Yes, definitely, I didn't enjoy the group work." As before, the questionnaire results were more negative, suggesting that students were less likely to enjoy group work over working alone. One student shared, "I'd rather work by myself. Relying on others makes me lazy". Another

student commented, "Both—sometimes groups don't work for me because they are hard to get equal participation".

One aspect of group work that may have impacted on students' acceptance of it relates to learning from other students in their group. As before, results were mixed. One student said, "I always learn from other students. Learning different study habits or test taking methods is a good thing". But another student said "I did not learn from other students `cause I was not really listening. I was being polite." Still another student said, "We had fun and I thought we learned a lot, and I thought it was a good way to also get to know people because we had to work on a team." Overall, approximately half of the students felt that they had learned from others and the other half felt they did not.

My teacher journal suggested another factor that might have impacted on students' perceptions of group work. That is, there was a pattern of students preferring to select their own groups over my assigning them to groups. I would randomly assign students to the different cases and allow them to switch somewhat, but I did not want them to completely rework the group. Most did not change their group at all, but it was clear that students wanted more control over who they were required to work with to complete the assignment.

The size of the group also appeared to make a difference in student attitudes toward PBL. From the interviews, questionnaires and my teacher journal it appeared that students had more positive comments when the group size was smaller. In the future I will use this information and restrict the size of the groups to 3 or 4 students per group. I will also ensure that students have more practice with group work.

Overall, the data shows mixed results and somewhat negative comments from students on group work, but the possible reasons for their negativity may relate more to the way the group work was implemented than to the PBL nature of the group. This is another factor I will need to address in future PBL implementation as I work to improve my teaching. It is important for students to learn to work as a team since this is the focus of medical practice today. Healthcare institutions are increasingly encouraging interdisciplinary communications and teamwork among health professionals to optimize patient care (Britton, Keating, Kirchner, Laatsch, Lehman, et al., 2005).

3) PBL can increase student knowledge about the curriculum

The third theme to emerge from my data analysis was that PBL did seem to increase students' understanding about the lesson. As one student said during her interview, "I would say, I didn't know much about the heart attacks and know more now." Another student explained it this way: "Because it's just as easy to take the theories that you learn and literally apply it to hands, uh, working. For instance, you know that EDTA is in a lavender instead of a green tube." Students seemed to learn about heart disease and a heart-healthy lifestyle and have more knowledge about phlebotomy.

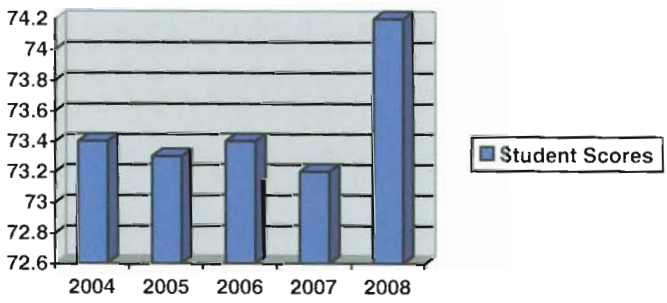
Evidence of student learning through the PBL work also is provided by student artifacts. As described in Chapter 3, students were required to write a narrative report and answer one or two of the questions posed in their particular problem. Examples of student reports are displayed in Appendix IV; the PBL problems are displayed in Appendix III. This year's student reports show a remarkable improvement over the past semester student reports.

First, most of the students' papers averaged approximately a 450-500 word count, whereas earlier reports averaged only 250-300 words, suggesting that this year students were more thorough in their research. Second, student reports were better-developed as they covered questions in greater depth, reflecting greater depth of learning. For example, one student, in answering the question, "What additional laboratory testing methods are recommended for a possible stroke victim", wrote: "A Prothrombin Test (PT) and an Activated Partial Thromboplastin test (PTT) should be performed to check that the individual's blood clotting function is normal and not the cause of one or more of the problems the patient is having". She also wrote: "A Carotid Doppler is a method which uses ultrasound waves to take a picture of the carotid arteries in the neck. This will show the blood flowing to the brain and can also show if the carotid artery is narrowed by arteriosclerosis. Transcranial Doppler is when ultrasound waves are used to measure blood flow in some of the arteries in the brain. These two tests will help to locate any problem with blood vessels if there are any." Her report thus demonstrated an understanding about not only laboratory testing methods but also about ultrasounds and electrocardiograms. Another student stated, "Heart disease is a leading cause of death in not only the United States but worldwide", whereas another said "Myocardial infarction is defined as a heart attach or death of heart muscle due to obstruction (occlusion) of a coronary artery." Each student seemed to understand more about heart disease and attacks than before they engaged in PBL. Student reports in previous years were much more general and did not reflect as great a depth of knowledge.

Another possible piece of evidence that my students may have benefited somewhat from PBL comes from the statewide certification examination that all phlebotomy students must take. According to the certification board, this exam has a major focus (ca. 34%) on the

heart and on tests related to its functions, for which reason I wanted to use it to assess my students' progress on my heart unit. I have been teaching phlebotomy for a number of years and my students have taken the same examination each year. I also taught entirely through lectures prior to 2008, at which time I began using PBL in combination with lecture. A comparison of my PBL class with all of my earlier, lecture-based classes reflected a slight increase in average student passing score for 2008 compared to earlier years, as illustrated in Figure 2 below.

Figure 2



As can be seen, the 2008 score of 74.2 reflects a very small increase over the average score of ca. 73.3 from 2004-2007, but previous years' scores all hovered consistently within about 0.2 of a point of each other. It is understood that any score change clearly cannot be attributed solely to the introduction of a new teaching method, as other factors such as student population, testing conditions, other pedagogical influences, etc., could also have contributed to students' test scores; in addition, test scores reflect the entire phlebotomy curriculum and not solely the heart-based curriculum in which my problem-based learning was contextualized. Therefore, the best that can be said from these data is that there is only a very small suggestion of possible improvement in last year's PBL + lecture class over previous years' lecture-only classes.

As just mentioned, test scores reflect an entire curriculum and the PBL section of my class was embedded only in the heart-healthy part of that curriculum, thus any increase in scores would necessarily reflect more than simply the content learned through PBL. But as reviewed in Chapter 2 of this thesis, students' growth in academic performance when using PBL appears to stem mostly from an increase in critical thinking and problem-solving skills (e.g., Lai et al. 2006; Martínez-González et al., 1999). Therefore, if PBL played a role in the slight increase in student performance on the board certification examination it may actually reflect an increase in critical thinking as well as on learned content.

Overall, I believe that the data suggests that students experienced some success with learning about heart disease, testing methods, treatment options, and critical thinking. To the extent that they experienced success in their learning, I also experienced success in my efforts to improve my teaching.

Summary

In this chapter, the findings of my qualitative data measures were presented and analyzed. Overall, the combination of qualitative data sources suggests that students were divided in the extent to which they valued PBL over pure lecture, as well as in the extent to which they valued group over individual work. Some evidence suggests that they may have increased their knowledge about the heart, and that they perceived of the PBL problems as being connected to "real life". In addition, there may have been a very slight gain in their critical thinking skills, as suggested by their performance on the certification examination, but there are too many variables impacting on the test results to conclude any definitive gains. Further

research will have to be conducted to see if this increase in performance is really due to PBL and not student population or other differences.

As to whether PBL helped me enhance my own skills as a teacher, one of the reasons that PBL was important to me was it was simply different from standard teacher-centered lecture, and I believed it could be very useful in my teaching. I believe the data from my study clearly demonstrated that my use of PBL enhanced my students' learning and constituted an important method to increase students' knowledge as reflected in their work and even on the certification board examination. With respect to the examination, even a slight increase in achievement is important and reflects what was found in much of the research literature I read as most studies showed only slight increases in students' abilities. For these reasons I feel PBL can be used as a valuable tool to improve my teaching practice.

In the next and last chapter, these data will be summarized briefly and methods of potential implementation will be discussed. An action plan for future use of the PBL method in my classroom will be outlined, and some final thoughts on what I learned will be discussed.

Chapter 5

Discussion, Action Plan, and Implications

In many college classrooms students sit in neatly formed rows of seats while listening intently—or not—to a teacher-centered lecture for an average of two to three hours. Is this the best teaching method? I have serious doubts as to whether this is the best method of instruction for students. In fact, students may in adulthood be able to listen for longer than an average school-aged child, but why can't we try something slightly different? In this study, I attempted to do that by introducing problem-based learning (PBL) into my teaching in addition to my standard lecture-based teaching.

Summary and Discussion

The main reason for conducting the research and implementing PBL into my curriculum was to improve my own teaching and enhance learning in my students, who represent a diverse and largely minority group. I chose PBL because it has been shown to be a useful technique to improve critical thinking and problem-solving skills in students (Lai, Tiwari, & Yuen, 2006), and because it requires students to work together in teams to solve problems.

PBL implementation occurred in my class over a period of about five weeks. Each week students formed their groups and set about to accomplish a list of activities which are outlined in my action plan. As the student groups completed their weekly assignments the individuals within each group prepared their student reports for submission on the final meeting date set on the class schedule. The student groups also worked on their final group project for the panel presentation date, which was the same date as the student reports were

due. At the end of each class period, the student groups discussed what they had learned and what else they might need to learn to accomplish their goal.

To investigate the effectiveness of my PBL implementation for my students, I observed students closely during their group work, examined the work products they submitted, and interviewed them for their perceptions of the new pedagogy, including not only problem case studies but also working in groups. Overall, I found that students had mixed perceptions of both PBL and group work, with about half preferring lecture vs. PBL, and roughly half preferring working alone vs. working in groups. Possible reasons for this included a lack of clarity and experience in both of these dimensions for both students and me, as PBL was new for all of us.

Despite these mixed results, there may have been a slight improvement in student achievement compared to previous years as evidenced by the quality of the individual reports they submitted as well as the group posters they prepared on their problems. Further, a standardized test on the topic of the problems, which was the heart and circulatory system, suggested a possible overall score increase compared to student achievement on this topic in previous years. A small increase is not surprising as in most research improvements in students' abilities when using PBL were small (DeGrave et al., 2006; Livingston, McParland & Noble, 2004). Although the test score increase was very small and cannot be attributed simply to the use of PBL as other factors cannot be ruled out, I am hopeful that this new curriculum will make a lasting impact not only on my students' knowledge about the circulatory system but especially on their personal commitment and empowerment to choose a "heart-healthy" lifestyle for themselves and their families,

As mentioned, I also chose PBL partly because of its requirement for students to learn to work effectively in teams. This is important for phlebotomy students because in the general workplace today, a heavier focus on the ability to work as a team with many different types of people is a necessity, and the laboratory has not been exempt or in a vacuum over the years especially as today more pressure is on management to ensure a healthy environment in the workplace. Within the laboratory setting, the phlebotomist is the first person that most patients encounter. They usually represent the laboratory and may very well be the only person that a patient sees from the laboratory. Because of this simple fact, phlebotomists represent the laboratory. The laboratory in a hospital setting is open for 24-hours a day, every day of the year, and for this reason most phlebotomists work in teams of phlebotomists plus the testing personnel who also are on staff all the time. It is imperative that the laboratory has a healthy and cooperative team atmosphere so that its function is not affected by negative influences. Because working together is often the best atmosphere for a productive work environment, healthcare institutions are increasingly encouraging interdisciplinary communications and teamwork among health professionals to optimize patient care (Britton, Keating, Kirchner, Laatsch, Lehman, et al. 2005).

Finally, by choosing PBL to help enhance my students' learning and critical thinking, I also hoped to empower them to set and pursue high academic and professional goals. As they become members of the healthcare team many different aspects of their life may change and those include improved economic status, professional recognition, opportunities to become part of a community of workers, and learning about effective communication in healthcare, public relations and client interaction. Any one of those could dramatically improve the life

of one of my students, most of who belong to ethnic/cultural groups that are traditionally underrepresented in science and healthcare fields.

Action Plan

The Action Plan based on my study consists of the five-week teaching unit I developed and tested, centering on preventing heart disease and leading a heart-healthy lifestyle, along with the goals and rationale for the unit.

Goals and Rationale for Teaching this Unit

Since I began teaching in 1991, I have discovered that students do have some knowledge of how to prevent heart disease and lead a healthy lifestyle. Nonetheless, knowing more about nutrition and exercise and the treatment options that are available for heart disease can add to the students' overall knowledge about a heart healthy lifestyle, and this is one of my major goals in teaching this unit. During class my students learn about the heart, blood and blood cells, coagulation, blood pressure measurements, laboratory testing, and testing requirements and collection processes for cardiac testing but students should benefit from the project in many different ways, and a second major goal in teaching this unit is to contextualize it within multicultural and gender issues. That is, this unit is contextualized within the inequities related to culture and gender that I have uncovered in my research and which often result in minorities, women, and the elderly not receiving the same quality of medical care as others due in part to a lack of education about these populations on the part of many health professionals. To help address these issues of inequity, different genders and cultural and age groups will be included in the problems I create, and students will learn about how to deal with these populations respectfully. Given the fact that health

professionals are instructed on professional conduct and multicultural diversity in a somewhat limited way, I believe students will benefit from learning from the multicultural curriculum unit that I developed.

Furthermore, as most of my students belong to diverse cultural and ethnic groups, learning about how health issues might affect different populations differently will enable them to learn more about themselves, as they eventually face healthcare decisions about their family or themselves they will be informed about current techniques and practices that are available for diagnosis and treatments, and possibly this will help them to make better decisions. In addition, through their phlebotomy careers they may be empowered to help change the current trends in heart disease not only for themselves but also for the patients they will serve.

A third goal for teaching this unit is to enhance students' ability and willingness to work as a team which, as mentioned, is becoming increasingly important in the medical workplace. In this unit, the students will benefit from working in small groups and learning cooperatively when working on their group projects, which consist of posters or PowerPoint panel presentations as well as a question-and-answer section. These student projects potentially will benefit other students in healthcare also as they are displayed in the hallway and all other healthcare students, including nursing students and emergency medical technicians, can view them and gain useful information on heart conditions, treatment, healthy lifestyles, etc. In this way the other students may learn something from the posters that they may have not known.

Finally, another goal was to fulfill my own desire to improve my pedagogy and enrich the curriculum by promoting students' critical thinking and lifelong learning skills, as well as to educate many people on heart disease and empower them to make the changes necessary to change the current trends with respect to heart attacks and disease.

The PBL Curriculum Unit

The PBL cardiovascular curriculum unit will be presented to the students as they read the cardiovascular chapter in their textbook and will continue over a period of five weeks. During the unit, however, I must continue to make use of the basic class pedagogy of lecture because my course needs to cover a broad spectrum of topics in order to prepare students for the certification exam they will be required to take and pass. PBL is being added to enrich, but not replace, the standard teacher-centered lecture component.

The basic plan for the unit is presented below, followed by a description of the "seven simple strategies to promote a heart-healthy life" upon which the unit is based.

Class 1

Topic: The Circulatory System

Activities:

- Lecture
    - Structure, function, diseases, and testing methods re. the cardiovascular, lymphocytic, and fibrinolytic systems
    - ABO& Rh blood types

- PBL development
    - Formation of student groups; distribution and explanation of problems to groups
    - Trip to computer lab to conduct research; print out and share research material within the groups

Class 2

Topic: Blood Collection Equipment, Additives, and Order of Draw

Rationale: The primary duty of the phlebotomist is to collect blood specimens for laboratory testing. Blood is collected by several methods: arterial, capillary, and venipuncture. In this unit we will learn about the supplies and equipment used for specimen collection regardless of method used.

Activities:

- Lecture
  - Equipment and supplies for the purpose of collection of blood: Antiseptics, needles, test tubes, additives, and color coding
  - Order of draw

- PBL development
  - Students in each group select, from the questions related to their specific problem, which question they will address in their individual research papers
  - Students in each group organize their panel for the presentation they will make to the class, and select a leader for the panel
  - Students share their research information with group members as needed, and conduct additional research as necessary

Class 3

Topic: Venipuncture Procedures

Rationale: Venipuncture is the term used to describe the process of collecting or drawing blood from a vein. It is the most common way to collect blood specimens for laboratory testing. Although the steps may vary slightly, venipuncture procedures need to include certain steps in order to obtain an appropriately identified, quality blood specimen from a patient's arm, wrist, or hand vein.

Activities:

- Lecture
  - Describe collection differences: timing, priority, test, patient identity
  - Explain routine venipuncture procedure
  - Explain syringe and butterfly collection procedure
  - Discuss unique requirements for collection on special populations: pediatric, geriatric, and long-term-care patients.

- PBL
  - Students continue to share their research information with group members as

needed, and conduct additional research as necessary

- Students decide on the format of their group presentation and begin working on it: e.g., arranging for who will bring which materials, how they will be used, etc.

Class 4

Topic: Preanalytical Considerations

Rationale: The preanalytical (before analysis) phase of testing process begins when a test is ordered and ends when testing begins. Numerous factors associated with this phase of the testing process, if not properly addressed, can lead to errors that can affect specimen quality, jeopardize the health and safety of the patient, and ultimately increase the cost of medical care. Since each patient situation is unique, in addition to possessing the technical skills needed to perform a blood draw, a phlebotomist must have knowledge of the many patient variables, complications, and procedural errors that may be associated with blood collection.

Activities:

- Lecture
  - Describe various physiological issues, problem sites, vascular access devices and sites, patient complications and conditions, and procedural error risks, as well as troubleshooting failed venipuncture efforts

- PBL
  - Students in each group organize their project using the materials they brought in.
  - Students in each group organize and prepare for their panel presentation to the class
  - Students share their research information with group members

Class 5

Topic: Student project presentations and panel discussion.

Activities:

- Lecture
  - Review for final exam

- PBL
  - Students present their individual reports to the class
  - Student groups share their project and panel discussion with the class

Seven Simple Strategies to Promote a Heart-Healthy Life

As mentioned, my curriculum unit is based upon a series of strategies for promoting a heart-healthy life. These strategies, derived largely from work by Godfrey & Manson (2008), provide some of the background for the PBL problems and help students situate their research and their posters or PowerPoint presentations within the larger context of living a heart-healthy life. Each of the strategies is explained briefly below.

Weight Management

The prevalence of obesity has been rising worldwide for the past several decades with the greatest increase seen in the United States (Duarte, Freeman, Gadre, Haque, Haque, & Taylor, 2008). Obesity is generally defined as a body mass index, or BMI, of greater than 30 kg/m^2 (Duarte et al., 2008), which refers to the weight in kilograms divided by the square of the height in meters. In the obese population, left ventricular dysfunction, atherosclerotic heart disease, obstructive sleep apnea, asthma, and venous thromboembolism are recognized cardiopulmonary causes of morbidity and mortality (Koenig, as cited in Duarte et al., 2008). In addition to BMI, A waist size of > 35 inches in women is linked to a range of chronic diseases (Godfrey & Manson, 2008) as well as to a greater risk of peripheral adiposity (Hu, Manson & Rana as cited in Godfrey & Manson, 2008), and an increase in peripheral adiposity is a strong marker for a risk of diabetes and heart disease. Many patients will benefit from losing 10-20 pound weight loss in a year.

Regular Physical Activity

It is recommended that each patient develop an exercise plan that includes a minimum of 30 minutes of brisk walking or a comparable activity. Plans also should include strength or resistance training and patients should keep an activity journal to log pedometer readings.

Cessation of Smoking

Smoking has a detrimental effect on heart health, therefore every attempt should be made to cease smoking regardless of previously unsuccessful attempts to quit. Recommendations for stopping smoking include nicotine replacement as delivered by an inhaler as well as antidepressant therapies or combination strategies (Fu as cited in Godfrey & Manson, 2008).

Risk Assessment Tools

It is highly recommended that doctors make use of standardized practices to assess patient risks and prescribe treatments, which can help doctors to treat all patients the same without regard to patient sex, race or cultural differences.

Diagnostic Screening

Research has found that noninvasive diagnostic testing may be less accurate in women than in men (Larson & Lloyd-Jones, as cited by Godfrey & Manson, 2008). Coronary angiography is the preferred diagnostic strategy for high-risk symptoms in women (Blumenthal, Budoff, Hui, Nasir, & Redberg as cited in Godfrey & Manson, 2008).

Aspirin

Aspirin therapy under the prescription of a medical doctor can be beneficial for people to help prevent heart disease unless there is a specific contraindication. Aspirin is not without some risks, because gastrointestinal bleed is a real threat especially in the elderly age group.

Drug and Vitamin Therapy

Statin drugs have proven useful in the treatment of secondary prevention of heart disease. Statins are cholesterol-lowering drugs and have shown to lower the risk of heart disease by

20% to 35% overall. In addition to statins, omega 3 fatty acids, vitamin D, and calcium have major potential benefits in the prevention of heart disease but their efficiency for primary prevention has not been conclusively demonstrated; further study on a large scale and random clinical trials are needed.

In summary, a broad array of strategies is available to reduce the risk of heart disease in women and other disenfranchised groups, including lifestyle changes, risk assessment tools, use of aspirin and other pharmacological agents when appropriate. Other interventions, including omega 3 fatty acids and vitamin D, appear to be promising but need further research to verify if they will in fact provide a benefit.

Implications

In this final section of my Thesis I present the implications and recommendations that I derived from my overall study. These implications take the form of some basic lessons on how to use PBL most effectively, and concern tutor knowledge and preparedness, group assignments and responsibilities, and the overall value of PBL for both students and teacher.

Tutor Knowledge and Preparedness

The first lesson I learned was about tutor preparedness. During my research on PBL I had read that the tutor must continue to learn about PBL and about how best to use this teaching method. I learned early on that this is true, that is, the teacher must be extra prepared when implementing a new pedagogy like PBL. I learned that I needed to know a great deal about how to use the library to conduct research, how to use the Internet for research, and how to write a research paper so that I could tutor my students in those areas. I also learned that I

needed to be prepared to answer questions about the assignment, as students were not always clear on exactly what they were supposed to do or learn. Being very well prepared is one of things I will take away with me for the next time I use PBL in my classroom, and a major recommendation I would make for instructors who wish to try PBL in their own classrooms.

Group Assignments and Responsibilities

The second lesson involved group assignments. Students wanted more control over who was in their groups. I initially assigned my groups randomly, but allowed some switching for the students who thought they needed to switch. In any case I would not let the groups consist of more than four students, so the trading was kept to a minimum. Related to group assignments, students were concerned about being graded on work done by the group as a whole, i.e., the group posters and presentations, rather than on the basis of their own work. They felt better after I explained that their whole grade would not be based entirely on the group work but instead would largely be based on their individual reports. In the future, I would allow students more choice over their group assignments, perhaps based on common interest in a specific topic. I also would explain clearly at the outset of PBL that grades are to be based on a combination of individual and group work, and would recommend that other instructors do the same.

Overall Value of PBL for Students and Teacher

The third observation was that, although students were mixed in their reviews of both PBL and group work, their work suggested that they actually did learn the academic content taught through the problems. It may be that, in some cases, PBL is useful and beneficial

without being appreciated; it may also be that student appreciation of PBL increases with greater experience on the part of the teacher. I recommend that teachers who might encounter a similar reception from their students not give up on PBL but instead work harder to improve PBL implementation, including coaching students through their problems and complaints.

As for value to the teacher, one of my main reasons for selecting PBL was to allow me to grow as a teacher. I selected PBL because of its extensive use in the medical field: PBL has been used to instruct doctors, pharmacists, nurses and now also phlebotomists. I feel that incorporating problems and group work into my teaching has not only varied my pedagogical methods but also has improved my teaching effectiveness as well as my enthusiasm for teaching, and I look forward to continuing to improve problem development and implementation in my phlebotomy classroom. Over time and with experience, I anticipate that the short- and long-term benefits for students will begin to show more clearly. I would strongly recommend PBL as a potentially valuable tool to other teachers who have considered varying their own lecture-based pedagogical style for the benefit of themselves and their students.

References

Aaron, S., Basualdo, C., Cook, D., Crocket, J., Kovithavongs, T., & Meilke, B. (1998). "Assessment of Exam Performance After Change to Problem-Based Learning: Differential Effects by Question Type." *Teaching and Learning in Medicine*, 10(2), 86-91.

Albert, M., Boutain, D., Brandt, P., O'Connor, F., & Thomas, M. (2001). "Case-Based Teaching and Learning Experiences." *Mental Health Nursing,*: 22, 517-531.

American Heart Association Nutrition Commitee. (2006). "Diet and Lifestyle Recommendations." Retrieved December 1, 2008, from http:/www.americanheart.org/C/06/114/82.pdf.

Arámbula-Greenfield, T. (1995). "Teaching science within a feminist pedagogical framework. *Feminist Teacher,* 9(3), 110-115.

Blom, S., Hulten, G., Larsson, A., Tryding, N. & Wernroth, M. (1999). "Effects of an education programme to change clinical laboratory testing habits in primary care." *Scandinavian Journal of Primary Health Care*, 117, 238-243.

Bose, M., Jarreau, C., Lawrence, L. & Snyder, P. (2004). "Using cooperative learning in clinical laboratory science education." *Clinical Laboratory Science*,17(1),12-18.

Britton, L., Keating, S., Kirchner, P., Laatsch, L., Lehman, D.,Madsen-Myers, K., Milson, L., Otto, C. & Spence, L. (2005). "Cooperative learning effect on teamwork attitudes in clinical laboratory science students." *Clinical Laboratory Science,* 18(3), 150-159.

Brock, D., Keary, J., Kim, S., Phillips, K., Phillips, W. & Pinsky, L.(2006). "A conceptual framework for developing teaching cases: a review and synthesis of the literature across discilines." *Medical Education* 40, 867-876.

Burdett, K., David, T., Patel, L. & Rangachari, P. (2000). "Problem-based learning in medicine a practical guide for students and teachers." *Medical Education*, 34, 316-325.

Campbell, C., Price, D. & Miflin, B. (2000). "A conceptual framework to guide the development of self-directed, lifelong learning in problem-based medical curricula." *Medical Education*, 34 299-306.

Coppola, B. & Hayward, L. (2005). "Teaching and technology: making the invisible explicit and progressive through reflection." *Journal of Physical Therapy Education*, 19(3), 30-40.

Dai, D., Malkani, J. & Smith, J. (2005). "Student perceptions of the case method in educational psychology and its impact on teaching and learning." *Teaching Educational Psychology*, 1-11.

Davis, Barabara Gross (2001). *Tools for Teaching.* New York: John Wiley & Sons, Inc.

De Grave, W., Dolmans, D., Jacobs, J., Van Der Vleuten, C., Visschers-Pleijers, A. & Wolfhagen, I. (2006). "Students perceptions about the charateristics of an effective discussion during the reporting phase in problem-based learning." *Medical Edcuation*, 40, 924-931.

Dolmans, D., Jacobs, A., Scherpier, A. & Wolfhagen, I. (2003). "Validation of a short questionnaire to assess the degree of complexity and structuredness of PBL problems." *Medical Education*, 37, 1001-1007.

Dolmans, D., Scherpbier, A., Van Luijk, S. & Wolfhagen, I. (2006). "The relationship between professional behaviour grades and tutor performance ratings in problem-based learning." *Medical Education*, 40, 180-186.

Duarte, A., Freeman, D., Gadre, S., Haque, A., Haque, S. & Taylor, J. (2008). "Pulmonary and Cardiovascular Complications of Obesity: An Autopsy Study of 76 Obese Subjects." *Arch Pathol Lab Med* 132, 1397-1404.

Finucane P. & Nair, B. (2002). "Is there a problem with the problems in problem-based learning?" *Medical Education,* 36, 279-281.

Gamboa, T., Pinto, P.R. & Rendas, A.(1999). "A computer simulation designed for problem-based learning." *Medical Education*, 33, 47-54.

Godfrey, J. & Manson, J. (2008). "Toward Optimal Health: Strategies for Prevention of Heart Disease in Women." *Journal of Women's Health* 17, 1271-1275.

Haidet, P., Levine, R., McMahon, K., Perkowski, L., Richards, B., Schneider, V. & Thompson, B. (2007). "Team-based learning at ten medical schools: two years later." *Medical Education*, 41, 250-257.

Jolly, B. (2206). *Problem-based learning.* Chicago: Blackwell Publishing Ltd.

Lai, P., Tiwari, A., So, M. & Yuen, K. (2006). "A comparison of the effects of problem-based learning and lecturing on the development of students' critical thinking." *Medical Education*, 40, 547-554.

Livingston, G., McParland, M. & Noble, L. (2004). "The effectiveness of problem-based learning compared to traditional teaching in undergarduate psychiatry." *Medical Education*, 2004: 38: 859-867.

Lonka, K., Nieminen, J. & Sauri, P. (2006). "On the relationship between group functiong and study success in problem-based learning." *Medical Education*, 40, 64-71.

Lonka, K., Nieminen, J. & Sauri, P. (2006). "On the relationship between group functioning and study success in problem-based learning." *Medical Educaiton*, 40, 64-71.

Make Healthy Food Choices. (n.d.) Retrieved December 1, 2008 from http://www.americanheart/healthydiet.org.

Manning, D. & Olmesdahl, P. (1999). "Impact of training on PBL facilitators." *Medical Education*, 33, 753-755.

Martínez-González, A., Morales-Lopez, S., Petra, I., Piña-Garza, B., Rojas-Ramirez, J.A. & Valle, R. (1999). "Assessment of students performance in problem-based learning tutorial sessions." *Medical Education*, 33, 818-822.

Meddar, J., Steele, D. & Turner, P. (2000). "A comparison of learning outcomes and attitudes in student-versus faculty-led problem-based learning: an experimental study." *Medical Education*, 34, 23-29.

Mills, G. (2007). *Action Research: A Guide for the Teacher Researcher.* New Jersey: Pearson Education.

Sweeney, G. (1999). "The challenge for basic science education in problem-based medical curricula." *Clinical Investment Medical*, 22(1), 15-22.

Appendices

APPENDIX I

Student Interview questions.	
1. Did the case discussions help you see perspectives that you would not have thought of? 2. a.) Do you think you learned more, less or about the same about this topic using this case-method approach compared to through lecture? b.) Why or why not? 3. Was it difficult or easy to find information on your topics?	
4. Do you think the cases used in class reflect real life situations? 5. Do you think the theories covered in class/text were helpful for this assignment?	
6. Did you participate more in this class than your other classes? 7. a) Did you like researching individually and then pooling information to reach a collective answer, b.) Why or why not?	
8. What did you learn from other students in your group while using cases in small groups? 9. Do you feel you are more capable of tackling real life problems now than before you took this course?	
10. How do you feel about case discussions and analysis? 11. Do you prefer this individual + group work to lecture?	
12. What advice would you give a student interested in taking a phlebotomy class using cases?	

APPENDIX II

Student Questionnaire	Response
1. Do you prefer direct instruction (lecture) to the case method approach? Why or why not?	
2. Do you prefer working by yourself or in small groups of students in class?	
3. Did you learn important things from other students? And how did you share your ideas or understanding of material with other students?	

Appendix III

PBL problems:

An elderly women presents in the emergency room complaining of shortness of breath and chest pain upon further questioning the patient informs the nurse of tightening of her chest. She is 89 years of age Asian American appearing to be in relatively poor health. Her blood pressure is measured as 50/100 mm/Hg, temperature is normal at 98.6°, breathing is labored. The patient's family informs the nurse that the patient appears to have suffered a stroke.

Laboratory testing performed:

CK	75 U/L	AST	25 U/L	Na+	165 mEq/L
CKMB	1.2 U/L	EKG	normal function	K+	3.5 mEq/L
MYO	25 ug/L	BNP	30.5 pg/ml	Cl-	100 mEq/L
TNI	< 0.05 ng/ml	CBC	normal	CO_2	14 mEq/L

Urinalysis shows a low specific gravity but otherwise normal.

The patient was treated in the emergency with oxygen mask and infused with normal saline. The patient appeared to have slow speech and a lack of muscle control on her left side of the body.

1.) What conditions does the patient appear to have?

_____

2.) What tests or symptoms are abnormal?

_____

3.) What additional laboratory testing methods would you recommend?

_____

4.) What types of treatment would be available for this patient, standard and alternative?

_____

5.) Are there any implications from your research that may be helpful to the class overall health?

_____

_____

6.) Comments:

An elderly woman presents in the emergency room complaining of malaise, lethargy and overall not feeling well. She is a 78 years of age Mexican American female appearing to be in average height and slightly overweight with a pale complexion. Her blood pressure is measured as 155/101 mm/Hg, temperature is slightly elevated at 101.6° F, and pulse is measured high. The patient is complaining of abdominal pain and soreness on her left side.

Laboratory testing performed:

CBC:

WBC	15.5	(10^3/mL)	CK 100	NA 122
RBC	3.54	(10^6/mL)	CK 5.3	K 5.3
HGB	10.6	g/dL	TNI 1.3	CL 103
HCT	31.4	%	MYO 89	CO2 32
PLT	225	(10^3/mL)		
MCV	89	fL		

Diff– normal

Physical exam reveals markedly high blood pressure, abnormal EKG, abnormal breathing. The patient was treated with diuretics, pain medication, and placed on further testing protocol. The patient was admitted to the hospital for further investigation.

1.) What conditions does the patient appear to have?

_____

_____

2.) What tests are elevated?

_____

_____

3.) What disease do the symptoms suggest for this patient?

_____

_____

4.) What treatment options would be available for this patient?

_____

_____

5.) The prognosis for this patient is?

_____

_____

_____

_____

_____

6.) Comments:

An elderly Caucasian women arrives at the emergency room via ambulance from a MVA. She suffered from a crushed chest during the accident. The patient is unconscious upon arrival. The patient's identity is unknown. People at the accident site provided the following description of the accident: the patient appeared to have loss control of her vehicle suddenly.

Laboratory testing performed:

CBC:

WBC	15.5	(10^3/mL)	CK 230	NA 122
RBC	3.54	(10^6/mL)	CKMB 6.3	K 5.3
HGB	14.6	g/dL	TNI 0.22	CL 103
HCT	42.4	%	MYO 106	CO2 32
PLT	285	(10^3/mL)		
MCV	89	fL		

Diff– normal

EKG abnormal LV function

Physical exam reveals slightly high blood pressure, abnormal EKG, abnormal breathing. The patient was treated pain medication and normal saline. The patient was admitted to the hospital for further investigation.

1.) What conditions does the patient appear to have?

_____

2.) What tests are elevated?

_____

3.) What disease do the symptoms suggest for this patient?

_____

4.) What treatment options would be available for this patient?

_____

5.) The prognosis for this patient is?

_____

6.) Comments

A man arrives in the emergency room complaining of shortness of breath and chest pain. Upon further questioning the patient informs the nurse of a tingling feeling in his left arm. He is a 65 years of age black male appearing to be in average health. His blood pressure is measured as 145/101 mm/Hg, temperature is normal at 98.6°, and pulse is measured and slightly elevated.

Laboratory testing performed:

CK	250 U/L	AST	55 U/L
CKMB	5.10 U/L	EKG	abnormal LV function
MYO	150 ug/L	BNP	515 pg/ml
TNI	0.25 ng/ml	CBC	normal

The patient was treated in the emergency with oxygen mask, diuretics, nitroglycerine, and pain management medications. While be considered for coronary bypass surgery the patient deteriorated rapidly and suffered another episode which subsequently lead to his death.

1.) What conditions does the patient appear to have?

_____

2.) What tests are elevated?

_____

3.) What disease does the ↑ BNP suggest for this patient?

_____

4.) What treatment options would be available for this patient if he had survived?

_____

5.) Are there any implications from your research that may be helpful to the class overall health?

_____

6.) Comments:

APPENDIX IV

Student Reports: Student #1

Additional laboratory tests for a possible stroke victim

This paper is for the purpose of answering the question of "What additional laboratory testing methods are recommended for a possible stroke victim".

An elderly woman in the emergency room is complaining of shortness of breath, chest pain and a tightening of her chest. Several laboratory tests have already been completed. An EKG and urinalysis have been done along with several other blood tests. The woman's CO2 level is low, her sodium level is high and the other tests reflect normal levels or function.

To further access whether the woman has had a stroke there are several other tests that would be beneficial.

A Cerebral Arteriogram is done to show abnormalities of the blood vessels, including narrowing, blockage or malformations. This is done by injecting a special dye into the blood vessels through a catheter inserted into an artery in an arm or a leg. This test will help determine if there is a problem with blood flow to the brain. A Computed Tomography scan of the head can also be used to check blood flow in and around the brain. A CT scanner sends x-rays through the head and each rotation can show a thin slice of the head. To check blood flow with a CT scan an iodine dye is used and injected in a vein IV in an arm.

There are a couple of types of ultrasound that would also be of benefit in addition to the EKG that was already performed. A Carotid Doppler is a method which uses ultrasound waves to take a picture of the carotid arteries in the neck. This will show the blood flowing to the brain and can also show if the carotid artery is narrowed by arteriosclerosis. Transcranial Doppler is when ultrasound waves are used to measure blood flow in some of the arteries in the brain. These two tests will help to locate any problem with blood vessels if there are any.

A Prothrombin Test (PT) and an Activated Partial Thromboplastin Test (PTT) should be performed to check that the individual's blood clotting function is normal and not the cause of one or more of the problems the patient is having.

Using all of these tests is a process of elimination. Each test performed will show either normal results or something that can provide more information about the patient's condition. When a test is performed and the results are normal it is necessary to continue with the testing to locate the problem or better diagnose the symptoms that the person is exhibiting. It is necessary to conduct tests that will provide the desired information related to the particular problem at hand. The tests listed above can be used for several ailments but will be very effective in checking to see if the elderly woman actually is suffering from a stroke or some other health concern.

References:

The Internet Stroke Center
Strokecenter.org

Washington University in St. Louis

Web MD

Webmd.com

APPENDIX V

Student Posters: Group #1