Handheld computers: Do they support or constrain nursing students at the point-of-care?

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HANDHELD COMPUTERS: DO THEY SUPPORT OR CONSTRAIN
NURSING STUDENTS AT THE POINT-OF-CARE?

by

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Handheld Computers: Do They Support or Constrain Nursing Students at the Point-of-Care?

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Doctor of Philosophy Learning and Technology

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ABSTRACT

PDAs Support Self-Regulated Learning In Nursing Students

by

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Technology has made a significant impact within the healthcare system over recent years. As technology continues to evolve and becomes a major driving force within the healthcare system, so will the need for preparing technologically competent healthcare professionals. Also within the healthcare system, changes such as a decrease in the length of hospital stay, the aging population, and the multi-disease processes of the aging population, presents a challenge to nursing faculty to adequately prepare tomorrows' nurse. One of the most promising technological devices being used by healthcare professionals is the handheld computer or personal digital assistant (PDA). Although the current literature supports the use of the PDA by practicing nurses and nursing students, little is known how to incorporate these devices to support and develop life-long learners.

A mixed-method design directed this study. Biemiller & Meichenbaum’s Think-Aloud was conducted at the onset and conclusion of the study. A grounded theory approach was utilized to gather data pertaining to PDAs and nursing students. Upon observing the participant accessing the PDA, a semi-structured interview occurred. The
last component of data collection was obtained via a tracking system on a nursing focused
PDA software program.

The results demonstrate that the PDA supports self-regulated/self-directed learning in
nursing students. Biemiller & Meichenbaum's Think-Aloud demonstrated that all
participants increased in their ability to be self-directed learners at the conclusion of the
study. Furthermore, the results demonstrated that students are accessing the PDA in the
clinical site, in the classroom, in studying for test/exams, and when completing
assignments. Although the age varied for the participants, the method preferred for
learning was from the screen.

Pintrich's self-regulated learning model was used as a method of determining the
extent and progression of identifying self-regulated learners. Again, the results displayed
that the PDA supported the participant in becoming self-regulated learners by providing
them with a tool that offers precise, current, accurate, and current time information. With
the ease of accessing information any time and from anywhere, nursing students have the
potential to control what and how learning occurs.
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Lastly, this is dedicated in memory of my daughter and granddaughter, Melanie Ann and Crystal Irene who left me 14 years ago. Not one day goes by where I don't think of you-I love and miss you both very much! Love, mom & grandma.
CHAPTER 1

INTRODUCTION

Nursing programs across the country are being challenged to provide nursing students with the tools they will need upon graduation. No longer will the graduate nurse be able to enter the workforce with theoretical and manual skills alone. Due to the severe nursing shortage (Buerhaus, Donelan, Ulrich, Norman, & Dittus, 2006), the ever-changing and increasing intricacy of the healthcare environment (National League for Nursing, 2005), the complexity of multiple-disease processes within the growing aging population (Hetzel & Smith, 2001; Gerberding, 2006), and major advances in informational technology, nurses entering the profession will need to be flexible, self-directed and competent in providing care in a vast number of environments and situations. Furthermore, the nurse of the future will have to be self-directed and technologically competent to meet the growing demands placed on him.

Theoretical Framework

For well over 50 years educational psychologist have attempted to understand how learning occurs, how one obtains knowledge and what factors contribute to, or interfere with learning. Throughout this time, many theories have evolved. One of the more recent theories of learning is self-regulated learning (SRL). Although there are many theories
that present and describe self-regulated learning, Pintrich’s model was selected to provide the framework for this study. Pintrich (1995) proposes that SRL consists of four areas of regulation and four phases of learning that one goes through to obtain new knowledge. The four areas of regulation are cognition/metacognition, motivation/affect, behavior, and context. Within his model, Pintrich emphasizes that the first three areas of regulation (cognition/metacognition, motivation/affect, and behavior) are controlled by the learner, while context is not subject to learner control. Cognition/metacognition addresses the learner’s different cognitive strategies used for new learning, as well as metacognitive strategies that the learner uses to control and regulate their cognition. Motivation/affect pertains to the beliefs or self-efficacy the learner holds in regards to acquiring new knowledge, or completing an assignment. Additionally, motivation/affect includes any strategy that the learner utilizes to accomplish the desired outcome or goal. Behavior is the effort and actions the learner displays or initiates in completing the goal; help seeking, time management and persistence are examples of behavior. Context involves the environment, or more specifically, the classroom, and is unable to be controlled by the learner.

The four phases that the learner progresses through in the learning process are forethought, planning and action, monitoring, control, and reaction/reflection (Pintrich, 1995). Forethought, planning, and action involve setting the goal and assessing prior knowledge and/or schemas that the learner has. Monitoring is the second phase, which establishes how the process will be monitored by the learner. Specifically, the learner will be monitoring metacognitive responsiveness to the self, the task, and the context. Pintrich stresses that monitoring is one of the key aspects or components of the learning process.
The third phase, control, is a result of the monitoring. The learner attempts to control the self, the task, and the context. Reaction/reflection, the last phase that Pintrich presents, focuses on the process of the prior phases and the self, the task, and context.

Pintrich’s (2005) model, unlike other models of SRL, is not in a cyclic format, but rather displayed in a table format. He presents his model in this format to support the following assumptions: (a) the learner may revert to a prior phase or regulation, and that phases may overlap and/or occur simultaneously with multiple interactions; (b) the phases are not hierarchical or linear in structure such that earlier phases always occur before later phases; and (c) monitoring, control and reaction can be ongoing simultaneously.

Appendix I displays an overview of Pintrich’s SRL model, and how the regulations and phases are interwoven throughout the learning process.

Furthermore, Pintrich (2005) identifies four additional assumptions that are applicable to all SRL models. The first assumption identified by Pintrich, is the “active, constructive assumption, which follows from a general cognitive perspective” (p. 453). Within this assumption, all learners are considered as active participants in constructing new knowledge. That is, each learner has the ability to construct, or develop a goal or outcome and select strategies that will be used to attain the goal. Pintrich emphasizes that learners are assumed active participants and not passive by-standers throughout the learning process.

Potential control of assumption is the second assumption, which suggests that the learner is able to control, monitor, and regulate external resources and contributions, as well as monitoring, and controlling behavior, and the cognitive and metacognitive processes. Also included in this assumption are factors that cannot be controlled the by
the learner, such as biological, developmental, and contextual differences.

Goal, criterion, or standard is the third assumption. All SRL learners identify, in one form or another, a standard, criterion, or goal that is used to compare one’s progress. The learner is free to change strategies or goals upon self-monitoring throughout the learning process. The last assumption, which Pintrich alludes to as not being in every SRL model, is mediators. Pintrich describes this assumption as that there is much more to learning than the individual’s inherent characteristics, or the contextual aspects of the environment, but that learning occurs when “the individual’s self-regulation of their cognition, motivation, and behavior … mediate the relationships between the person, context, and eventual achievement” (Pintrich, 2005, p. 453).

Therefore, for this study, Pintrich’s (1995, 2005) four areas of regulation, the four phases of learning, and the assumptions proposed support the skills needed by the nursing student and future nurses. Throughout the process of developing these skills, the nursing student also has access to a tool, the personal digital assistant (PDA), that allows the student to search information at the point in time when it is needed, and not 1 or 2 hours later. By actually placing the learning directly into the hands of the student nurse, it may also be preparing him for practice in the real world, where patients have multiple disease processes and are receiving multiple medications.

Purpose Statement

The use of handheld computers, or personal digital assistants (PDAs), a phenomenon that is emerging within the healthcare system, is increasing at a rapid pace. In 2003, more than 559,800 nurses and 408,020 physicians reported using the PDA in their daily
practice (Stolworthy, 2003). Due to the rapid growth in mobile technology, one expert predicted that by 2006, more than 1.2 billion dollars would be spent for mobile computing in healthcare (Scully, 2004). Furthermore, current literature demonstrates how the PDA is changing the way nurses practice. Changes within the operating room (McCord, 2003), utilization review (Lanway & Graham, 2003), training nurses for specialty areas (Blair, 2006), infusion teams and data collection (Rosenthal, 2005), and assisting and preparing the re-entry to practice nurse (Colevins, Bond & Clark, 2006) are examples of how the PDA is positively impacting nursing practice today.

Nursing education is another area where the use of PDAs is emerging at a rapid pace. A variety of articles has provided subjective information about PDA use in nursing education. PDAs are assisting faculty in student recordkeeping and evaluation (Lehman, 2003), and teaching pharmacology courses at the graduate level (Huffstutler, Wyatt & Wright, 2002). Additionally, they provide access to current resources for the student at the point-of-care (POC) (White, Allen, Goodwin, Breckinridge, Dowell & Garvy, 2005). Moreover, nursing executives across the country have voiced their expectations that the graduate nurse will be technologically competent upon entering the profession (McCannon & O’Neal, 2003).

Although the above literature supports the utility of PDAs in nursing education, there is a lack of data supporting this. Therefore, without such support to guide future research of this phenomenon, faculty may continue to introduce and use the PDA without purposeful planning, direction, and outcomes; subsequently, failing to meet the technological needs of the entry-level nurse.
The purpose of this study is to describe why, how, and for what students use the PDA in the clinical setting, or at the point-of-care (POC). Additionally, this study will begin to determine the degree to which the student assumes responsibility for their learning, distinguishing the self-regulated learner from the non-self-regulated learner.

Research Questions

The following questions will direct data collection and begin to provide evidence-based data focusing on the effects of the PDAs and SRL in nursing students at the point-of-care:

1. In what ways does the PDA support or constrain SRL in nursing students?
2. To what degree does the PDA assist the learner in taking control of a learning situation?

Table 1 on the following page demonstrates the relationship of the research questions to the semi-structured interviews that will be utilized at the beginning of the study to the Areas of Regulation and Phases of Pintrich’s SRL Model (1995, 2005).

Limitations of the Study

There are three primary limitations to this study. The first limitation is the lack of any previous quantitative studies that address SRL, technology, PDAs, and nursing education. Therefore, without such prior research, this study will attempt to combine the four components to develop a conclusion, or hypothesis, and/or theory. The second limitation is having four or five participants and one investigator. Valuable information may be lost if the investigator is following-up with one participant, while another participant is using

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the PDA. The last limitation is having the participants in the same facility. Although this may be positive in some aspects, not all nursing programs are afforded the ability to maintain their nursing students in the same facility for more than one semester—therefore; this may decrease the generalizability of the results.

Table 1  Research Questions Related to the Semi-Structured Interview Questions

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Beginning Semi-Structured Interview Questions</th>
<th>Areas of Regulation &amp; Phases</th>
</tr>
</thead>
<tbody>
<tr>
<td>To what degree does the PDA assist the learner in taking control of a learning situation?</td>
<td>1. Is the participant accessing the PDA at the POC?</td>
<td>Motivation to learn; seeking information</td>
</tr>
<tr>
<td>To what degree does the PDA assist the learner in taking control of a learning situation?</td>
<td>2. How did the participant identify the need to access the PDA at the POC?</td>
<td>Cognition/metacognition; awareness of own perceived knowledge</td>
</tr>
<tr>
<td>To what degree does the PDA assist the learner in taking control of a learning situation?</td>
<td>3. What program/software is the participant accessing on the PDA at the POC?</td>
<td>Choice behavior; perception of content</td>
</tr>
<tr>
<td>In what ways does the PDA support or constrain SRL in nursing students?</td>
<td>c. Could the participant have sought out the information from: A faculty member? Staff nurse? Classmate/fellow student? If so, why did not the participant seek out the information from the identified resource?</td>
<td>Help-seeking behavior</td>
</tr>
<tr>
<td>In what ways does the PDA support or constrain SRL in nursing students?</td>
<td>4. How much time did the participant invest in searching out the “identified information” required?</td>
<td>Motivation; time management; effort, general persistence</td>
</tr>
<tr>
<td>To what degree does the PDA assist the learner in taking control of a learning situation? and In what ways does the PDA support or constrain SRL in nursing students?</td>
<td>b. Was the participant able to identify any other resource on the PDA that may have been accessed?</td>
<td>Cognitive monitoring, Cognitive control &amp; regulation: Activation of metacognitive knowledge</td>
</tr>
</tbody>
</table>

**Terminology**

*Nursing Central Bundle:* A combination of nursing focused textbooks that are
electronically available for use with a PDA or from one’s personal computer. The bundle
contains the following text: Davis’s Laboratory Manual, Davis’s Drug Guide, Disease & Disorders, and Taber’s Cyclopedia Medical Dictionary. Also available is access to on-line medical/nursing journals. Unbound Medicine is provider of the specific nursing software bundle.

**Personal Digital Assistant/Hand Held Computer (PDA):** Small, compact computer that has the potential to provide access to a variety of databases and personal information, such as addresses and phone numbers. The device may be very sophisticated, such as providing access to the Internet, or as simplistic as to hold a limited volume of information. Its functions greatly depend on the user and the comfort of the user with technology.

**Point of Care (POC):** Any environment, such as a healthcare facility, long term care facility, or home setting where a person requires direct care by a licensed/registered professional nurse.

**Self-Regulated Learning/Self-Directed Learning (SRL/SDL):** The learner who takes control of his own learning. The process involves several different constructs, such as acknowledging the degree of knowledge one has about a topic, different skills, tactics, or methods of learning, setting goals, and monitoring ones progress towards achieving the identified goal.

**Think-Aloud/Talk-Aloud:** The process of verbalizing ones’ thought process while working through a task. Such as a fundamentals nursing student who verbalizes the steps of how to prepare mixing two types of insulin one syringe.
CHAPTER 2

LITERATURE REVIEW

Background and Significance

Technology has advanced tremendously over the past few decades. It has provided society with a great number of conveniences, such as banking and shopping from the convenience of one’s home and at one’s own leisure, worldwide communication from anywhere and at almost any time, and the potential to access unlimited information from the click of a mouse to a push of a button. The future of technology, which is yet to come, will become more sophisticated, more user-friendly, and has the potential to enhance one’s everyday life.

In addition to the above benefits, technology has also drastically influenced two major areas of society, healthcare, and education. Within the healthcare system, technology has afforded many changes to benefit the patient as well as the healthcare provider. One of the most beneficial technological devices that have enhanced the role of the healthcare member is the handheld computer, or the personal digital assistant (PDA). The PDA, a small compact device, is able to provide the practitioner with considerable amounts of current and valuable information, which in turn, saves the practitioner precious time, therefore, improving the role and responsibilities of the practitioner. Furthermore, noting
the benefits of the PDA, several healthcare educational programs have begun to implement the PDA within the curricula for both medical and nursing students.

Within education, technology has opened the eyes of the student to the entire world, no longer limiting learning to the community in which one resides. Due to the many technological advances incorporated into education, such as the World Wide Web, educators must strive, more so than at any previous time, to develop students who are able to take responsibility for one’s own learning. In doing this, tomorrows’ student will be able to know when and how to assess and evaluate their learning outcomes, and make sound decisions of how to accomplish learning goals.

The following literature review some of the changes within the healthcare system, and furthermore, the impact of how technology has changed today’s healthcare system. Healthcare issues will be presented first, which will demonstrate the changes that have occurred over the past years. Due to these vast changes, technology’s role in the healthcare system will be presented, demonstrating how technology has been able to alleviate the many challenges brought about by the changes within the healthcare system. PDAs within the healthcare system and the use of PDAs by nurses and in nursing education will provide an insight into how these handheld computers have the potential to enhance the role of the healthcare worker.

As technology is greatly influencing the area of education, self-regulated learning (SRL) appears to be one of the frameworks that has the potential to support and guide learning. SRL and technology will be presented, demonstrating how the learner has the potential to regulate and control what learning occurs. Due to the lack of articles that support the goal of this study, the last two areas to be discussed addresses current
literature which attempts to combine SRL and nursing education and SRL, PDAs, and
nursing education.

Healthcare Issues

Over the past 20 to 25 years, the national healthcare system has changed rapidly. Some of the major changes include an increase of utilization review boards, changes in Medicare reimbursement, the increased availability of outpatient surgical procedures and community services, and an increase of participation in managed care (DeFrances, Hall & Podgornik 2005; Frey, 2004; Rosseter, 2006). Additionally, Defrances et al. (2005) emphasize that advances in new medications, earlier detection of disease, as well as advances in technology have also advanced the healthcare system. As a result of these many modifications, one other major factor has been altered within the healthcare system, that is the length of hospital stay; in 1970, the average length of stay (LOS) was 7.8 days, whereas in 2003, the LOS decreased to 4.8 days (Defrances et al., 2005; Stanton & Rutherford, 2004). With such drastic advances within the healthcare system, the healthcare provider will be the one required to keep current with these many changes and carry them out.

Throughout these many modifications, one element within the healthcare system remains at risk for being unable to support and carry out these rapid changes. That element is the practicing nurse. Across the nation there is a critical nursing shortage. According to a report by the American Association of Colleges of Nursing (Rosseter, 2006), there are currently 118,000 vacancies for registered nurses nationwide. Additionally, the nurse to population ratio varies tremendously across states. Nevada has
the second lowest nurse to population ratio nationwide. According to the Nevada State Board of Nursing, Nevada's nurse-to-population ratio is 548 nurses per 100,000 people; this ratio is much lower than the national average of 782 nurses per 100,000 people (Packham, Griswold, Burkey, & Lake, 2005). Furthermore, experts predict that the nursing shortage will not improve until at least 2020 (American Nurses Association, 2005).

Two major factors that contribute to the nursing shortage are the growing age of the practicing nurse and the limited number of potential students entering nursing programs. The average age of the practicing nurse, which also includes nursing faculty, is 45 to 49 years of age (Health Resources & Services Administration, 2005). Buerhaus, Donelan, Ulrich, Norman, and Dittus (2006) suggest that approximately one out of every three nurses plan to retire within the next three years, which will only add to the nursing shortage. Nursing education is another area that is suffering from the shortage. The National League for Nursing (Klestzick, 2005) reported that there were more than 147,000 qualified applicants who were refused admission into nursing programs in 2005 due to the shortage of nursing faculty. Because of the aging nurse, the lack of nursing faculty, and the limited number of students completing nursing programs, the nursing shortage will influence the care the patient receives, regardless of the many advances within the healthcare system.

Although the healthcare system is making progress in keeping people healthier longer, there are still foreseeable issues that have not been addressed; the growing elderly population (Hetzel & Smith, 2001) and the higher acuity of hospitalized patients (Stanton & Rutherford, 2004; Gerberding, 2006). In 1990, the US Census reported 31.2 million
people 65 years and older; in 2000, that number increased to 35.0 million, an increase of 12% (Bergman, 2006; Hetzel & Smith, 2001). In addition to an increase in the elderly population, Gerberding (2006) reports that 80% of the aging population has at least one chronic disease, and 50% have more than one. Stanton and Rutherford (2004) reported that although the LOS has decreased, the acuity of the hospitalized patient has increased. As the acuity of the patient increases, the more complex the care becomes, subsequently, requiring more bedside time and care of the practicing nurse. With the increase in the aging population, higher acuity of patients with multi-disease processes, and the shortage of nurses, future practicing nurses will require an in-depth knowledge base, as well as the ability to identify when to seek out additional needed information to provide appropriate, efficient, and safe care.

Technology in Healthcare

Although technology cannot increase the number of nurses, it can reduce many of the demands faced by the nurse on a daily basis. Computerized charting is one of the largest contributions that technology has provided for the practicing nurse. Computerized charting began to be introduced into healthcare facilities across the nation in the mid 1990’s (Johnson & Martin, 1996; Stephens & Mason, 1999). Although there are many different formats of computerized charting, the primary focus is to provide the practicing nurse with a method of documenting efficiently, as well as meeting the standards set forth by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO), the accrediting body of healthcare facilities (Johnson & Martin, 1996). Overall, computerized charting decreases the amount of time the nurse uses to document and provides a
systematic approach to assessing the patient's physical and psychosocial progress or
decline. Furthermore, computerized charting is patient-focused, which may include
mutually agreed upon outcomes of the care, discharge planning, and patient education.
Additionally, it is designed to prompt the nurse for further input when an abnormality is
identified or when further action is required (Rothschild et al., 2005).

Another valuable contribution of technology within the healthcare system involves
medication administration. There are many studies that provide insight into the dangers of
medication administration; Wilson et al. (2005) suggest that an estimated 7,000 patients
die a year from medication errors while hospitalized. Advances within this area include
computerized medication orders that are directly input into the computer by the physician,
a bar coding identification system, and computerized automated distributor system.
Prior to physicians using computers to directly input medication orders, it was the
responsibility of the unit secretary to transcribe the orders to the medication
administration record (MAR). Due to the lack of medical background and/or education of
the unit secretary, the potential for transcribing the wrong medication or dose existed,
therefore, leading to the wrong medication being administered. Furthermore, Oliven et al.
(2005) demonstrated that there was a decrease in medication errors when the physician
input the medication orders directly into the computer system.

The bar code identification system is a computerized program that has drastically
decreased the number of medication errors within the healthcare facility. The bar code
provides each patient with a specific identification number on his wrist band upon
admission to the healthcare facility. Prior to administering any medications, the wristband
is scanned, as well as the medication, to assure that the right medication is being
administered to the right patient (Galusha, Brown, & Kelly, 2003).

Freestanding medication distribution computers have advanced to become more sophisticated than in previous years. Currently, the computerized automated distributor system is able to dispense the accurate medication upon receiving the patient’s name and identification number. A drawer opens, providing the nurse with the exact number of pills, or directs the nurse to an attached refrigerator to obtain the medication. A study by Shack and Tolloch (2006) provides data demonstrating with the use of the bar code identification system and the computerized automated distributor system, a reduction in the number of medication errors have decreased considerably.

Other technology that has provided increased accuracy and/or convenience for the healthcare provider includes intravenous infusion pumps (Keohane, Hayes, Saniuk, Rothschild, & Bates, 2005; Hucsh et al., 2005) vital sign machines, blood glucose measurements, oxygen saturation of the patient, and managing accurate levels of medication for the elderly population (Homick et al., 2006). Incorporating technology within the healthcare system is providing a vast number of advantages, which focuses on safe care of the patient, as well as saving precious time for the healthcare provider. As new technology is developed and introduced into the healthcare system, the potential exists for an increase in efficiency and appropriate patient care, and more importantly, less errors.

Rapidly emerging in the healthcare system is the use of the handheld computer, or PDA. Over the past five to ten years the healthcare professional, be it the physician or nurse, has started accessing current information from the PDA while caring for the patient (Stolworthy, 2003). The PDA is a small computer capable of providing the practitioner
with a relatively large number of current resources while at the bedside. With the vast number of software programs available for the PDA, each practitioner selects the software that best meets their area of specialty. Therefore, it may be very general and broad for the family practitioner or medical-surgical nurse, such as drug or laboratory references; or it may be specialty focused, such as pediatric practitioner having access to the required childhood immunization schedule. Another advantage of the PDA is that it may be updated frequently, therefore, providing the practitioner with the most current information, which allows for the most recent safe-care practices.

PDAs in Healthcare

The increase use of PDAs in the medical profession has been documented by two landmark studies. Forrester's Consumers Technographics North American Bench Mark Study (Stolworthy, 2003) and Healthcare Without Bounds: Trends in Mobile Computing (Scully, 2004). Both studies identified that nurses use the PDA more than physicians and that nursing focused drug references are the most frequently used PDA software by practicing nurses. Stolworthy (2003) states:

The nurses, who were the early adaptors of PDAs, quickly recognized the inherent value of mobile drug references and loaded their handhelds with them. It was not until the software producers began releasing nursing specific titles addressing the 5 R’s that the adoption rate of nursing specific PDA software entered its current state of rapid growth.

Scully (2004) also identified that computerized documentation was also important to the practicing nurse. The main factor with documentation that is appealing and useful to the practicing nurse is that it saves time and is easier to do. According to Scully
A lot of them feel inundated with the documentation they do...nurses often have to wait 'til the end of the shift to write. If they have the way to do this as they go, this could significantly improve their efficacy.

Furthermore, Scully (2004) describe the benefits of computerized documentation by community health care and hospice nurses, which involves the nurse being able to “...download their daily schedules and patient charts from the main server into a handheld computer about half the size of a laptop. Nurses can do more and see more patients in the day than if they were handwriting”.

The findings of these studies suggest that as the nurse becomes more comfortable using the PDA, and the availability and applicability of software increases to meet the needs of the nurse, the more the nurse will incorporate the PDA in his professional practice.

PDAs: Changing Nursing Practices

The PDA is providing practicing nurses with many options for managing their practice. Scollin, Callahan, Mehta, and Garcia (2006) stress the importance of access to evidence-based, safe practice resources at the bedside or POC. To meet this need, numerous free databases or software programs for the PDA are available. Some such programs include the Decoder, the GCS, the Medical Calculator, and Shots 2004 (Davenport, 2004b). Upon entering the laboratory results of arterial blood draws, the Decoder alerts the nurse of the possibility that the patient may be experiencing respiratory or metabolic acidosis or alkalosis, a potentially life-threatening situation. The GCS
(Glasgow Coma Scale), which is universally used, provides an overview of the person’s mental status after a head trauma or stroke. The Medical Calculator provides the user with the most frequently used medical equivalents, thereby providing a safe method of calculating correct medication doses. Shots 2004 offers a reference to required childhood immunizations. As noted by George and Davidson (2005), the practicing nurse who uses such resources and programs is “…focusing more time on patient care and less time tracking down important information”.

Not only are PDAs used as a resource for the practicing nurse, they have provided a means to streamline and better organize the various areas or departments within the healthcare system. Lanway and Graham (2003) describe how their role as utilization review nurses (URN) has been made easier by using a PDA to conduct their daily responsibilities. Upon identifying the challenges within their department, the authors developed and piloted a program using the PDA. Once the pilot program was completed and adjustments were made, the results were positive; the URN saved approximately “two to three hours each day on documentation…helping patients to be discharged today instead of tomorrow…” (Lanway & Graham, 2003). The authors further stated that retention of URNs had drastically increased. Furthermore, with the time saved, the URN was able to become more involved with guiding and assisting “hospital discharge planners and case managers with coordination of care” (Lanway & Graham, 2003).

The operating room (OR) is another specialty area where the PDA is providing a means of saving time and increasing accuracy. According to McCord (2003):

…each of about 50 physicians performs 25 to 30 different types of procedures in the OR, so 1,500 preference cards have to be updated regularly. When team leaders fall
behind in their updates, they can leave a backlog of as much as several weeks and a
database that does not necessarily reflect physician wishes. (p. 997)

Due to this overwhelming backlog, the need to also maintain current surgical
equipment for each procedure, and to decrease duplication of documentation, McCord
(2003) began to search for an easier method that would meet the above challenges. Upon
reviewing the literature, the PDA was the technology of choice, and with a software
program from the Internet, McCord was able to develop a program that would “...help
circulating nurses store, track, and organize the important information for which they are
responsible” (McCord, 2003, p. 997). The PDA also assisted with decreasing the amount
of time used for documentation as well reducing duplication of documentation throughout
the OR.

Re-entry into practice and recruiting and retention to specialty areas, such as the
intensive care unit, are two other areas where the PDA has proven to be of assistance. The
Wake Area Health Education Center (AHEC) is part of a national program that assists
and prepares nurses who have been out of practice for more than five years for re-entry
into the workforce. The program quickly identified the PDA as a useful tool in which to
provide immediate POC resources for the re-entry nurse. A drug reference text, Tabers’
Cyclopedia Medical Dictionary, and a manual of procedures were purchased. For the
most part, the participants felt that the PDA and the software were of great assistance in
helping them to return to their role as a practicing nurse. Although not all participants
were comfortable using the PDA, one participant did state that “Other nurses came to me
for information I had on the Palm; it was wonderful” (Colevins, 2006, p. 47).
According to Blair (2006), training nurses for specialty areas may take anywhere from 3 to 5 years. In an attempt to decrease this timeframe, Blair provided the participants with clinical coaches, PDAs, and simulators to enhance their learning. The PDAs contained several references, such as a drug reference guide, a calculation for medication administration program, a laboratory interpretation guide, and Tabers’ Cyclopedia Medical Dictionary. Although the results of the study have not yet been published, Blair strongly supports the use of the PDA as a necessary tool for the nurse at the bedside. She further emphasizes that the cohort members were sought-out by peers searching for up-to-date information that could be obtained in a matter of minutes.

Several areas within the healthcare facility and system are incorporating PDAs as a tool to support nurses with time management, patient safety, evidence-based safe-practice, and access to the most current information. The benefits of the PDA have been demonstrated in emergency rooms (Ondash, 2004), infusion teams and data collection (Rosenthal, 2005), general hospital units (Thompson, 2005a), and community nursing (Scully, 2004). As the use of the PDA becomes more widespread, and new ways of using it become available, the future of PDAs in nursing will afford the practicing nurse with the necessary tools and resources to provide safe and effective care in a timely fashion.

PDAs in Nursing Education

Nursing students can be overwhelmed by the amount of information they are responsible for learning. Additionally, due to the rapid changes in the healthcare system, today’s hard bound textbook is already out of date. The potential for providing large amounts of in-hand information through a PDA may decrease a student’s anxiety level.
and increase their ability to make appropriate decisions at the POC. Furthermore, in an attempt to encourage preparation of future nurses, the National League of Nursing (NLN), an accrediting body for nursing programs across the country, provides the following statement “...nurse educators are expected to more effectively integrate technology into their teaching through the use of distance learning, simulation, and PDAs....” (National League for Nursing, 2005). Such a bold statement implies an imperative for nursing programs to develop and integrate high-level technology skills within and across the curriculum.

Although NLN has set the standards for nursing education, and nurse managers have voiced their expectations for the entry-level nurse (McCannon & O'Neal, 2003), there is a lack of evidence throughout the literature that nursing programs are incorporating the technological standards into nursing curricula. Several pilot and exploratory studies have addressed the possibility of implementing the PDA, both at the undergraduate and graduate level, but few have required the student to purchase a PDA upon entering the program. Moreover, many of the studies use the PDA primarily as a tracking system, or record keeping and evaluation for undergraduate clinical faculty (Lehman, 2003), in the nurse practitioners program (Scordo & Yeager, 2003), or in specific courses, such as graduate pharmacology (Huffstutler, Wyatt, & Wright, 2002). On the forefront of preparing future nurses, Drexel University requires their students to purchase a PDA with specific nursing software. The dean, Gloria Donnelly, states (Scully, 2004):

You just can’t teach them everything in the classroom, you can’t expect them to carry everything around in their head, it’s too dangerous. In the old days, every nurse had a bandage, scissors, a watch, and a couple of other things. The PDA is like the bandage
and scissors. It's always in your pocket in case you need to access information.

Due to the rapidly changing medications and drugs, Huffstutler, Wyatt, and Wright (2002) elected to incorporate the PDA into their advanced level pharmacology course. The authors propose that in comparison to a textbook, the PDA would encourage students to look up the most current drug. A challenge the authors presented was the lack of "buy-in" from some of the faculty and older students. Their findings reveal that after attending a workshop where an emulator was used to demonstrate the "how-to(s)" of the PDA, faculty and students were able to use the PDA proficiently. Once the comfort level of using the PDA was established, additional workshops provided demonstrations of the benefits of the data-base software. Although technology problems caused frustration for some of the students and faculty, the consensus was that current information is imperative for the practicing nurse. The results also demonstrated an increased frequency of PDA use with increased comfort in using the PDA.

Faculty use of a PDA has important implications for student use. According to Miller et al. (2005), student use of the PDA in the clinical setting was directly related to faculty PDA use. Although a student may have a PDA at the clinical site, if the faculty member was not using a PDA, the student would not use one. Miller et al. attempted to identify why the faculty member did not use the PDA in the clinical setting. The first explanation involved the age of the faculty member; the older the faculty, the less likely it was that the PDA was used. This assumption appears to be a common theme throughout the current literature in PDA use with both practicing nurses and nursing faculty. The many years of experience and the in-depth acquired knowledge the faculty member possessed was the second reason why faculty were not using the PDA.
Although these may be valid reasons, Miller et al. (2005) voiced concerns about the importance of demonstrating to future nurses the need to stay current, as well as when one identifies the need to search out much needed information for the safety of the patient. The results of the study demonstrated that the students who were committed to using the PDA in the clinical setting had a decreased reliance on the faculty, staff, and text, and would seek out information from the PDA before seeking answers from other sources.

Patient confidentiality with technology is another important concern facing the implementation of PDAs at the POC. In 1996, The Health Insurance Portability and Accountability Act (HIPPA) increased the requirements for the level of security and confidentiality of the patient. Because of mandates for maintaining patient confidentiality, many healthcare facilities have implemented stringent regulations, which in turn, make it difficult in some healthcare facilities to use personal technology. Thompson (2005b), who was advised by her supervisor that she should not be using a PDA in the healthcare facility due to HIPPA regulations, provides a Quick Guide to HIPPA Compliant PDA Use. By using protection such as passwords and encryption to protect access to one's PDA, and avoiding entering any Protected Health Information (PHI), the PDA has the potential of being as useful a tool as the stethoscope. Thompson further stressed that if care is taken in what is entered into the PDA, the PDA is, and will continue to be a very useful resource for the practicing nurse.

Throughout each of the studies cited above, there were common themes of concerns, such as difficulty in obtaining faculty buy-in, lack of how to use the PDA by the faculty, the cost of the PDA to the faculty member, as well as to the student, and the lack of consistency from one faculty member to the other. In contrast, there are also evolving
themes that lend support to the use of the PDA by the practicing nurse and in nursing education. While used as a resource at the bedside, the PDA is able to provide the practicing nurse with pertinent, up-to-date information about drugs and medication, laboratory values, patient education, as well as other health related information. Furthermore, the PDA has also been successfully implemented in specialty areas, providing a means for increasing organization, decreasing time on tasks, and increasing time with patients. Many questions addressing the use and benefits of the PDA still remain unanswered. Therefore, drawing from prior studies, future studies must be designed to either support or negate the concerns and benefits of the PDA in nursing and nursing education.

Self-Regulated Learning, Technology, Nursing Education, and PDAs

With the many advances in technology, educational psychologists are now beginning to understand how technology contributes or interferes with learning, primarily distinguishing the SRL from the non-SRL. Because of this, a great deal of research, both previously conducted and currently underway, is attempting to demonstrate the benefits of learning with technology, and how to improve technology to meet the needs of all learners. Previous studies have also demonstrated that the SRL is able to learn with technology; therefore, research is also the focus of how to design technology so that it will guide and reinforce the constructs and skills that the SRL possess.

The nurse who is a SRL knows how to differentiate what he knows and what he does not know; the SRL has the ability to identify prior knowledge and therefore, build upon it by seeking out pertinent information prior to making a decision about patient care. One
possible way to develop SRL nurses is to provide opportunities to guide and develop the
skills of SRL in the nursing curriculum. Although few studies address SRL in nursing
education, the potential of technology, more specifically the PDA, may be one way in
which to accomplish this goal. Drawing from the work that demonstrates how the SRL is
able to learn from technology based tools; there is the potential that the same can be
obtained with technology in nursing education.

Self-Regulated Learning

Self-regulated learning (SRL) stems from Bandura's (1986, 1997) social-cognitive
learning theory. Bandura's theory identifies three key components that contribute to
learning: the person, the environment, and behavior. When describing the person,
Bandura implies that cognition and metacognition is a major contributing component of
the person, as well as attitudes, beliefs, and biological factors. Additionally, within the
person, Bandura (1997) emphasizes that self-efficacy, "...refers to beliefs on one’s
capabilities to organize and execute the courses of action required to produce given
attainments" (p. 3). Another important aspect that should be noted is it that Bandura
differentiates self-efficacy and self-esteem. Self-efficacy deals with the person’s own
thoughts and capabilities of completing a goal/project, whereas, self-esteem deals with
how the person judges his self-worth. Although the two are different constructs, one has
the potential of affecting the other.

Bandura (1997) includes two types of environment, the sociocultural, and the
physical. The sociocultural environment includes interactions between the learner and
teachers, parents, friends, and peers. The physical environment addresses the milieu of the
classroom, available space, and the required necessities, such as food, shelter, and safety. He further implies that these environments “take three different forms: those that are imposed, selected, and created” (Bandura, 1997, p. 163). The environment that is imposed may include the classroom or the clinical environment. The selected and the created environments allow for some control by the learner. The learner has control of the type of actions/reactions within each of these two environments.

Behavior, according to Bandura (1997), takes many facets, such as modeling one’s behavior after peers, visualizing an appropriate action/intervention to succeed, and assessing one’s own method or strategies for learning. Behavior also addresses the reaction and/or response that the learner demonstrates in a particular learning situation, such as the amount of time and effort that was invested in preparing for an exam or the action the learner exhibits upon receiving results from a test or an assignment.

Bandura (1997) proposes that for learning to occur within the individual, there is an interaction among these three components, which he identifies as reciprocal causation. Accordingly, reciprocal causation may be demonstrated when a learner sets a goal (personal), receives feedback from it (environment), and changes the pattern of studying (behavior) to accomplish a higher order of learning. Hence, the goal is determined, in part by previous feedback from prior performances, which will also dictate or determine the amount of time the learner invests to accomplish an identifiable goal. Bandura further suggests that the response the learner experiences from the three components will affect future goals, actions, and outcomes.

Although Bandura’s (1997) social-cognitive theory is the main theoretical concept of SRL, two other learning theories warrant being considered when discussing SRL. The
first one is Vygotsky’s (Bruning, Schraw, Norby, & Ronning, 2004) sociocultural theory. Vygotsky’s theory supports the person’s behavior within the environment. He further suggests that much learning occurs in the environment of the community, which includes interactions between the learner and parents, peers, and friends. As Bandura suggests, some environments are imposed, such as one’s culture and/or community. Furthermore, within the cultural or community environment, modeling occurs.

Another important component provided by Vygotsky (Bruning, Schraw, Norby, & Ronning, 2004) is scaffolding. Vygotsky believed that for one to learn, the learner needs to be aware of what knowledge they already have. Only after prior knowledge is identified is the learner able to seek out new information or knowledge. Vygotsky implied that as new knowledge is obtained, the new knowledge is built upon the previous learned knowledge, hence scaffolding new knowledge on existing knowledge.

The second learning theory that supports SRL is constructivism. The constructivist theory is based on the assumption that learners employ schemas that already exist and add new information to it, therefore increasing the depth or breadth of the schema, or developing new schemas. When applying the constructivist approach to SRL, Martin (2004) suggests “…the active character of a learner’s interactions in learning tasks … results in the construction and reorganization of knowledge structures internal to the learner” (p. 135). Therefore, supporting Bandura’s (1997) learning model, as more knowledge is acquired, the learner’s capabilities increase allowing for higher goal setting and an increase in knowledge attainment.

Based upon Bandura’s (1997) theoretical model, numerous research studies have been conducted to better understand how learning occurs and how each component of
Bandura's model interacts with the other to promote learning. Possibly even more important, studies began to look at the degree or extent to which a learner has personal control over his learning process. It is from the results of numerous studies that SRL began to emerge.

From Bandura's (1997) work addressing SRL, several models have emerged. Schunk & Zimmerman (1989) and Zimmerman's (1989, 2005) model of SRL includes the triad of person, environment, and behavior, which are the same as Bandura's. Although not as closely related, Pintrich (2005) addresses the three components (person, environment, and behavior) of SRL, but appears to be more in-depth and breadth than Bandura or Schunk and Zimmerman.

According to Pintrich (2005), self-regulated learning is the ongoing process of regulating, monitoring, and controlling ones' cognitive, metacognitive, motivation and behavior to obtain an identified learning goal or outcome. Regulation involves controlling the amount or degree to which the learner invests in the learning process; it further permits the learner to regulate the cognitive and metacognitive strategies used, and the development of new strategies to assure learning.

Monitoring involves being conscious of the amount of time and methods invested in the learning process, as well as assessing and evaluating if the strategies and time invested are guiding the learner towards the identified goal. Control provides the learner with the ability to control the environment, the time spent on learning, and the strategies that are being used. It further provides the student the ability to adjust these components to ensure learning occurs.
Prior knowledge of the topic and self-efficacy also influences the extent to which the student regulates, controls, and monitors the learning process. Prior knowledge provides the learner with a starting place from which the learning goal is identified. Motivation is the belief the learner holds in regards to acquiring new knowledge, or completing an assignment. Motivation is controlled in many ways, both positively and negatively. The motivated learner may use self-talk to solve a difficult question or problem, whereas the non-motivated learner may contribute a low grade to lack of effort, and not lack of ability.

Self-efficacy, a component of motivation, affects the goal or outcome that is identified; if the student has confidence that the goal is obtainable, the learner will more than likely accomplish the goal. For the learner who has low confidence, or self-efficacy, the goal will be set lower, therefore, preventing the learner from possibly reaching a higher level of knowledge acquisition. Self-efficacy also contributes to the effort of obtaining the goal; the learner with a high level of self-efficacy will continue the process when a strategy proves to be unsuccessful, or when faced with obstacles, failure, or setbacks.

Behavior is the effort and actions the learner displays or initiates in completing the goal, and may include seeking out guidance or assistance from a peer or faculty member. Cognition addresses the strategies that one uses to learn, whereas metacognition are strategies that the learner uses to control and regulate his cognition. Each of the components of SRL directly or indirectly relates to each other, providing the learner with a means to adjust one or more components of SRL to achieve the outcome or identified goal. The learner has control of the components; therefore, the learner assumes the
responsibility for learning new knowledge, therefore to obtain the identified goal or outcome.

In addition to Pintrich’s (2005) SRL model, Biemiller & Meichenbaum (1992) were also interested in the degree to which one assumes or takes control of one’s own learning. Over a 15-year period, they studied high- and low-self-directed learners at the elementary school level. From their study, Biemiller & Meichenbaum defined the high-self-directed student as one “…whose level of cognitive development exceeds the complexity of tasks they are being taught have “surplus mental capacity” permitting them to “think” (self dialogue) about what they are doing” (1992, p. 76). Contrary, the low-self-directed students, when faced with a new task “…approach it with less well-established prerequisite skills. The sequence of steps to be considered in the new task creates “overload,” or at least occupies the student’s full attention. Little or no capacity is left for verbal thought processes while conducting the task” (Biemiller & Meichenbaum, 1992, p. 76).

Biemiller and Meichenbaum (1992) concluded that high-self-directed students verbalized up to two times more than the low-self-directed student. From this information, they were able to identify five distinct verbal task functions for coding verbal speech, which are defining, planning, conditional planning, monitoring, and evaluating. The authors concluded that both the high- and low-self-directed learners had a similar number of statements for defining and evaluating, but that the high-self-directed learner had more planning and monitoring statements. Accordingly, to Biemiller and Meichenbaum (1992), the verbal task functions describe the metacognition or task regulatory functions of verbal speech.
The results of the above findings by Biemiller and Meichenbaum (1992) strongly support Pintrich's (1995) model of self-regulated learning. Biemiller & Meichenbaum and Pintrich propose that the self-directed/self-regulated learner monitors and controls the progress that is being made towards achieving the identified goal or outcome. Furthermore, both theories suggest that the learner evaluates, or considers his prior knowledge before identifying the goal or outcome. Additionally, both theories advocate that planning occurs after prior knowledge is identified and a goal or outcome has been identified. Table 2 demonstrates the similarities of Biemiller and Meichenbaum categories of task functions of directive speech with the four Phases of Self-regulated Learning identified by Pintrich.

From the described coding system, Meichenbaum & Biemiller, (1998) further identified three phases or roles of self-direction, which are acquisition, consolidation, and consultation (Table 3). These three phases describe the level of cognitive understanding that the learner has for the skill or task. If the learner lacks the cognitive ability to understand the skill, it is less likely that the learner will be able to verbalize the steps he is doing to accomplish the skill, which is typical of the low-self-directed learner. The high-self-directed learner will be able to verbalize the steps that are being taken, therefore, this learner will also be able to transfer what has been mastered or learned to other situations and/or learning experiences.

The premise of SRL is that the learner takes control of his own learning; thereby, identifying prior knowledge about the topic and knowledge that remains to be learned. Once the learner identifies the information that is required, or information that is needed to further understand a concept or idea, the learner sets a goal to acquire the knowledge.
Furthermore, SRL is an ongoing process that is continuously being monitored, regulated and controlled, and at any time throughout the process the learner has the option of changing strategies or to adjust the outcome or goal previously identified.

SRL may take the student days or weeks to accomplish the identified outcome or goal. Unfortunately, in the clinical setting, when faced with a new situation at the POC, the nursing student does not have the luxury of time to monitor, control, and regulate new learning. The student needs to acquire new knowledge at that point in time to provide safe patient care.

Although the student has a knowledge base to build upon, it is unrealistic to expect the student to be able to recite the volumes of information that may be associated with just one disease process and its treatment, let alone a combination of disease processes, which is frequently the case. Therefore, in using the framework of SRL, the question that needs to be answered is what resources are available to the student to monitor, regulate, and control the acquisition of new knowledge at the POC. To possibly provide and answer to this question, the next step is to review what the literature is currently stating in regards to technology supporting SRL.

Self-Regulated Learning and Technology

The pace at which technology has advanced in providing the learner with another tool to learn has quickly surpassed the research that supports how technology enhances learning, and/or how students learn from it. Although many studies have looked at how technology advances learning, there are still many gaps and questions to be answered. In review of the current literature that addresses technology and SRL, few articles have identified direct links and/or benefits. Furthermore, much of the available literature
Table 2  Comparison of Biemiller & Meichenbaum’s and Pintrich Categories of Task Functions of Directive Speech and Pintrich’s 4 Phases of Self-Regulated Learning

<table>
<thead>
<tr>
<th>Task Function</th>
<th>Description</th>
<th>Phase</th>
<th>Pintrich: 4 Phases of Self-regulated Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defining</td>
<td>Statement or question labels and notes features of tasks, procedures, and objects (“It’s John’s game.” “The red paint.”)</td>
<td>Forethought, Planning &amp; Activation</td>
<td>Involves planning &amp; goal setting as well as activation, perceptions, and knowledge of the task, context, and the self in relationship to the task.</td>
</tr>
<tr>
<td>Planning (often combined with Conditional Planning)</td>
<td>Statement or question about what will or should happen next (“Can I do X?” “Mix some soap in the paint.” “Where are the sparkles?” “I need...”)</td>
<td>Monitoring (ongoing task)</td>
<td>Monitoring Concerns various monitoring processes that represents metacognitive awareness of different aspects of the self, task, or context.</td>
</tr>
<tr>
<td>Conditional Planning</td>
<td>Statement or question relates to a plan to a condition or specifies the basis for choosing between alternative plans (“If we make noise, then we won’t have recess.”)</td>
<td>Control</td>
<td>Control Efforts applied to control and regulate the different aspects of the self, task, or context.</td>
</tr>
<tr>
<td>Monitoring (ongoing task)</td>
<td>Statement or question notes progress, or lack thereof, on the task (“Your going too fast.” “Slow down.”)</td>
<td>Reaction &amp; Reflection</td>
<td>Represents various kinds of reactions and reflections on the self and/or task or context.</td>
</tr>
<tr>
<td>Evaluating (completing or aborted task)</td>
<td>Statement or question concerns conclusions on ending the task- regarding the product, the child’s ability, or the experience of doing the task. (“This is my best one so far!” “I can’t do it.” “The math squares are fun.”)</td>
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<table>
<thead>
<tr>
<th>Phases/Roles</th>
<th>Description</th>
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<tbody>
<tr>
<td>Acquisition</td>
<td>The learner observes, imitates, and acts under the guidance of the instructor. This is the low-self-directed student who is unable to understand the task or skill and depends upon the instructor to guide them. Due to the lack of cognitive understanding or mastery of the task or skill, the learner is unable to talk while doing the expected task or skill.</td>
</tr>
<tr>
<td>Consolidation</td>
<td>The task or skill begins to become automatic to the learner. The automaticity reduces the attentional and memory load associated with the skill, freeing up cognitive capacity to attend to other features of the task or to talk or think about the task while doing it.</td>
</tr>
<tr>
<td>Consultation</td>
<td>The learner has a fairly strong cognitive understanding of the task or skill, and therefore can perform requisite skills and plan specified applications, provide assistance to others as needed, collaborate effectively with others in planning large tasks, and consult with themselves when they encounter difficulties or problems in accomplishing tasks.</td>
</tr>
</tbody>
</table>

Adapted from Meichenbaum, D. & Biemiller, A. (1998). *Nurturing Independent Learners: Helping Students Take Charge of Their Learning* (pp. 75-77).
focuses on two constructs of SRL, scaffolding (Quintana, Zhang & Krajcik, 2005; and Graesser, McNamara, & VanLehn, 2005) and help seeking (Aleven, Stahl, Schworm, Fischer, & Wallace, 2003).

Quintana et al. (2005) begin by describing why students struggle with obtaining pertinent information from internet searches. They concluded that the lack of metacognitive skills contribute to this problem. For the most part, the novice learner will use superficial skills in searching the internet, such as assessing the actual presentation of the webpage, is it attractive, does it catch the eye of the learner or is it boring. Skimming the webpage for the answer is another tactic that novices use. If the answer is not jumping out to the learner, the learner will move on to another webpage. Lack of how to select pertinent information and synthesize it from the volumes of information that are available on the internet is another concern that Quintana et al. presented.

Because of the above, Quintana et al. (2005) conducted a study that looked at how scaffolding could enhance self-regulated learning. In answering this question, they developed a software program that displayed a metacognitive framework for on-line learning. The software focused on assisting and guiding the student in columns that are labeled as asking questions, searching, evaluating and reading, and synthesizing. Within each of these areas, the learner is encouraged to document, or copy and paste the information one has located. Although the template was developed to guide the student, Quintana et al. suggests that students do not search the web deeply enough, instead the student skims the page that comes up and then goes to another page if the answer is not prominently displayed. This conclusion relates back to SRL and the assessing of prior knowledge and goal setting.
Additionally, the authors reviewed and evaluated three software programs, Artemis, Symphony, and Digital IdeaKeeper. The Artemis software displays the focus or goal of the internet search at all times which helps keep the learner focused on the task. Symphony, which is modeled after concept mapping, allows the learner to view the different components of the goal and stay focused. The IdeaKeeper focuses the learner more on the content of the webpage and not the esthetics of it, therefore prompting the learner to look for information not entertainment. The conclusion drawn by the review of such programs was that although these software programs may assist in learning to a certain point, more research focusing on developing, reviewing of metacognition, and how technology affects learning still need to be conducted.

Point&Query, AutoTutor, and iStart are software programs identified by Graesser et al. (2005) that assists and guides the learner in scaffolding. Staying consistent with SRL, the authors stressed the importance of assessing prior knowledge and metacognitive awareness when using any type of software programming. Each of the programs focused on a particular aspect of SRL learning. Point&Query prompts the learner to pose questions and answers; AutoTutor is similar to a coach, communicating with the learner to force answers to a question; and iStart assist the student in reading and comprehension/understanding. Similar to the recommendations of Quintana et al. (2005), Graesser et al. suggest that much more research needs to be conducted before implementing these software programs.

Aleven et al. (2003) reviewed literature that addressed help seeking patterns of students using the World Wide Web (www). They reviewed such software programs as intelligent tutoring systems (ITSs), computer assisted instruction (CAIs), educational
hypermedia systems, and project or problem-oriented learning environments. Furthermore, they reviewed programs that offered system initiated help to learner initiated help. The results of the studies was that learners who may need the assistance or help were not accessing the help available to them, and those learners who did not need the assistance were the learners who most often used the help-seeking devices/components. This finding should not be too alarming, for it is the self-regulated learner who understands his own level of knowledge and seeks out help when needed, versus the non-self-regulated learner who does not know when they need to seek out help.

Azevedo & Cromley (2004) and Azevedo (2005) have studied how teaching SRL strategies to learners may enhance learning with technology. Using SRL models of Winne & Hadwin (1998) and Zimmerman (2001), Azevedo & Cromley conducted a study in which one group received training in SRL and the other did not. The results demonstrated that those who received the SRL training did much better and was able to learn more with multimedia than the control group who did not receive SRL training. Although this demonstrates that SRL may enhance learning with technology, the authors suggest that more research has to be conducted and more attention has to be focused on the development of software to guide the learners.

Azevedo (2005) presented a brief overview of the models of SRL and previous studies that demonstrates positive learning with technology. Upon comparing and contrasting what was previously studied, Azevedo conducted a study to compare the different methods of scaffolding in an attempt to observe how each scaffolding method would assist the learner. The conclusions drawn from his study support that scaffolding, regardless of the method has a positive effect on the learner. Azevedo concluded by
stating that more research is needed to assess the benefits of scaffolding and furthermore, how other components of SRL may be incorporated into software programs.

Winne & Stockley (1998) strongly believe that technology, if developed appropriately, is able to guide, reinforce, and advance SRL in students. As with all learning, effort is a key component in the tactics that the learner uses. Winne & Stockley describe effort as “a fundamental response-produced experience” (p. 114) and suggest there are three aspects of effort that will affect if and when learning occurs. The first aspect of effort involves the number of steps required in a tactic that the learner is using, the second aspect is the length of time the learner takes to identify and implement the tactic, and the last aspect addresses whether or not the tactic will meet the desired goal or outcome. They further suggest that the more often a learner uses a specific tactic, the more automated the tactic becomes, therefore, decreasing the amount of effort required to implement it. This, therefore, allows the learner to focus on, and learn other useful tactics.

In addition to effort, Winne & Stockley (1998) describe industrious as another key component in learning; industrious refers to the degree to which a learner believes that if a task is challenging it will require effort. Hence, the learner who is industrious and applies effort represents the self-regulated learner who is mastery oriented. The authors’ further state the self-regulated learner has the capability of transferring tactics from one domain to another. As indicated by the authors, the need to address effort and industriousness becomes significant when the learner is interacting with technology.

In demonstrating the effort and industriousness, Winne & Stockley (1998) suggests that if a computer program has the ability to direct and reinforce a specific tactic often enough, even though at first it may take effort on the part of the learner, the tactic will
become automated. Additionally, as the automaticity of the tactic is developed, ease at which the learner is able to learn increases; thus, as the level of knowledge increases, scaffolding occurs, promoting the ability to obtain a higher level/order of knowledge.

Winne & Stockley (1998) presented a computer program called STUDY that was capable of interacting with the learner. Throughout the interactions, the STUDY program provided the learner with an opportunity to monitor his own progress, cue the learner in an attempt accomplish an identified goal, and also has the potential to assist the learner in meeting goals by directing the learner in a systematic approach for solving problems. As the learner progressed through the task, the program was capable of monitoring the learner’s progress, and could initiate new tactics if needed. Although the above technology is a sample of what may assist in developing self-regulated learners, Winne & Stockley concluded by emphasizing that “Technological advances afford educational innovation, but we argue they must be perceived as roads for transporting productive change rather than as engines of it” (p. 133).

Using their own model of SRL, Hadwin & Winne (2001) propose how a software notebook, CoNoteS2, has the potential of guiding a learner through the learning process to attaining a higher level of knowledge. The software provides the learner with an organized template in which the learner is able to place new information, such as pertinent notes, terminology, and other resources, as well as self-selected sections of a text. This format or template is based on scaffolding, therefore, assisting the learner in building upon prior knowledge until the identified goal is met.

Furthermore, Hadwin & Winne (2001) suggest that the CoNoteS2 offers the student tacit cues that are imbedded throughout the software. They feel that by providing the tacit
cues, the learners “…attend to aspects of their studying without explicitly directing or instructing those studying activities” (Hadwin & Winne, 2001, p. 322). The authors present how each phase within their SRL model provides the learner with the ability to complete the phase and move forward to the next phase. Although there is potential for SRL software programs, such as CoNoteS2 to assist and guide the learner, the authors suggest that there remains a desperate need for more research and collaboration to mesh SRL and technology together for the benefit of the learner.

There is not doubt that as technology becomes more sophisticated, educators will be required to incorporate these various technology tools into the learning environment. The above studies briefly touch upon the many challenges that educators, as well as learners will need to attend to in the very near future. Yet, before any technology can be incorporated into the educational arena, the educator must have some sense of a theoretical framework to assist and guide the implementation. The role of technology in the process of SRL is still developing and evolving, but at the same time, there is evidence that suggests that technology is learner friendly when SRL is the framework.

Self-Regulated Learning in Nursing Education

Although little has been documented addressing SRL as a frame work in nursing education, Kuiper (1999, 2002, 2005), Kuiper and Pesut (2004) have begun to look at how SRL and information seeking behaviors are able to provide the nursing student with a method of taking responsibility for learning in the classroom and at the POC. Demonstrating and encouraging nursing students to work through the process of identifying goals or outcomes, monitoring, regulating, and controlling their strategies,
provides the student the opportunity to take control and responsibility for learning. Furthermore, with the rapid changes in the healthcare system, the student will be developing life-long learning habits that will ensure safe, effective, and efficient care.

Kuiper (1999) developed a clinical nursing model of SRL that focused on reflection and journaling. The reflective SRL model is similar to that of Schunk & Zimmerman’s (Zimmerman, 1989, 1998b) SRL model and includes the following three components: 1) environment of self-regulation; 2) metacognitive self-regulation; and 3) behavioral self-regulation. Each of the three components has sub-components that provide the learner with the ability to self-monitor, control, and regulate learning. The basis for Kuiper’s model was that by providing prompting questions that forced the participant to reflect on ones actions and reaction, and thought process throughout the clinical day, the more the participant would begin to monitor, control, and regulate future clinical days. Kuiper hypothesized that with the prompting and reflection, the participant would develop SRL skills.

Participants of Kuiper’s (2002) study included 2-year degree and 4-year degree graduate nurses; the two levels were purposefully selected to assess if there was a difference in metacognitive processing between the two levels of education. Upon observations and reflective journaling, Kuiper identified that there was a difference between the two levels of education; the 4-year degree nurse demonstrated a higher degree of metacognitive operations than the 2-year degree nurse, whereas, the 2-year degree nurse focused more on behavioral cognitive operations that the 4-year nurse.

Furthermore, the 2-year degree nurse demonstrated greater increase in thinking strategies, whereas, the 4-year degree nurse demonstrated a higher level of cognitive and
metacognitive thinking strategies. Although Kuiper (2002) did not directly imply that SRL learning is more appropriate for the 4-year degree nursing student, the greatest difference from the beginning to the end of the study demonstrated that the 4-year degree nursing student demonstrated a higher level of metacognitive processing, and strategies for critical thinking.

Critical thinking has been defined in numerous ways and by numerous disciplines over the past several years. Furthermore, the National League for Nursing (2005) requires critical thinking as an outcome for nursing programs across the country. Kuiper and Pesut (2004) propose that without addressing cognition and metacognition, critical thinking skills are unobtainable. They further suggest that SRL and reflection develops cognition and metacognitive processes, therefore, guiding the development of critical thinking skills. They equate cognitive processing with critical thinking and metacognitive processing with reflective thinking. With this assumption, Kuiper and Pesut suggest that by presenting prompting questions for reflection to the student, the student will begin to gain the tools of SRL, subsequently developing critical thinking skills.

While Kuiper and Pesut (2004) strongly support the reflective SRL framework for developing SRL and critical thinking skills in nursing students, they identified barriers that may prevent SRL as a framework in nursing programs. These barriers include (Kuiper & Pesut, 2004):

...student characteristics of resistance and attitude, inadequate time, perceived need to cover content and dispense information, resistance to teaching style changes, institutional barriers, lack of knowledge of the concept, and lack of self-efficacy in ability to teach critical thinking. (p. 384)
As with any new teaching theory or framework, documentation supporting the benefits and increased ability of the student to critically think as a result of reflective SRL will need to be demonstrated. Furthermore, faculty who are hesitant to teach reflective SRL will require support and guidance if the expectation is to produce critical thinking nurses.

Kuiper (2005) repeated her previous study using prompting questions to foster reflective SRL, except that in the current study, she provided the participant with a tape record so the participants could tape the answers instead of writing them. Additionally, the participants were senior baccalaureate nursing students who were completing their final courses and preparing to enter the role of the practicing nurse. The results of this study support previous findings; those who answered the prompting questions began to demonstrate a higher level of critical thinking (cognition) and use of self-monitoring (metacognition). Kuiper (2005) further suggests that:

...when students are guided to reflect with all aspects of self-regulation, there is multidimensional consideration of every aspect of the situation that is similar to the clinical reasoning activities nurses practice on a daily basis-monitoring thinking, reactions, and the environment: making judgments: and revising plans and approaches. (p. 355)

SRL as a learning model for nursing curriculums across the nation presents nursing faculty with a new model of teaching, thereby, transferring the responsibility of learning onto the learner. In doing so, faculty are preparing future nurses who, as SRL, are able to meet the demands of the healthcare system, as well as providing safe and effective care to the growing elderly population who present with multiple disease-processes.
Self-Regulated Learning and PDAs in Nursing Education

Numerous articles have addressed the PDA and nursing education, however, very little of what has been documented is based upon any type or framework of learning. For the most part, most articles addressing PDAs and nursing education are anecdotal and/or descriptive. The following study is the only study to date to address the use of PDAs and self-directed learning.

Miller, et al. (2005) explore whether having access to the PDA in the clinical setting altered the information seeking behaviors of nursing students, and how the clinical faculty viewed the students use of the PDA. The results demonstrated that students who were self-directed (self-regulated learners) became comfortable with the PDA in the clinical setting, and were able to function more independently. Therefore, the student was able to provide more hands-on care, and less time seeking out guidance or answers from faculty or nursing staff. It was also noted that the students who were comfortable with using the PDA to seek out information were able to assist nursing staff at the clinical site with pertinent POC information. The study also suggest that if faculty did not use PDAs or were unable to assist the student in finding information on the PDAs, the students were less likely to use them.

Their findings may be sending the wrong message to the student; that current information is not valued or important to the practicing nurse. In reality, research has identified the lack of buy-in by faculty due, in part, to the average age of the faculty member, the lack of understanding technology, how the PDA functions, and how to use it.

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Summary of Literature Review

Self-regulated/self-directed learning as presented by Pintrich (1995) and Biemiller & Meichenbaum (1992) lends itself in providing the framework for this study. Both theories place the responsibility of learning onto the learner. Additionally, many of the components/constructs are similar, such as evaluating the level of prior knowledge one has, and then setting an outcome, goal, or criterion based upon the prior knowledge. Additionally, the authors agree that the learner is motivated to learn, monitors progress toward the identified goal, and controls, and/or adjusts the skills or tasks to accomplish the goal. SRL and self-directed learning also provides the guidance to the new nursing student, who eventually will be the nurse who will seek out pertinent data before making decisions about patient care.

As previously discussed, the healthcare system is drastically changing due to many factors. The PDA, an important technological tool for the student nurse, as well as the practicing nurse, has the capability of providing vast amounts of current data at the place where it is needed the most—at the patient’s bedside. Therefore, introducing the PDA and the potential benefits it may offer to the nursing student today may very well assist in saving a life tomorrow.
CHAPTER 3

METHODOLOGY

Study Design

A mixed-method design using both quantitative and qualitative data directed this study. Descriptive quantitative data were obtained from the tracking system of the Nursing Central PDA bundle. Two sets of qualitative data were collected: the first set of data were gathered using the Think-Aloud Protocol (Biemiller and Meichenbaum, 1992); the second set was guided by the Grounded Theory approach (Creswell, 1998; Streubert-Speziale & Rinaldi-Carpenter, 2007). Utilizing the three methods of data collection provided a deeper and broader understanding of how participants use PDAs to enhance their learning.

The tracking system of the Nursing Central PDA Bundle provided empirical data, which included the number of times the participant synchronized their PDA, the number of applications opened, and the number of records read. These data provided an overview of the participants’ level of prior knowledge in a need-to-know situation, and an insight into the degree to which the participant is taking control of a learning situation.

The first set of qualitative data, the Think-Aloud Protocol, was collected at the beginning and at the end of the study. This approach was utilized to provide the
participant the opportunity to describe his thought process while seeking out information on the PDA. Furthermore, this protocol has the potential of differentiating the self-directed/self-regulated learner from the non-self-directed/self-regulated learner.

The second set of qualitative data was gathered using a Grounded Theory approach; this methodology was selected for several reasons. First, grounded theory is the product of the data observed and gathered, not drawn from previous works (Creswell, 1998; Streubert-Speziale & Rinaldi-Carpenter, 2007). Secondly, grounded theory involves obtaining information from the person who lives the phenomenon, such as the nursing student who is in the clinical setting providing direct patient care; this provides first-hand information to the investigator (Creswell, 1998).

Next, data comparison is ongoing, therefore, allowing or guiding the investigator to amend follow-up questions and data collection as needed and as the evolving hypothesis dictates. Lastly, the end-result of a grounded theory approach may generate a hypothesis regarding the phenomenon that is being studied, the use of the PDA by nursing students at the POC (Creswell, 1998; Merriam, 2002; Polit & Hungler, 2003; Streubert-Speziale & Rinaldi-Carpenter, 2007).

Grounded theory, as previously discussed, provides an opportunity to observe participants in the natural setting, leading to the development of a theory. There has been much written about whether the researcher should have a theoretical framework prior to the study, or if one is constructed as the research is occurring. Creswell (1998) emphasizes “…a researcher does not provide a theoretical framework in this review (literature review) inasmuch as the intent of grounded theory is to generate or develop a theory” (p. 179). Though the development of a theoretical framework may bias the data,
SDL/SRL was utilized for this study to provide a way to place the participants, or to identify where the participants were at the beginning of the study. This was necessary to assess if the PDA supported SRL/SDL.

Site

A major healthcare facility in Las Vegas was the site of data collection. This site was selected because the facility provides continuous clinical experiences for three of the four levels/semesters of nursing students within the nursing program at the School of Nursing (SON) at the University of Nevada, Las Vegas (UNLV). When participants remain in the same facility for two or three semesters, the participant’s comfort level to the environment has been established. Additionally, the participant is familiar with the routine and protocols of the facility; therefore, alleviating any variable that may potentially contribute to adjusting to a new facility prior to becoming comfortable enough to focus on his own learning needs.

The geriatric population was the focus of the theoretical component of the level two participants. They were on a general medical-surgical unit that treated all levels of patients. The level of acuity, as defined by the facility, ranged from 2 – 6, with 6 requiring a great deal of care; the average-length-of-stay was three to five days. The majority of patients were 65-years old or above.

The level three participants, who were focusing on the acutely ill adult in the theory course, were on a Certified Cardiac Unit, involving three levels of patient care. The first level was the Chest Pain Observation; the patient was admitted and observed for 23 hours due to potential cardiac problems. The second level of care was the Intermediate Level
care, which cared for the patient who was experiencing cardiac problems, but was not sick enough to be in the intensive care unit. The third level of patient care was the Cardiac Medical/Surgical Telemetry Unit that focused on cardiac patients who were about ready to go home, teaching was the emphasis on this unit. As the participants rotate through each of these levels, they gain a better understanding of the needs of various critically ill patients.

Participants

The participants for this study were second and third level baccalaureate-nursing students from the SON at UNLV. The nursing program consists of four levels/semesters (Appendix II). Levels two and three were selected to participate in the study because the first semester students are becoming acclimated to a rigorous program, and are not in the health care facility the entire semester. Additionally, the fourth level students are preparing to graduate and, like the first level/semester students, they are not in the health care facility for the entire semester.

The purposeful sample consisted of four students from the second level and five students from the third level of the nursing program. All students entering the nursing program are required to meet specific criteria and have a minimum GPA of 3.00. Additionally, each of the students selected successfully scored at or above the national average for designated Educational Resources, Inc, (ERI) Comprehensive Achievement Profiles, such as Fundamentals of Nursing (Level I) and Gerontological Nursing Level II), as well as passing all prior nursing courses and math exams. To control for variability among different clinical settings, the sampling from each level were randomly selected.
from those completing their clinical rotation at the selected healthcare facility as previously described. Therefore, the participants are considered homogenous because of the minimum requirements that each student must meet.

The nine participants consisted of seven females and two males. Three participants had not used the PDA prior to the study, all others had used it in previous semesters. The average age of the participant was 20 to 25 years of age, with the oldest participant being between the ages of 41 to 45 years-of-age. The ethnicity of the participants included three Hispanic/Latinos, two Asian/Pacific Islanders, one African-American, one White/Caucasian, and one who preferred not to answer.

Three participants were responsible for a child under the age of 18. Five of the nine participants worked some type of job, with work hours ranging from a minimum of 4 hours to a maximum of 30 hours per week. This will be the first degree for six of the participants; all participants are full time students, which consists of 15 credits hours. The average cumulative GPA is 3.32, with the highest being 3.60 and the lowest is 3.03. The average nursing GPA is 3.10, with the highest at 3.59 and the lowest at 2.65.

The inclusion criteria included being a current second or third semester nursing student at the School of Nursing at UNLV and being assigned to the healthcare facility previously described. Owning or having access to a PDA with the Nursing Central software bundle was also a requirement. Exclusion criteria were any non-nursing students at UNLV or current nursing students who were not in the second and third semester of the program, and who were not assigned to the clinical site described above. Additionally, students who did not have access to, or own a PDA, and/or the Nursing Central bundle were excluded.
The risk of sampling bias was minimal because each student who was assigned to the specific healthcare facility had an equal chance of being selected. The selection of participants occurred by a randomized drawing from those students who signed and returned the Informed Consent. Potential risks to the participant were minimal; the comfort level of the participant being observed and interviewed by a previous faculty member may have caused some degree of discomfort. The benefits to the participant included new methods of using the PDA, using the PDA in different settings, and feeling comfortable enough to use it in front of the patient and staff nurses.

Data Collection

Upon obtaining informed consent and distributing the serial numbers for the PDA bundle, all participants completed a Pre-Study Questionnaire. Because three of the participants had not used the PDA before the study, they were offered a one-on-one session to review the PDA and the software bundle. Although only one participant took advantage of this offer, all participants were offered guidance throughout the study on how to search out information in a more efficient manner.

The PDA tracker began collecting data after each participant downloaded and synchronized their PDA. Ongoing observation and follow-up questions addressing which textbook the participant was using, what specific information the participant was seeking out, if the information was located, and if the information obtained was helpful supported the tracking data.

The first qualitative data to be collected was the Think-Aloud, which was audio taped, and completed by all participants within the first two weeks of the study/semester, and

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then repeated within the last two weeks of the study/semester. Each participant was provided with a case study that represented a new patient assignment (Appendix IV). Once time was allowed for the participant to read the case study, specific instructions for completing the Think-Aloud were provided to the participant (Appendix V). Cuing, answering questions presented by the participant, and requesting clarification from the participant during the Think-Aloud occurred on an individual bases. Upon completing the Think-Aloud, audio tapes were transcribed and coded.

Guided by Grounded Theory, participants were observed in the clinical setting for any use of the PDA. Upon observing the participant using the PDA, a follow-up interview was completed. At the beginning of the study, specific exploratory questions (Appendix VI) guided the audio taped interviews. Weekly field notes, consisting of the time of day, the appearance of the participant (such as facial expressions and body language), and the length of time the participant was observed searching out information on the PDA were also documented.

The data gathered from the observations and field notes were transcribed and coded. As the study progressed, and themes begin to be constructed, follow-up interview questions and field notes were revised to focus on confirming or refuting the constructed themes. The semi-structured interviews varied greatly in time, some were as brief as 5 minutes, while others lasted 15 to 20 minutes. Every effort was made to prevent interfering with the role and responsibilities of the participant, which was the role of a student nurse.
Data Analysis

Two sets of data was obtained from the PDA Tracker, the first set of data displays the participant use of the PDA itself, the second set demonstrates the use of the PDA bundle accessed from the participants desktop. The number of times the PDA was synchronized, the number of applications opened, and the number of records read are included in the data set from the PDA. The number of searches for each text are included from the desktop data.

Each participant’s Think-Aloud statements/data were coded according to the task directive speech, which includes defining, planning, monitoring and evaluating, as well as the number of statements (Table 5). Upon completing the think-aloud at the end of the semester, the pre and post-study coded data was compared and analyzed for any differences in the task directive speech and the number of different verbal statements (defining, planning, monitoring and evaluating) of the participants. The data was then analyzed to identify which of the three phases of self-direction the participant demonstrated.

The semi-structured questions guided the beginning interviews. Upon transcribing and coding the data obtained, follow-up questions were constructed to verify the data for the following week. Utilizing the constant comparative method, data were coded, and questions were revised or developed to confirm or dispute the themes being constructed. This method of data analysis provided for ongoing coding and categorizing of the data into meaningful and similar concepts and themes for future observations and interviews.

The process of returning to obtain data, transcribing the information, coding, and identifying similar concepts and categories ensured that the full scope or understanding of
the phenomenon was occurring. Figure 1 displays how the data were coded and themes constructed. The last step involved narrowing the data into major constructed themes.

Figure 1: Adapted from Streubert-Speziale & Rinaldi-Carpenter (2007), p. 133-149.
CHAPTER 4

RESULTS

Think-Aloud Protocol

The Think-Aloud, which was completed at the beginning and at the end of the semester, makes visible the thought process of the participant, as well as an insight into the degree to which the participant assumes responsibility for his own learning. Upon completing the coding of the participants statements, eight of the nine participants were identified as being SRL/SDL (Table 4). Furthermore, when comparing the beginning and ending statements, one is able to view the change in the participants.

The SRL/SDL participants verbalized more planning and monitoring statements than defining and evaluation statements, as supported by Biemiller & Meichenbaum (1992) SDL model. Additionally, the third level participants had more statements than the second level participants did. This would be expected, as the third level participants have had more theory and clinical experience, therefore, they have a broader knowledge base with which to draw information/knowledge from.

Before beginning the Think-Aloud, all participants were provided with a case study and were encouraged to take whatever time was needed to read the case study before proceeding with the Think-Aloud. Although there was no time limit in reading the case study or in preparing for the Think-Aloud, only one participant took the time to underline

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pertinent data that was familiar or known. Furthermore, this participant identified what was not known, and then identified the information that would be needed to care for the patient. Once the participant developed a list of what to search out on the PDA, the Think-Aloud began.

Throughout the pre-study Think-Aloud process, two participants were identified as having a strong understanding of their prior knowledge, which contributed to their ability to focus on the information that needed to be sought out, and not the task of how to seek it out on the PDA. Furthermore, the two participants demonstrated the ability to self-talk through any areas they were not sure of, therefore, determining if there was a further need to search out additional information. All three of the participants who demonstrated a higher level of awareness of prior knowledge were in the third level.

The one participant, who was identified as a non-SDL/SRL, had more defining statements than planning or monitoring. This participant, who was in level two, struggled throughout the Think-Aloud, and was not sure of what or how to describe the thought process that was being used when searching out information on the PDA. Although this participant had access to the PDA in the previous semester, it was evident that the participant was attempting to do two things at once, verbalizing the dropdown menus within each textbook and attempting to describe what information was being sought out. This participant also took the longest time, of all of the participants, to complete the Think-Aloud.

When identifying the phase or roles of self-direction, it varied across all three phases. The non-SDL/SRL was in the acquisition phase. As previously stated, this participant experienced difficulty in verbalizing exactly what the thought process was when
searching out information on the PDA. Subsequently, there was not a level of mastery in using the PDA and verbalizing the steps in doing so.

The next phase, consolidation, was the phase that most of the participants were in; six of the nine participants displayed the ability to search out information on the PDA with little difficulty or effort. Furthermore, when the participant is able to automatically complete a task or skill, such as seeking out information on the PDA, they are free to verbalize or think about the current task while implementing it. Additionally, the participant is also able to focus on the information and/or knowledge that are needed to learn.

Two of the participants, who were from the third level group, were identified as being in the consultation phase or role, as these participants were able to self-talk when presented with a task or skill that was unfamiliar or unknown, whereas, the other participants asked questions, or for clarification of the interviewer. Furthermore, these two participants were identified as the participants who would be sought out, by their peers, if the required information was unable to be located or obtained.

The findings of the post think-aloud were consistent, as each participant advanced to the next phase of self-direction. Although the overall total number of statements decreased, the statements that were made were more focused and deliberate than at the beginning. When comparing the number of planning and monitoring statements to the total number of statements, each participant had an increase in the number of planning and monitoring statements in comparison to the pre-study Think-Aloud.

The participant who was non-SRL/SDL had the most statements at the end of the study. Furthermore, end of study statements was more focused and deliberate. The
participant took the time to underline what was familiar or known, therefore, displaying the ability to identify prior knowledge. From this information, the participant identified pertinent drugs, labs, and pathophysiology that would need to be sought out on the PDA and Nursing Central bundle. Although identified as in the acquisition phase at the beginning of the study, this participant demonstrated the ability to search-out information in a more automatic manner by the end of the study, thereby, progressing to the consolidation phase.

Table 4  Think-Aloud Protocol

<table>
<thead>
<tr>
<th>Participant</th>
<th>Pre-Study</th>
<th>Post-Study</th>
<th>Pre-Study</th>
<th>Post-Study</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D=P</td>
<td>M</td>
<td>E</td>
<td>Total</td>
</tr>
<tr>
<td>TL</td>
<td>40</td>
<td>68</td>
<td>38</td>
<td>1</td>
</tr>
<tr>
<td>TJ</td>
<td>44</td>
<td>37</td>
<td>23</td>
<td>1</td>
</tr>
<tr>
<td>TH</td>
<td>84</td>
<td>86</td>
<td>28</td>
<td>1</td>
</tr>
<tr>
<td>TB</td>
<td>31</td>
<td>46</td>
<td>49</td>
<td>3</td>
</tr>
<tr>
<td>TM</td>
<td>32</td>
<td>42</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>SS</td>
<td>40</td>
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<td>4</td>
</tr>
<tr>
<td>SM</td>
<td>32</td>
<td>34</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>SL</td>
<td>65</td>
<td>29</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>SD</td>
<td>27</td>
<td>27</td>
<td>20</td>
<td>0</td>
</tr>
</tbody>
</table>

D: Defining; P: Planning; M: Monitoring; E: Evaluating; Total: Total Number of Statements; Phase: Phase of self-direction
Prior to discussing the data obtained from the Unbound Medicine tracker, it is important to note that because the tracking system was new, there were unanticipated technological problems. Although the problems were resolved during the study, some of the beginning data were unobtainable; therefore, the data presented is not all inclusive of the participants’ use of the PDA and desktop Nursing Central bundle. Furthermore, when discussing the frequency of accessing the PDA and the records read, one must keep in mind that when the participant opened a textbook, it was only counted as one record read, regardless of the number of items searched, such as searching out pertinent data about 10 different medications is equal to only one record being read.

The first set of data obtained from the Unbound Medicine PDA tracker demonstrates the overall pattern of the use of the PDA by the participants. Presented within this data are the synchronization habits, the number of applications opened, and the number of records read (Table 5), which varies a great deal between the participants and levels. The synchronizations are the number of times a participant accessed unboundmedicine.com to obtain new and/or updated information for their Nursing Central bundle. The applications opened are the number of times a participant opened or accessed the Nursing Central bundle, and lastly, the number of records read is the number of textbooks that were viewed by the participants.

Although there were problems with the tracking system, the data shows that two of the participants synchronized their PDA much more than the other participants did. The two participants were from level three, and were first time users of the PDA and the Nursing Central bundle. Additionally, the third participant, who was also a first time user...
of the PDA, synchronized the PDA six times and was in the second level. Although this
is not as frequent as the two other new participants, it was the second highest
synchronizations for the second level. The remainder of the participants were not as
aggressive in synchronizing their PDAs to obtain updates and/or new information. The
pattern of synchronizing the PDAs was fairly equal for the remainder of the participants,
regardless of which level the participant was in.

Table 5 Frequency of Accessing the PDA Bundle

<table>
<thead>
<tr>
<th>Participant</th>
<th>Synchronizations</th>
<th>Applications Opened</th>
<th>Records Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL</td>
<td>26</td>
<td>210</td>
<td>296</td>
</tr>
<tr>
<td>TJ</td>
<td>39</td>
<td>61</td>
<td>306</td>
</tr>
<tr>
<td>TH</td>
<td>9</td>
<td>62</td>
<td>451</td>
</tr>
<tr>
<td>TB</td>
<td>11</td>
<td>48</td>
<td>152</td>
</tr>
<tr>
<td>TM</td>
<td>5</td>
<td>79</td>
<td>304</td>
</tr>
<tr>
<td>SS</td>
<td>4</td>
<td>609</td>
<td>Unknown</td>
</tr>
<tr>
<td>SL</td>
<td>10</td>
<td>329</td>
<td>1323</td>
</tr>
<tr>
<td>SD</td>
<td>6</td>
<td>107</td>
<td>3</td>
</tr>
<tr>
<td>SM</td>
<td>3</td>
<td>166</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

The number of applications opened, or the frequency of accessing the PDA by the
participants, varies a great deal. One participant accessed the PDA Nursing Central
bundle 609 times over the course of the study, where as another participant only accessed
the bundle 48. When viewing the number of times the PDA was opened, one must also
remember that this represents the pattern of opening the Nursing Central bundle at the
POC, be it medical-surgical, pediatrics, or at the mental healthcare facility, as well as in
the classroom.

The number of records read is the number of textbooks that were viewed when the
Nursing Central bundle was opened. Again, due to technical problems, some of the early
data were unobtainable, such as the participant who opened the application 609 times. Nevertheless, the available data demonstrate the broad range of records read or textbooks viewed, with the lowest being only 3, and the highest number being 1,323 times.

The next set of data provided by the tracker indicates the frequency of accessing the Nursing Central bundle from the desktop. The data obtained from the desktop bundle does not provide individual participant use, but rather usage by textbook and level. In comparison, the participants in the second semester accessed the desktop version 817, whereas, the third semester participants accessed the desktop version 1,418 times.

As supported by current literature, Davis’s Drug Guide, a reference for medications, was the most frequently viewed and read resource for both levels. Although it may be expected from the second level participants (Graph 1), as they were completing the pharmacology course, the third level participants (Graph 2) were also searching out medication references. Furthermore, the third level participants were seeking out medication information almost twice as often as the second level participants.

Taber’s Cyclopedia Medical Dictionary was the second most frequently accessed textbook for both levels. Within the second level, Taber’s was viewed most frequently within the first half of the semester. The third level participants had the most views in the last half of the semester. The primary information that was sought out by both groups included prefixes, suffixes, definitions, abbreviations, nursing diagnosis and information about specific disease processes.
Graph 1  Level Two Desktop Access

Frequency of Accessing Desktop

- Davis's Drug Guide
- Tabers
- Disease & Disorders
- Davis's Lab Manual

May  June  July  Aug.

0  30  60  90  120  150  180
Graph 2  Level Three Desktop Access

Frequency of Accessing Desktop

- Davis's Drug Guide
- Tabers
- Disease & Disorders
- Davis's Lab Manual

May  June  July  Aug.
D & D and Davis's Laboratory Manual were the least accessed textbooks in both levels. Although D & D was accessed a little more frequently than Davis's Laboratory Manual, neither level accessed either one of them more than 100 times. There was not one specific disease process that was sought out the most in D & D. The most frequently sought out laboratory values in Davis's Laboratory Manual included white blood cell counts, red blood cell counts, complete blood cell counts, and the therapeutic level of theophylline.

Observations and Follow-up Interview

Observation and follow-up interviews were conducted throughout the semester. Guided by Streubert-Speziale & Rinaldi-Carpenter's (2007) model of Grounded Theory, Substance Codes, or open coding was the first step in data gathering. Several codes were used as to avoid missing any pertinent findings. Furthermore, it provided the basis from which questions were developed for the following week (Table 6). Categorization, or constant comparative was the next phase; as more data were collected, reoccurring concepts and categories began to be constructed (Table 7). As categories began to be constructed, more specific questions were developed, which either supported or refuted the constructed categories.

The last phase, Basic-Social-Psychological Process Identified (BSP), supported specific pertinent questions to substantiate the categories and concepts. Questions, such as “How are the participants using the PDA?” and “In what environment, or where is the PDA being used by the participant?” began to provide substantive support for the constructed categories and concepts. In posing these questions to the participant over the
last half of the study, the identified categories and concepts were confirmed. Reduction sampling provided the opportunity to narrow the concepts into major concepts and categories, therefore, allowing for the beginning of a hypothesis.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>As a laboratory and diagnostic tool</td>
<td>How the PDA is used</td>
</tr>
<tr>
<td>Tabers' Cyclopedia for the nursing diagnosis</td>
<td>Text used within PDA</td>
</tr>
<tr>
<td>Understand pathophysiology of a disease in class</td>
<td>Where PDA is used</td>
</tr>
<tr>
<td>Used for clinical prep</td>
<td>What PDA is used for</td>
</tr>
<tr>
<td>Safe medication dosage</td>
<td>Why the PDA is used</td>
</tr>
<tr>
<td>Found answers in seconds</td>
<td>Ease of using PDA</td>
</tr>
<tr>
<td>Studying for exams</td>
<td>Non-clinical Use of the PDA</td>
</tr>
<tr>
<td>Answering patient’s questions</td>
<td>When PDA is used and Comfort of using it</td>
</tr>
<tr>
<td>Current and precise information</td>
<td>Advantages of PDA</td>
</tr>
<tr>
<td>Decreased my anxiety in clinical</td>
<td>Personal benefits</td>
</tr>
</tbody>
</table>

The data collection and coding process resulted in the construction of the following major theoretical concept: learning strategies provided and supported by the PDA. Although this study was primarily focused on the use of the PDA at the POC, data addressing how the PDA was accessed outside of the POC was obtained. This data is unable to be separated apart from how the participant uses the PDA at the POC, as it contributes to how the PDA supports learning across the nursing curriculum. Furthermore, theory courses are taught to prepare and support the nursing student to perform safe and knowledgeable care while in the clinical setting or at the POC, hence, theory and clinical are unable to be separated as though they were different entities.
Table 7  Reoccurring Concepts and Categories

<table>
<thead>
<tr>
<th>Concepts/Categories</th>
<th>Statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDA Resources being used</td>
<td>Davis’s Drug Guide for medications, safe dosage range, side effects, and</td>
</tr>
<tr>
<td></td>
<td>contraindications</td>
</tr>
<tr>
<td></td>
<td>Laboratory and diagnostic tests for the abnormal laboratory values</td>
</tr>
<tr>
<td></td>
<td>Taber’s Cyclopedia for Nursing Diagnosis</td>
</tr>
<tr>
<td></td>
<td>Pathology of the disease</td>
</tr>
<tr>
<td>How the PDA is being use</td>
<td>Used it for my other classes when I had a question about drug doses, spelling</td>
</tr>
<tr>
<td></td>
<td>and indications for certain drugs</td>
</tr>
<tr>
<td></td>
<td>Used it for clinical prep</td>
</tr>
<tr>
<td></td>
<td>In clinical when assigned a new patient or new drug</td>
</tr>
<tr>
<td></td>
<td>A resource for tests</td>
</tr>
<tr>
<td></td>
<td>Study for exams</td>
</tr>
<tr>
<td>Why the PDA is accessed</td>
<td>Preferred method of learning-from a screen</td>
</tr>
<tr>
<td></td>
<td>Provides fast, accurate and current information</td>
</tr>
<tr>
<td></td>
<td>Is small and compact, it fits right in my pocket</td>
</tr>
<tr>
<td></td>
<td>Easy to access</td>
</tr>
</tbody>
</table>

The major concept/category, learning strategies provided and supported by the PDA, provides a number of ways in which the participants are learning when using the PDA.

First, within the actual clinical setting, the PDA provides immediate and current information about disease processes, medications, new terminology, and explanations of new or unknown procedures and/or tests. All participants agreed that they were able to obtain important and current information from the PDA, therefore, providing them with the knowledge and ability to provide safe, accurate, and current care.

Within the clinical setting, the most frequently accessed text was the drug guide, which is not surprising and is supported by the current literature (Scully, 2004; Stolworthy, 2003). Within the drug guide, the most frequently accessed information included contraindications/precautions, adverse reactions/side effects, route/dosage, assessment, and patient/family teaching. The participants felt that the PDA was
invaluable to them while administering medications. Furthermore, they did not hesitate to use the PDA when a medication order was not within the recommended safe dose range, or when the clinical faculty questioned them about a drug. Additionally, over the course of the study, each participant stated that at least one staff nurse approached them about a drug, be it a safe dose range, a potential side effect, or the correct spelling of a drug. The consensus from the participants was that they wanted to be safe when administering drugs, and would not hesitate to use the PDA.

Although this may not be astonishing information because the current literature supports it, what is different and worth noting is that the participants, in both levels, use the PDA in their theory courses to look up medications. Participants stated that while in the classroom they access the PDA to look up unfamiliar medications, as well as the safe dose, side effects, and other needed information. The participants agreed that becoming familiar with, and knowing common medications is one of the biggest challenges throughout the nursing program. Therefore, having the PDA available to them at the POC and in the classroom provides them with a tool to search out new medications at the time it is needed, or in current time.

Furthermore, the PDA provides a tool for studying medications. Within the third level, three of the five participants who had access to the PDA while in the pharmacology courses stated that they used the PDA to study for tests. When questioned why, the participants responded by saying that the PDA presents the same material as the textbook, but that the PDA removes all of the “extra stuff,” therefore, providing them with the pertinent information about the medication. The participants also stated that the important information, such as life threatening side effects are written in red, therefore, alerting the
reader to very specific and important information with which to monitor the patient.
The two participants in the third level who did not have access to the PDA bundle while
taking the two pharmacology courses were questioned if they thought that the PDA would have, perhaps, made it easier for them in when they were taking the courses. Both participants strongly agreed that the course would have been less stressful, and, even more importantly, they felt they would have obtained a higher grade if they would have had access to the PDA. Additionally, one of the participants stated that all of the course grades in levels one and two might possibly have been higher if the PDA had been purchased while in level one.

The second level participants also stated that they access the drug guide at the POC and when in the classroom. It is important to remember that the second level participants have only had their PDA for about 8 weeks; therefore, they have not had the experience of accessing the PDA that the third level participant has had. According to the participants, the delay of accessing the PDA in the classroom was due to the limited amount of time they had with using the PDA and searching out what it provides, such as the various drop-down menus. Each of the second level participants stated that now that they know more of what is available on the PDA, they have started to use the PDA in the pharmacology course, as well as in other courses they are currently taking.

The one participant in level two who just received the PDA and Nursing Central bundle for the study also started that the PDA was beneficial in the classroom. Additionally, this participant stated that her test scores in pharmacology have increased since obtaining the PDA, and furthermore, she strongly felt that her first semester pharmacology grade would have been higher if she had purchased the PDA in the first
semester. This participant also stated that she was able to understand now why her fellow classmates were able to develop strong and accurate nursing diagnosis and explanations of a disease process while she was experiencing such difficulty.

Davis's Laboratory Manual, Disease & Disorders (D & D), and Taber's Cyclopedia Medical Dictionary were also accessed, in varying degrees, by the participants throughout the study. For the most part, the above textbooks were only accessed at the POC when a participant received a new patient assignment who had an unfamiliar disease processes, a new or abnormal laboratory value, new terminology, and unfamiliar tests and/or procedures. Educating the patient and/or family about new medications, or discharge instructions were also identified reasons for accessing the PDA at the POC.

The primary reason for accessing the PDA outside of the POC and the classroom was the day before clinical, when the participants pick up their patient assignment from the healthcare facility; it is at this time that the PDA and the Nursing Central bundle is used the most. Depending on the diagnosis of the patient and the medications or laboratory values, each textbook would be accessed to obtain a better understanding of what was occurring with the patient. The goal of obtaining a solid understanding of the disease process, expected signs and symptoms, and required care of the assigned patient(s) were the focus of accessing the PDA and bundle.

When pursuing the rationale for using the PDA and not hardbound textbooks, it was explained that one "would have to have two, three, and maybe even four textbooks surrounding them and that they would have to flip back and forth between books and chapters, because everything they needed was not in one place." Four of the participants
stated that they even had to go onto the Internet, prior to obtaining the PDA, to obtain current information, as the textbooks were out dated.

In addition to searching out new information at the POC, completing clinical preparation worksheets, and searching out medications at the POC and in the classroom, the PDA was also used for other course assignments and in other clinicals, or POC. Within the second level, participants are required to complete, and post, a case study dealing with the elderly population on a weekly basis. One of the requirements for completing the case study is to site the resource of where the information was obtained. In pursuing the acceptability of using the PDA as an acceptable site, all agreed that it was acceptable, and furthermore, it was about the most frequently sited source.

Level two also includes caring for pediatric and obstetrics patients. Once again, participants from both levels identified the use of the PDA for safe pediatric medication doses, and stages of labor at the POC. As one participant shared, while she was observing in the neonatal intensive care unit (NICU), the staff nurse was explaining the different medications that were being used for the severely ill babies. The participant went on to say that she was able to pull her PDA out and look up the classification of drugs, the safe dose, and the reason for administering them. She further stated that although she was observing, she learned a great deal about the medications that are specifically designed for use in the NICU.

The mental health population and the acutely ill population are the focus of level three. Participants in the third level stated that they use the PDA at the POC and in the classroom. Additionally, four of the five participants voiced the ease of teaching the patient, in understandable language, about their medications in preparation for discharge.
Furthermore, because the mental health patient may have multiple disorders, the participants stated that the PDA was very helpful in understanding what was occurring with the patient because there were no outward signs of illness within that environment. The major concept, learning strategies provided and supported by the PDA as displayed in Table 8 provides participant statements supporting the major concept; Diagram 1 displays the domains & taxonomies of how the major concept was constructed.

Table 8  Major Concept/Category

<table>
<thead>
<tr>
<th>Concept/Category</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Strategies Provided &amp; Supported by the PDA</td>
<td>Used it for my other classes when I had a question about drug doses, spelling, and indications for certain drugs. The practice of looking up information for myself helps to better retain it. A resource for tests and studying for exams. Used it for homework/Case Studies for class. Would constantly be looking at it and eventually the more I looked at it the more I started to remember the information. I learn from the screen-it isn't like looking at a textbook when I use it, I cannot learn from a book, prefer reading from a screen. Built up my confidence in clinical and now I enjoy coming to clinical to relate what I learned from the bundle to what the patient has. Makes my studying and preclinical write-up more efficient. Actually feel comfortable because when I don't know something I get anxious and sometimes worried that if I get questioned by a patient I won't be able to give them an answer. Never felt “ashamed” or awkward when using my PDA in front of my patients to answer their own questions. Reference tool always at hand, allows me to teach myself when instructors or other nurses are unavailable.</td>
</tr>
</tbody>
</table>
Diagram 1: Learning Strategies Provided & Supported by the PDA

Clinical/POC, Classroom Theory & Studying for Tests

Learning Strategies Provided & Supported by the PDA

Self-Regulated/Self-Directed Learning

Preparation for clinical, Case Study's & Theory Courses

New/Unknown Medications

New/Unknown Procedures & Laboratory Values

Abbreviations & Terminology

Patient Teaching


Nursing Dx: Assessment, Goals, & Interventions

Actions, Safe Dose and Route, Side Effects, Pr. Teaching & Contraindications

Safe implementation of new procedures, expectations, & results. Labs: Potential Causes/Contributing Factors,

Understanding & Safely implementing orders/care

Disease Process, Causes, S & S, Medications, Safe Dose, & Side Effects to monitor for

Offers precise & pertinent information, alleviates having to search through extra stuff in numerous textbooks.

Would constantly be looking at it and eventually the more I looked at it, the more I started to remember the information.

The practice of looking up information for myself helps to better retain it.

Never felt "ashamed" or awkward when using my PDA in front of my patients to answer their questions.

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CHAPTER 5

DISCUSSION

Research Question

Much has been written about the benefits and use of the PDA by practicing nurses and nursing students. The practicing nurse has identified the PDA as an invaluable tool that provides the nurse with more control over such things as safe medication administration and evidenced-based practices at the point-of-care (POC), (Scollin, Callahan, Mehta, & Garcia, 2006; Scully, 2004; Stolworthy, 2003), time management and current-time documentation (Lanway & Graham, 2003), and training nurses in specialty areas (Blair, 2006). Furthermore, the PDA has been identified as a resource for both faculty and students in various nursing programs across the country. For the most part, the PDA has been used as a tracker for clinical faculty, or in graduate level courses, such as pharmacology.

Most of the current literature addressing the use of PDAs within nursing programs is either anecdotal or exploratory. Furthermore, there appears to be gaps in the current literature with respect to collecting data, and the use of multiple methods in an attempt to obtain the richest data that would either support or refute the value of PDAs within nursing programs. Therefore, the purpose of this study was to determine if the handheld
computer, or PDA, supported or constrained nursing students at the POC.

Data collection for this study was obtained using three methods: (a) the Think-Aloud Protocol (Biemiller & Meichenbaum, 1992), (b) POC observation with follow-up interviews, and (c) empirical data from the Nursing Central bundle that was obtained from the participants PDA. Additionally, the following two questions assisted in guiding the data collection: (a) in what way does the PDA support or constrain SRL in nursing students, and (b) to what degree does the PDA assist the learner in taking control of a learning situation?

Pintrich’s (1995) SRL Model presents four areas of Regulation (cognition, motivation/affect, behavior, and context) and four Phases (forethought, monitoring, control, and reaction/reflection) that the self-regulated learner progresses through. Furthermore, Pintrich indicates that there is not a specific progression from one phase to the next; the learner may display actions from monitoring, control, and reaction/reflection all at one time. Additionally, goal setting may be identified at any time throughout the learning process, and may change as the learner progresses through the phases.

Due to the nature of the study, the short time period with which the study was completed, and the small number of participants, it is beyond the scope of this study to demonstrate each of regulation areas and phases presented by Pintrich (1995). Therefore, the areas of regulation and phases that were demonstrated by the participants, from observation and data collection, will be presented.
Self-Regulated/Self-Directed Learning

Think-Aloud

According to Biemiller & Meichenbaum (1992), self-directed learners are able to verbalize their thought process while working through a task, such as developing a plan of care for a patient using the PDA and Nursing Central bundle. Depending upon the total number of statements, and the types of statements made (defining, planning, monitoring, and evaluating), the learner is identified as either a SDL or a non-SDL. The results of the beginning Think-Aloud identified eight of the nine participants as being SDL. Although there were eight SDL, there was a wide range in the number of statements, and types of statements that were made by the participants. Furthermore, two participants demonstrated a higher level of SDL, with one participant being identified as a non-SDL.

The two higher level SDL(s) were more aware of their cognitive and metacognitive strategies when preparing for, and throughout the Think-Aloud process. They demonstrated the ability to work through an unknown or unfamiliar disease process or medication by using self-talk. They first identified prior knowledge about the disease or medication, and then they identified what was similar, if anything, from previously completed clinical paperwork, or in a theory course. Both participants further self-talked, and were able to identify important areas to assess, and/or evaluate, such as respiratory rate and depth, or heart rate and rhythm. Occasionally, both of the participants sought out information on the PDA after completing the self-talk. When questioned why they did this, they stated that they wanted to be sure they did not miss any important information, or areas of assessment.
The one participant, who was identified as a non-SDL, experienced a great deal of difficulty in verbalizing the thought process while searching out information on the PDA. The participant was able to either search out information or verbalize what thought processes were occurring, but was unable to do both at the same time. Furthermore, this participant spoke very softly, frequently throughout the process the participant was encouraged to speak up or to speak louder.

It was also noted that this participant had double the defining statements than any other type of statements, had a fairly high number of total statements, and had the longest duration of the Think-Aloud process. This participant did not display any type of prior knowledge, nor any type of cognitive or metacognitive strategies. However, as the study progressed, this participant began to demonstrate a better understanding of prior knowledge that was available, as well as the ability to begin to self-talk, which assisted in providing guidance through areas of weakness that were identified.

The three participants presented display the difference between the SDL and the non-SDL. The two highly SDL(s), who were aware of cognitive and metacognitive strategies, verbalized and self-talked through the process using prior knowledge and cognitive strategies to make a decision about the care required of the patient. Alternatively, the non-SDL did not verbalize any prior knowledge, nor was there any demonstration of cognitive or metacognitive strategies throughout the Think-Aloud process. Although each participant had access to the PDA and the information that it offered, the SDL(s) accessed the PDA to verify the disease process and/or medication information that they worked through by self-talk and prior knowledge. Whereas, the non-SLD was unable to
identify exactly what was to be sought out, and experienced uncertainty when trying to complete the Think-Aloud process.

Although the Think-Aloud demonstrates if the learner is a SDL or not, if the learner is unable to identify prior knowledge, or is unaware of cognitive and metacognitive strategies, it does not make a difference if they have a tool, such as the PDA, to assist them in taking control of their learning. When comparing the three participants, it is important to consider that the highly SDL(s) were in the third level, whereas the non-SLD was in the second level. Additionally, the third level participants have had a longer period of time in using the PDA as a resource to seek out information, whereas, the second level participant only had eight weeks of prior use.

Another factor that must also be considered when viewing the SDL versus the non-SLD is how well each participant did academically in previous semesters. The non-SLD may not have had a solid understanding, or the ability to carry forward what was suppose to be previously learned due to this only being the beginning of the second level. Whereas, the SDL may have a very solid knowledge base and understanding of application of the content, which again, may be contributed to the extra semester that separates these participants.

The last assessment of the pre-study data obtained from the Think-Aloud involved identifying the phase of self-direction for each participant. All but three participants were in the consolidation phase. Therefore, each participant was displaying automaticity in the ability to verbalize the thought process while searching out information on the PDA. The two highly-SDL were identified as being in the consultation phase, which means they displayed a stronger cognitive understanding of the content, and were able to
self-talk or self-consult when faced with a difficult situation. On the contrary, the non-
SDL was identified as being in the acquisition phase. This participant was more apt to
observe others before completing a task, or requesting the faculty member for guidance.
The end of the study Think-Aloud displayed that each of the participants were at a higher
degree of SDL; all but one participant documented prior knowledge on the case study
before beginning it, which is a total reversal of the pre-study. In the pre-study, only one
of the participants took the time to identify prior knowledge. Additionally, each
participant consciously verbalized their level of knowledge, making statements such as
“I know what that drug is, it is for...” or “I will have to assess the patient for...because
they are taking this drug.” Therefore, the participant did not access the PDA for some of
the information that was previously sought out in the pre study sessions.

Another important observation was that each participant advanced in the phase of
self-direction. The non-SDL advanced from observing others, and seeking out the faculty
member for guidance to displaying the ability to verbalize the thought process as
information was being sought out on the PDA. Furthermore, this participant appeared to
be more in control of what was being sought out, as evidenced by the confidence and
strength of speech. At the conclusion of the study, all except for one participant were in
the consultation phase of direction. Each of the participants displayed the ability to self-
consult when faced with a difficult situation.

Although the participants were more self-directed at the end of the study, one must
also consider other contributing factors for the change in their ability to identify prior
knowledge as a first step in the Think-Aloud, as well as verbalizing their thought process
and ability to seek out needed information. Primarily, the participants have had an entire
semester of new courses, which means that they have been provided with new information that has permitted them to have a broader knowledge base than at the beginning. Additionally, the participants have also had 14 weeks at the POC, which has provided them with an opportunity to learn and apply new knowledge. Though the PDA may have assisted them in being more self-directed, one cannot place all of the progress on the PDA. Hence, in combining the above contributing factors, the participants were provided with a tool that encouraged and supported them in taking more control of their learning.

Observations and Follow-Up Interviews

As previously stated, the purpose of this study was to assess and begin to demonstrate if the PDA supports or constrains the nursing student at the POC, and to assess if the PDA supports SRL. Once the Think-Aloud was completed, observing the participants at the POC accessing the PDA was the focus. The first week of observation provided only two participants accessing the PDA; one participant from each level. The first observation was a third level participant who was in conversation with a staff nurse while accessing the PDA. The follow-up interview revealed that a new drug had been ordered and the staff nurse was unable to determine the correct spelling of the drug, therefore, the participant located the drug on the PDA and shared it with the nurse.

The second observation, a second level participant, was accessing the DPA to locate the safe dose range of a new medication ordered for the assigned patient. Both participants agreed that the information that was being sought out was easily accessed,
and pertinent to what they were searching for. Both participants further stated that it only took about “10 to 15 seconds” to locate the information.

The pattern of minimal use continued for two weeks in both levels. Although somewhat disappointed, this would become the norm rather than the exception. Occasionally, the participant may be assigned a new patient, or there may be a new medication order, or laboratory order, but for the most part, there was minimal use of the PDA at the POC.

In an attempt to collect data that would either support or refute the benefits of the PDA by nursing students, another question was developed. The previously identified follow-up questions remained the same, but the following question was added, “Did you access your PDA over the past week, if so when, where and why.” In posing this question to each of the participants on a weekly basis, a great deal of pertinent data began to be gathered; furthermore, it also provided information/foundation for the following week’s questions.

As previously stated, while at the POC, the participants accessed the PDA for medications more than anything else. Furthermore, in addressing medications, the participants accessed the PDA to search out new or unfamiliar medications in the classroom and when studying for a test. Pintrich’s (1995) first phase, forethought, planning, and activation was demonstrated by each of the participants when accessing the PDA. Automatically, or purposefully, prior knowledge was established in determining if the participant was familiar with or possessed knowledge about the medication, once it was identified that there was little or no prior knowledge about the
medication, the participant activated the plan of searching out the medication by accessing the PDA.

The goal, which may or may not have been identified, was to obtain an understanding of what the medication was for, what the safe dosage was, and what signs and symptoms should be observed upon administering the medication to the patient. Pintrich (1995) identifies this goal as a goal for eventual performance, which assists in preparing the participant to know information at a later time, be it for an upcoming test or administering medications at the POC.

Additionally, within the forethought, planning, and activation phase, the learner identifies their self-efficacy judgments and ease of learning judgments; both were attended to, be it consciously, or sub-consciously. The self-efficacy judgments address the individual’s perceived ability of completing the task, such as seeking out medications on the PDA, whereas, the ease of learning judgment is the degree of difficulty perceived by the participant in completing the task. The SRL assesses both of these judgments before beginning a task. In searching out medications at the POC, in the classroom, and for studying, the participants demonstrated that they were able to complete the task without a great deal of difficulty.

In following Pintrich’s (1995) model, the next phase is monitoring and/or control; Pintrich indicates that these two phases often overlap, which was evident in how and when the participants accessed the PDA. Although this may appear to be backwards, the participant first controlled which medication, laboratory value, or disease they were going to search out on the PDA. Once this was determined, the participant monitored and controlled what information was being sought out as determined by the selection
from the drop-down menu in the available textbooks. The participants continued to monitor and control what information was sought out and under what circumstances, be it at the POC, the classroom, or in studying for a test.

Although monitoring and control were discussed together previously, it is important to identify specific actions of monitoring and control individually. The SRL will attempt to monitor their motivation and affect by being aware of their own anxiety, self-efficacy, and interest. In doing so, the SRL attempts to identify what causes the anxiety or decreased self-efficacy, and then attempts to change it. This is evident in the participant who experienced anxiety in the clinical setting or the POC. In an interview, the participant stated that since having access to the PDA, the level of anxiety has decreased and that the PDA has “… built up my confidence in clinical and now I enjoy coming to clinical to relate what I learned from the bundle to what the patient has.”

Monitoring also addresses the awareness of effort, time use, and need for help. According to the participants, once prior knowledge was identified, and the participants had a general idea of what they needed to know, it took little effort to locate the information from the PDA. For the most part, the participants felt that even if they did not know the exact information they needed, the PDA presented information in such a way that they were able to locate what was needed. One participant explained that one “…would have to have two, three, and maybe even four textbooks surrounding them and that they would have to flip back and forth between books and chapters, because everything they need was not in one place.” The effort that was needed to search through four textbooks, and flipping from chapter to chapter, caused frustration in seven of the nine participants.
Time was also a major concern for the participants, as well as being a behavior that the SRL attempts to monitor. As the participants are completing 15 credits each semester, which includes two-8 hour clinical days, they felt that the PDA assisted them in managing their time, as well as saving them a great deal of time. As one participant stated, “...when I’m doing my prep work it makes it a lot faster to go through the paperwork and therefore I can look up more on my patient.” One of the third level participants who had not used the PDA prior to the study stated that “It just speeds everything up... I don’t have to go through maybe four books to get my Nursing Diagnoses. I don’t have to look up the drugs in another book and then maybe patho stuff in another book. It’s all right there in one place.” Overall, the average length of time saved when using the PDA ranged from one hour to four hours, which is a considerable length of time, especially if the participant has to prepare for two clinical days.

Need for help, or seeking out assistance is another area that Pintrich (1995) states that SRL monitors. Three of the nine participants did not want to seek out information from the clinical instructor or a staff nurse because it would cause a feeling of “discomfort,” or that they “may be looked upon as not being prepared to adequately care for their assigned patient.” Six of the participants stated that they would seek out the clinical instructor, but not the staff nurse. Overall, participants in the third semester were more willing to seek out information from the nurse than were the second semester participants.

The previous statements demonstrate that the third level participants are more aware of what they know and what they need to know. It further suggests that the third level participants are more advanced in their role as a SRL, as they are aware of when to seek
out assistance. Furthermore, the third level participant has had more theoretical content and more clinical experience than those who are in the second level, which may contribute to their comfort of seeking out assistance when identified and needed.

Control is the next phase in Pintrich’s (1995) SRL model. Control of cognitive and metacognitive strategies can have a major effect on the learner. The learner has to have an understanding, or awareness of how they learn, such as memorizing, or using different techniques for completing medication calculations. Pintrich stresses that if the learner does not understand or know how to control the cognitive strategies, the learner is unable to change strategies that do not support learning. Although very few of the participants were able to articulate specific whys in which they learn, one of the first-time PDA users was quick to identify the difference that had occurred in the learning process once introduced to the PDA.

The first-time user of the PDA began to realize that the PDA was the preferred method for learning to occur. The participant stated that (TJ, 2007):

For me it is like reading a book actually. The PDA is like a “dummy guide” and like I can picture it in my head as I am reading, not like a book where I have to look at other parts because I don’t understand. It actually enhances my learning because it is such a quick reference. I don’t mind using it whenever I need it and it helps me to remember. I like reading off a computer rather than off a page. I go on the internet all the time so I’m just constantly looking at the screen and I’d rather look at a screen tell me something than a page.
It should also be noted that this participant was within the 20 to 25 years-of-age group. The participant also indicated that technology was, for the most part, the major method of previous educational training.

Reaction/reflection is the last phase that Pintrich (1995) presents. Within this phase, the participant evaluates the outcome of the skill or task. In evaluating the results, they may be positive or negative, and furthermore, the SRL will adjust their strategies according to the outcome. In the participant who discovered the increased learning ability with the PDA, it would be a decision for the participant to decide to obtain other course textbooks that are accessible on the laptop, desktop or for the PDA. Also occurring within this phase is the assessment of self-efficacy, time spent on task, or learning, and planning changes that will enhance or provide for future learning. With this last phase, the learner may have to start the skill over again, going back to the forethought, planning, and activation phase.

The participants realized that as the acuity of the patient increases, they will be accountable for knowing how to provide safe, current, and accurate care to a broad scope of patients who present with multiple disease processes. The participants also agreed that it is unrealistic to expect that they will know everything, but by having access to immediate, accurate information, they believe they will experience less stress. As one participant stated, "...don't think we get to a point of knowing everything that there is to know."

**Personal Control of Learning**

Personal control of what is being learned was another important factor that the participants agreed upon. The ease at which the information was able to be located
lended itself to repetition, which provided for self-regulated learning. One participant stated “the practice of looking up the information by myself helps to better retain it.” Furthermore, six of the nine participants were within the age group of 20 to 25 years of age, which means that technology has been a part of their everyday life. As one participant stated, “I learn from the screen—it isn’t like looking at a textbook when I use it, I cannot learn from a book, prefer reading from a screen.” Therefore, to meet the learning needs and preference of learning, technology has to be available to those who have learned from it in the past, or currently learn from the screen now.

The participants also agreed that the PDA was a resource that was easy to use, provided the most current information, and assisted them in patient teaching. Upon questioning each participant about using the PDA in front of the patient, seven of the nine participants felt comfortable in using the PDA to search out information when a patient asked about their disease or a medication. The two who felt uneasy thought that it would cause the patient to think that they did not know what they were doing, or that they would look unprepared or incompetent. Upon discussing this further, one of the participants decided to use the PDA when the patient asked a question. The participant later reported that the patient was intrigued by the PDA, therefore, alleviating the participants concerns about appearing incompetent.

Similarly, the participants were questioned if any of the staff nurses approached them to inquire about the PDA. For the most part, the participants stated that they received inquisitive looks from the staff nurses when they were using the PDA. They further stated that some of the staff nurses looked at them as if they were playing games or text messaging friends, when in fact they were looking up information that they needed.
Upon pursuing this further, the participants were asked if they approached the staff nurse to share the information that they were searching out; six of the nine participants state that they did, in fact, share the PDA nursing bundle with the staff nurse. Responses from some of the staff nurse were positive, one thought it was great and wanted to know more about the DPA and the Nursing Central bundle, while another one stated that she wished they had PDAs when she was in nursing school.

**Nursing Central PDA Tracker**

As previously presented, the data obtained from the PDA tracker demonstrated the varying degrees or frequency in which the participants accessed it. The participant with the second highest number of applications opened, which was 329 times, viewed 1,323 records. From this data, it may be implied that the participant viewed four textbooks, or alternated between different textbooks each time the PDA program was opened. Another implication of the frequency of alternating between textbooks could be that the participant did not identify prior knowledge, nor did the participant develop a plan of how to obtain the information needed. Hence, the participant continuously went back and forth between two or more textbooks to locate the needed information.

Overall, the implications of the number of times the application was opened, and the number of records read indicates that some of the participants were more self-directed in using the PDA than others. Regardless of how many times the participant opened the application the important factor is the number of records read. Such as, if the participant opened the application 48 times and read 152 records, the participant viewed approximately three records at each opening. This may be interpreted as the participant
identifying prior knowledge, identifying the needed information, and then developing a plan to obtain the information, which was to access the PDA to obtain the identified information.

Conversely, if the participant opened the application 48 times and viewed 270 records, this would equate to the participant reading approximately 6 records each time the PDA was accessed. This may be interpreted as the participant was not sure of what to search out, therefore, going back and forth looking in the same textbook more than once. It further demonstrates that the participant was not sure of prior knowledge, and did not have a plan of how to search out the needed information.

Overall, the data from the Unbound Medicine tracker provided a great deal of information about the habits and use of the PDA by the participants. The PDA is accessed at the POC and while in the classroom to seek-out unfamiliar information, while the desktop version is accessed at home to prepare for clinical. Furthermore, due to the platform of the information, which is technology based, the participants agreed that it is not like reading a textbook, therefore, more learning occurs when accessing the bundle, be it from the PDA or the desktop.

One last concern is why certain textbooks were not accessed as frequently as others. One reason for this may be that there are required textbooks that support the population that is being studied, such as a gerontology text or a critical adult care text. Furthermore, when a disease process is presented, often times the abnormal and/or critical laboratory values will be presented and discussed, therefore, not alleviating the need to access the laboratory manual.
Implications and Future Research

Implications and Contributions

The current study is one of the first studies to provide any type of quantitative data addressing the use of PDAs by nursing students. Although there were technological difficulties, the data, however, did display the pattern and frequency of PDA use by the participants. Additionally, this study will contribute to the growing body of literature in three ways. First, the study supports previous literature in the fact that PDAs assist nursing students at the POC by providing them with current and accurate information that is easily accessible. Furthermore, the PDA provides current time learning, which is also important to the nursing student and practicing nurse.

The second contribution is that the PDA supports SRL/SDL. Miller et al. (2005) discusses how nursing students who access the PDA had a decrease of reliance on the faculty member, staff nurses, and the textbook. Additionally, Kuiper (1999, 2002, 2005) and Kuiper & Pesut (2004) have looked at how to implement SRL as a framework for teaching nursing students. The current study, which combines Miller’s, Kuiper, and Kuiper & Pesut’s studies, demonstrates how the PDA strongly supports SRL. When combining the PDA and the framework of SRL, the student is preparing to control the learning that occurs, as well as developing life-long learning habits.

Lastly, as technology continues to progress at such a fast pace, the nurse of tomorrow will have to be technologically competent to meet the demands and changes within healthcare. Without the ability to adjust or adapt to new technology, the nurse may be placing the patient at risk. Furthermore, as the nursing shortage continues, nurses will need to identify ways in which technology is able to support them in their daily practice.
Future Research

Before repeating this study, two issues need to be addressed. The first issue is the tracking system by Unbound Medicine. Although the tracker was able to collect pertinent data from the participants PDA, concerns exist as to whether the tracker would be able to collect data if the number of participants increased, as well as differentiating what text was sought out, and by which participant. Although this is just the first set of quantitative data, much more will need to be gathered to support or negate the current study.

Re-examining the Think-Aloud would be the second area of concern. Prior to presenting the case study for the Think-Aloud, there would have to be training sessions offered on how to verbalize one’s thought process. Although there was a great deal of data collected for this study, the participants did not have a lot of information or time to practice verbalizing what they were thinking, therefore, the potential exists that richer data may be obtained if the participant was more comfortable when completing the Think-Aloud.

Recommendations

Currently, all students entering the nursing program at the SON at UNLV are required to purchase a PDA and Unbound Medicine’s Nursing Central software. Although this provides the tool for SRL, there needs to be more support from faculty in demonstrating SRL. Therefore, due to the findings of this study, the following recommendations will be suggested and encouraged. First, to demonstrate life-long learning habits, SRL, and the importance of searching out information that is needed, all clinical faculty should be required to have access to a PDA and the same software
bundle that the students are required to have. When faculty do not have the tools that are required of the students, what message is being sent; that at some point you will know everything, and will not have to search out information? As previously pointed out, Miller et al. (2005) emphasized that if the faculty member did not have access to a PDA or did not use a PDA, the student was less apt to use one.

Secondly, it was identified in the current study that students believed they knew how to access and take full advantage of the software, when in reality, the majority of students were not aware of everything that is offered in the software. Therefore, formal training and the development of a resource manual for students and faculty must be made available to decrease any anxiety when accessing the PDA. The training sessions should be on-going, and should be designed to meet the needs of the population who require it.

The current study also confirms that students access the PDA across the curriculum, therefore, developing and implementing the use of the PDAs should be a collaborative approach between the faculty who teach theory and the researcher. In doing so, the student will begin to learn how to use the PDA to enhance and control their own learning. Although this will not be an easy task to complete, and it may take a year or more to implement it, the benefits will be observed in our students upon entering the nursing profession.

As one of the university goals is to become partners with the community, the SON has an obligation to share the benefits of the PDA with healthcare facilities where our students complete clinicals, and eventually practice. Therefore, in-services to practicing nurses should be offered to introduce them to the benefits of having access to the PDAs.
Emphasis needs to be placed on the fact that PDAs provide current, accurate, and precise information at the bedside, or POC. As the nursing shortage continues, this will be one area that may save the practicing nurse from being overwhelmed and decrease the number of medication errors and lack of appropriate treatments.

Professional goals that have been identified due to the findings of this study includes learning how to teach self-regulated, self-directed learning to nursing students. If the student is introduced to SRL/SDL in the first semester of the program, the student would have the beginning tools to take responsibility for their own learning. Once a level of comfort has been established, developing a manual to assist and guide other faculty in developing skills to teach SRL/SDL throughout the entire program. In maintaining continuity of a specific teaching framework, our nursing students would be provided with the necessary tools to excel once in the healthcare system.

Conclusions

There is little doubt that the PDA supports nursing students at the POC. Furthermore, with the exception of research, the PDA supports the nursing student across the curriculum. As presented, the PDA is accessed at the POC, be it in pediatrics, gerontology, or critical adults. It also is accessed in the classroom, for studying, and for completing assignments in different throughout the program.

The PDA also supports the self-regulated learner by placing the ability to plan and activate prior knowledge, monitor and control cognitive and metacognitive strategies, behavior, and motivation and affect in the hands of the learner. The degree to which the
PDA supports the learner is controlled by the learner, therefore, if the learner is not aware of how learning occurs, the PDA is just a small, convenient textbook.
### Appendix I

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<th>Areas of Regulation</th>
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<td>Phases</td>
<td>Forethought &amp; Planning</td>
<td>Target goal setting: involves the setting of task specific “goals” that can be used to guide cognition in general and monitoring in particular. The goal acts as a “criterion” which to assess, monitor, and guide cognition. Goal setting is most often assumed to occur before starting a task, BUT goal setting actually can occur at any point during performance. Learners may begin a task by setting 1) specific goals for learning, 2) goals for time use, and 3) goals for eventual performance; but goal can be adjusted/changed at any time during the task performance as a function of monitoring, control, and reflection. <strong>Activation of prior knowledge:</strong> at some level, process of activation of prior knowledge can and does happen automatically &amp; without conscious thought-automaticity. This automaticity is not a SRL &amp; involves general cognitive processing b/c it is NOT under explicit control of the learner. At same time, students who are more self-regulated, or metacognitively active can search their</td>
<td>Self-efficacy judgments: have shown that individuals’ judgments of their capabilities to perform a task have consequences for affect, effort, persistence, performance, and learning. Once a learner begins a task, self-efficacy can be adjusted based on the actual performance &amp; feedback as well as an individual attempts to actively regulate or change one’s efficacy judgments. <strong>Ease of learning judgments (EOL):</strong> Individuals determine the degree of difficulty to perform a task, how hard it will be to remember or learn new material. This is drawn from metacognitive knowledge of task and metacognitive knowledge of self in terms of past performance on task. EOL judgments are similar to self-efficacy judgments, although emphasis is on task rather than self. In this sense, EOL judgments &amp; self-efficacy judgments reflect task difficulty perception &amp; self-competency perception from expectancy value</td>
<td>Time and Effort Planning: Models of intentions, intentional planning &amp; planned behavior have shown that formation of intentions are linked to subsequent behavior in a number of different domains. In academic domains, time &amp; effort planning &amp; management would be the kinds of activities that would potentially be placed here. **Time Management: making schedules for studying &amp; allocating time for different activities, which are classic aspects of most learning &amp; study skills courses have shown that SRL and high-achievers do engage in time management activities. Zimmerman described experts who had specific behaviors to assist with “mastery” of their skills. As part of time management, students may make decisions &amp; form interventions about how they will</td>
<td>Perceptions of task: Includes individual’s perception of the task &amp; the context. These perceptions are really cognitions, not aspects of the contextual, BUT the focus of the perceptions is outward, away from the individual's own cognition &amp; motivation, and toward the task and contexts. In a classroom context (environment) these perceptions can be about the nature of the tasks in term of the classroom norms for completing the task, (i.e.: format to be used or procedures to be used to complete a task, such as working with others is permitted or considered cheating) as well as general knowledge about</td>
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### Areas of Regulation

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| Memory for relevant prior knowledge before they actually begin performing the task. This prior knowledge can include content knowledge as well as metacognitive knowledge about the task and strategies. *Activation of prior knowledge of content area can happen automatically, but it can also be done in a more planful & regulatory manner through various prompts & self-questioning activities, such as asking oneself “what do I know about this domain, subject area, topic, problem type, etc.” as well as the construction of better problem representation.** Activation of metacognitive knowledge includes the activation of knowledge about cognitive tasks & cognitive strategies & seems to be useful for learning. As with prior content knowledge, activation can be rather automatic, stimulated by the individual, task, or contextual features, or it can be more controlled & conscious. Metacognition task knowledge includes knowledge about how task variations can affect their value beliefs. **Perceptions of value & interest**: of task or content area. In expectation models, task value beliefs include perceptions of the relevance, utility, & importance of task. If learner believes task is relevant/important for future goals or generally useful for them, they are most likely to be engaged in task as well as choose to engage in the task in the future. In SRL, it is likely that these beliefs can be activated early on, either consciously or automatically, and unconsciously, as a student approaches or is introduced to task by teachers/others. In SRL, it is assumed students can attempt to control their value beliefs. **Perceptions of personal interest in the task**: or content domain (liking and positive affect towards math, hx., etc.). Research on personal interest suggests that it is a stable enduring character of an individual, but level of interest can be activated & can vary according to situation and context features called “psychological state of interest”. Interest is related to increased learning, persistence, & effort. Interest allocate their effort & intensity of their work, i.e.: study 1-2 hours every a.m. & p.m., and increase time at mid-term and end of the semester for studying for finals. Zimmerman also discussed how individuals can observe their own behavior through various methods & then use this information to control & regulate their behavior. Many learning strategy programs also suggest some form of behavior observation & record keeping in terms of studying to provide useful information for future attempts to change learning and study habits. Implementations of self-observation methods require some planning & the intention to actually implement them during learning activities. the types of tasks & classroom practices for grading in the classroom. **Perceptions of context**: classroom norms and classroom climate are important aspects of the student's knowledge activation of the contextual information (i.e.: when students enter a classroom, they may activate knowledge about general norms or perceive certain norms, such as talking is not allowed, working with others is cheating) that can influence their approach to the classroom & their general learning. *Other aspects of classroom climate, such as teacher warmth, enthusiasm. As well as equity & fairness for all students (lack of bias) can be important.

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| Memory for relevant prior knowledge before they actually begin performing the task. This prior knowledge can include content knowledge as well as metacognitive knowledge about the task and strategies. *Activation of prior knowledge of content area can happen automatically, but it can also be done in a more planful & regulatory manner through various prompts & self-questioning activities, such as asking oneself “what do I know about this domain, subject area, topic, problem type, etc.” as well as the construction of better problem representation.** Activation of metacognitive knowledge includes the activation of knowledge about cognitive tasks & cognitive strategies & seems to be useful for learning. As with prior content knowledge, activation can be rather automatic, stimulated by the individual, task, or contextual features, or it can be more controlled & conscious. Metacognition task knowledge includes knowledge about how task variations can affect their value beliefs. **Perceptions of value & interest**: of task or content area. In expectation models, task value beliefs include perceptions of the relevance, utility, & importance of task. If learner believes task is relevant/important for future goals or generally useful for them, they are most likely to be engaged in task as well as choose to engage in the task in the future. In SRL, it is likely that these beliefs can be activated early on, either consciously or automatically, and unconsciously, as a student approaches or is introduced to task by teachers/others. In SRL, it is assumed students can attempt to control their value beliefs. **Perceptions of personal interest in the task**: or content domain (liking and positive affect towards math, hx., etc.). Research on personal interest suggests that it is a stable enduring character of an individual, but level of interest can be activated & can vary according to situation and context features called “psychological state of interest”. Interest is related to increased learning, persistence, & effort. Interest allocate their effort & intensity of their work, i.e.: study 1-2 hours every a.m. & p.m., and increase time at mid-term and end of the semester for studying for finals. Zimmerman also discussed how individuals can observe their own behavior through various methods & then use this information to control & regulate their behavior. Many learning strategy programs also suggest some form of behavior observation & record keeping in terms of studying to provide useful information for future attempts to change learning and study habits. Implementations of self-observation methods require some planning & the intention to actually implement them during learning activities. the types of tasks & classroom practices for grading in the classroom. **Perceptions of context**: classroom norms and classroom climate are important aspects of the student's knowledge activation of the contextual information (i.e.: when students enter a classroom, they may activate knowledge about general norms or perceive certain norms, such as talking is not allowed, working with others is cheating) that can influence their approach to the classroom & their general learning. *Other aspects of classroom climate, such as teacher warmth, enthusiasm. As well as equity & fairness for all students (lack of bias) can be important.
### Areas of Regulation

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<td>influence cognition. *Knowledge of strategy variables includes all the knowledge individuals can acquire about various procedures &amp; strategies for cognition, including memorization, thinking, reasoning, problem solving, planning, studying, reading, writing, etc. Knowledge that rehearsal strategies can help in may be in recalling a telephone number, or that organization &amp; elaboration strategies can help in the memory &amp; comprehension of text information are examples of strategy knowledge. *Metacognitive knowledge has been broken down into 1) declarative knowledge, 2) procedural knowledge and 3) conditional metacognitive knowledge. 1. <strong>Declarative knowledge:</strong> of cognition is the knowledge of the &quot;what&quot; of cognition and includes knowledge of different cognitive strategies, such as rehearsal or elaboration that can be used for learning. 2. <strong>Procedural knowledge:</strong> is knowing &quot;how&quot; to perform &amp; use various cognitive strategies. Not enough to know that there are elaboration strategies, such as summarizing &amp; paraphrasing; it is</td>
<td>can be activated by task &amp; contextual features, and learners can also try to control and regulate it. <strong>Negative anticipatory affect:</strong> anxiety, fear, test anxiety, students who anticipate being anxious on test &amp; worry about doing poorly even before beginning the test can set a downward motion of maladaptive cognitions, emotions &amp; behaviors that lead them to do poorly. Anticipation affects such as anxiety or fear can influence the subsequent learning process &amp; certainly set up conditions that require active &amp; adaptive self-regulation of cognition, motivation, and behavior.</td>
<td>perceptions or beliefs that are activated when students come into a classroom. *These perceptions can be veridical (truthful) &amp; actual represent the classroom dynamics, but also possibility that the students can misperceive the classroom content b/c they are activating stereotypes without reflecting on the actual nature of the classroom (i.e.: female student in math class with a perception that male teacher may feel bias). These perceptions veridical or not, offer opportunities for monitoring &amp; regulation of the context.</td>
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<td>Monitoring</td>
<td><strong>Cognitive monitoring</strong>: involves the awareness &amp; monitoring of various aspects of cognition &amp; is important component of what is classically labels &quot;metacognition&quot;. In contrast to metacognitive knowledge, which is more static &amp; &quot;stable&quot; (individuals can tell if they know it or not), metacognitive judgments and monitoring are more dynamic &amp; process oriented, and reflects metacognitive awareness &amp; ongoing metacognitive activities individuals may engage in as they perform a task. *Two types of metacognitive awareness &amp; monitoring of cognition: 1) Judgments of learning &amp; 2) feeling of knowing. 1) <strong>Judgments of learning</strong> (JOL): &amp; comprehensive monitoring: These judgments may manifest themselves in a number of activities, such as individuals becoming aware that the do not</td>
<td><strong>Awareness &amp; monitoring of effort, time use, &amp; need for help</strong>: In this phase, students can monitor their time management &amp; effort levels and attempt to adjust their efforts to fit the task. In Phase 1, students set 2 hours for reading, in this Phase, the student realizes reading a chapter takes much longer to read (more time), therefore, changing their &quot;planning&quot; to increase time of hours to read. <strong>Self-observation of behavior</strong>: Monitoring should lead to an attempt to control &amp; regulate their effort (increase time to read/study). This type of monitoring behavior is often helped by formal procedures for self-observation (logs of reading</td>
<td><strong>Changing task &amp; context conditions</strong>: Students can, and should monitor their cognition, motivation, &amp; behavior; they also could and should monitor their task &amp; contextual features of the classroom. In classrooms, just as in work and social situations, one is not free to do what they please; they are involved in a social system that provides various opportunities &amp; constraints that shape &amp; influence their behavior. If students are unaware of the opportunities &amp; constraints that are</td>
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Cognition

1. **Just Noticeable Difference (JOL):** occurs when a student notices they are reading too fast or too slow. JOL also would be made when students actively monitor their reading comprehension by asking themselves questions. JOL could also be made when students try to decide if they are ready to take a test on material they just read & studied or in a memory experiment as they try to judge whether they have learned the target words. JOL could also involve students making judgments of their comprehension of a lecture as the instructor is delivering it or whether they could recall the lecture information for a test at a later point in time.

2. **Feeling of knowing (FOK):** occurs when a person cannot recall something when called upon to do so, but knows he knows it, or at least has a strong feeling that he knows it. “Tip of the tongue” phenomenon & occurs as a person attempts to recall something. FOK are made after failure to recall an item & involve a determination of whether the currently un-recallable item will be recognized or recalled by the individual at a later point in time. Possible evidence

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<td>understand something they just read or heard, or becoming aware that they are reading too fast or too slow given the text &amp; their goals. JOL also would be made as students actively monitor their reading comprehension by asking themselves questions. JOL also could be made when students try to decide if they are ready to take a test on material they just read &amp; studied or in a memory experiment as they try to judge whether they have learned the target words. JOL could also involve students making judgments of their comprehension of a lecture as the instructor is delivering it or whether they could recall the lecture information for a test at a later point in time. 2. <strong>Feeling of knowing (FOK):</strong> occurs when a person cannot recall something when called upon to do so, but knows he knows it, or at least has a strong feeling that he knows it. “Tip of the tongue” phenomenon &amp; occurs as a person attempts to recall something. FOK are made after failure to recall an item &amp; involve a determination of whether the currently un-recallable item will be recognized or recalled by the individual at a later point in time. Possible evidence</td>
<td>time, diaries of activities) or self-experimentation. All of these activities will help students become aware of and monitor their own behavior, which provides information that can be used to actually control and regulate behavior.</td>
<td>operating, then they will be less likely to function well in the classroom. Awareness &amp; monitoring of the classroom rules, grading practices, task requirements, reward structures &amp; general teacher behavior are all important for students to do well in the classroom.</td>
<td></td>
</tr>
<tr>
<td>Phases</td>
<td>Cognition</td>
<td>Motivation/Affect</td>
<td>Behavior</td>
<td>Context</td>
</tr>
<tr>
<td>--------</td>
<td>-----------</td>
<td>------------------</td>
<td>----------</td>
<td>---------</td>
</tr>
<tr>
<td>Control</td>
<td><strong>Cognitive control and regulation:</strong> Includes the types of cognitive and metacognitive activities that individuals engage in to adapt &amp; change their cognition. In most models of metacognition &amp; SRL, control and regulation activities are assumed to be dependent on, or at least strongly related to metacognitive monitoring activities, although metacognitive control &amp; monitoring are perceived as a separate process. As in many models of regulation, it is assumed that attempts to control, regulate and change conditions should be r/t cognitive monitoring activities that provide information about relative discrepancies between a goal and current</td>
<td>Many different strategies used to control motivation &amp; affect. A fair number of different motivational and emotional control strategies exist: 1. Attempts to control self-efficacy: use of positive self-talk 2. Extrinsic motivation: walk in park, watch TV (which are contingent upon completing task) 3. Making task more relevant &amp; useful in relation to future career and personal life 4. Self-affirmation: value of task to protect self-worth. <em>Other strategies students use to control emotions that might differ from those they use to control their efficacy and...</em></td>
<td><strong>Increase/decrease effort:</strong> Strategies for actual behavior control &amp; regulation are many and address issues of behavior control of physical health, mental health, work behaviors, &amp; social relationships with others, as well as behavior control of activities for academic learning. Students may regulate time &amp; effort they expend studying 2 textbook chapters based on their monitoring behavior and the difficulty of the task. If the task is harder than originally thought, they may increase their effort, depending on their goals, or they</td>
<td><strong>Change or renegotiate task:</strong> Context monitoring processes are intimately linked to efforts to control &amp; regulate the task &amp; the context. In comparison to control &amp; regulation of cognition, behavior, &amp; motivation, control of task &amp; context may be more difficult b/c they are not always under direct control of the learner. However, even models of general intelligence often includes attempts to</td>
</tr>
</tbody>
</table>
One of the central aspects of control & regulation of cognition is the actual selection & use of various cognitive strategies for memory, learning, reasoning, problem solving, & thinking. Selection of appropriate cognitive strategies can have a positive influence on learning and performance. These cognitive strategies range from simple memorizing to sophisticated strategies for reading, math, writing, problem solving and reasoning. Although the use of various strategies is probably deemed more cognitive than metacognitive control and regulation is the decision to stop using them or to switch from one strategy to another.

Various cognitive and learning strategies individuals use to understand and learn new material is placed here; for example, rehearsal, elaboration, & organizational strategies learners can use to control their cognition & learning. These strategies

<table>
<thead>
<tr>
<th>Phases</th>
<th>Cognition</th>
<th>Motivation/Affect</th>
<th>Behavior</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>progress toward that goal. For example, if reading textbook to learn, not just to read, student will monitor his comprehension, which can provide student with information about the need to change reading strategies.</td>
<td>value:</td>
<td>may decrease their effort if they perceive the task is too difficult.</td>
<td>shape, adapt, or control the environment as one aspect of intelligent behavior. Models of “Volitional Control” usually include a term labeled “environmental control”, which refers to attempt to control or structure the environment in ways that will facilitate goals and task completion. In SRL most models include strategies for self-regulation:</td>
</tr>
<tr>
<td></td>
<td>One of the central aspects of control &amp; regulation of cognition is the actual selection &amp; use of various cognitive strategies for memory, learning, reasoning, problem solving, &amp; thinking. Selection of appropriate cognitive strategies can have a positive influence on learning and performance. These cognitive strategies range from simple memorizing to sophisticated strategies for reading, math, writing, problem solving and reasoning. Although the use of various strategies is probably deemed more cognitive than metacognitive control and regulation is the decision to stop using them or to switch from one strategy to another.</td>
<td>1. Self-talk strategies to control negative affect &amp; anxiety, i.e.: don’t worry about grades or last question 2. Shame or guilt to motivate them to persist at a task 3. Defense pessimism: harness negative affect &amp; anxiety about doing poorly to motivate them to increase effort &amp; perform better 4. Self-handicapping: decrease effort or procrastinate to protect self-worth by attributing poor outcome to low effort/not low ability</td>
<td>General Persistence: which is also a “classic measure” used in achievement motivational studies as an indicator of motivation. Students may exhort (urge) themselves to persist through self-talk (keep trying-you’ll get it) or they may give up if task is too difficult, again depending on the goals &amp; monitoring activities. (p. 468: strategies)</td>
<td>Change or leave context: In traditional classrooms teachers have most of the control, but learners’ can and do attempt to “negotiate” the task requirements—it is an attempt for the learner to have some control over the task-context. In communities of learning, the learner has more control &amp; regulation of academic tasks &amp;</td>
</tr>
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</table>

Good students and SRL know when to seek out assistance and from whom. It involves person’s own behavior, but also involves contextual control b/c it is
### Phases

<table>
<thead>
<tr>
<th>Phases</th>
<th>Cognition</th>
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<th>Behavior</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reaction/Reflection</td>
<td>include using imagery to help encode information on a memory task as well as imagery to help one visualize correct implementation of a strategy also would be here, as well as various strategies like paraphrasing, summarizing, outlining, networking, constructing tree diagrams &amp; note taking.</td>
<td>necessarily involves the environment and is a social interaction (environment is one of Bandura's components of social-cog. theory). Students who generally do not need the assistance or help seek out the assistance, where as those who &quot;do&quot; need help neither 1) do not seek it out, or 2) seek it out to try to get a quick solution to the problem. This person also is seeking out help to &quot;over come a particularly difficult aspect of the task (performance v. mastery).</td>
<td>classroom structure, climate, and are often able too design own projects/experiments/tasks. Not all students at all levels are able to do this, younger learners have difficulty. Post-secondary college students have much more freedom in structuring their environment in terms of learning, as well as controlling &amp; regulating their study environment.</td>
<td></td>
</tr>
</tbody>
</table>

### Cognitive Judgments:

- The process of reaction and reflection involve learners’ judgments & evaluation of their performance on the task as well as their attributions for performance. Good self-regulators evaluate their performance in comparison to learners who avoid self-evaluation or are not aware of the importance of self-evaluation in terms of their goals set for the task. Good self-regulators are more likely to make adaptive attributions for their performance. Adaptive attributions are necessarily involves the environment and is a social interaction (environment is one of Bandura's components of social-cog. theory). Students who generally do not need the assistance or help seek out the assistance, where as those who "do" need help neither 1) do not seek it out, or 2) seek it out to try to get a quick solution to the problem. This person also is seeking out help to "over come a particularly difficult aspect of the task (performance v. mastery). |

### Affective Reactions and Attributions:

- Upon completion of the task students' reaction to outcomes as well as reflections on reasons for the outcomes, make attributions for the outcomes. Types of attributions for their success/failure can lead to experience of more complicated emotions, such as pride, anger, shame, & guilt. As reflecting on reasons for performance, both quality of attributions and quality of emotions experienced are important outcomes of necessarily involves the environment and is a social interaction (environment is one of Bandura's components of social-cog. theory). Students who generally do not need the assistance or help seek out the assistance, where as those who "do" need help neither 1) do not seek it out, or 2) seek it out to try to get a quick solution to the problem. This person also is seeking out help to "over come a particularly difficult aspect of the task (performance v. mastery). |

### Choice Behavior:

- Reflection is more a "cognitive" process, & so may have no behavioral reflection, but just as with forethought, the cognitions an individual have about behavior belongs here. Behavior reflections of effort expended or time spent on task can be important aspects of SRL. Students can make judgments or reflect on their cognitive processing/motivation. They can necessarily involves the environment and is a social interaction (environment is one of Bandura's components of social-cog. theory). Students who generally do not need the assistance or help seek out the assistance, where as those who "do" need help neither 1) do not seek it out, or 2) seek it out to try to get a quick solution to the problem. This person also is seeking out help to "over come a particularly difficult aspect of the task (performance v. mastery). |

### Evaluation of task:

- Students can make general evaluations of the task or classroom environment. Evaluations can be made based on general enjoyment & comfort, as well as more cognitive criteria regarding learning & achievement. In "student-centered" classrooms, time is set aside for necessarily involves the environment and is a social interaction (environment is one of Bandura's components of social-cog. theory). Students who generally do not need the assistance or help seek out the assistance, where as those who "do" need help neither 1) do not seek it out, or 2) seek it out to try to get a quick solution to the problem. This person also is seeking out help to "over come a particularly difficult aspect of the task (performance v. mastery). |
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<th>Motivation/Affect</th>
<th>Behavior</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>generally seen as making low attribution to low effort or poor strategy use, not lack of general ability in the face of failure (not dumb, but not enough effort). These adaptive attributions have been linked to deeper cognitive processing and increased learning and achievement, as well as a host of adaptive motivational beliefs &amp; behaviors, such as positive affect, positive efficacy &amp; expectancy judgments, persistence, and effort.</td>
<td>SRL. One can actively control types of attributions they make to protect own self-worth and motivation for future tasks. Attribution retraining focuses on helping to change attributions or attribution styles to have a more adaptive cognitive, motivational, affective &amp; behavioral reactions to life events. These reflections &amp; reactions can lead to changes in future levels of self-efficacy &amp; expectancy for future success, as well as value &amp; interest. These potential changes in efficacy, value, and interest from Phase 4 flows back into Phase 1 &amp; becomes the “entry level motivational beliefs” that students bring with them to new tasks.</td>
<td>make judgments about their behaviors. Students may decide that procrastinating in studying for an exam may not be the most adaptive behavior for academic achievement, therefore, in the future may decide to make a different choice in terms of effort &amp; time management. In reaction, the main behavior is “choice”, Students cannot decide only to change their future time &amp; effort management; they also may make choices about what classes to take, or what general course of study to take. This kind of “choice behavior” results in the selection of different contexts and leads to the last column: Context.</td>
<td>occasional reflection on what is working and what is not working in terms of both learner &amp; teacher reactions. As with cognition &amp; motivation, evaluations can feedback into Phase 1 components when students approach a new task.</td>
</tr>
</tbody>
</table>

## Appendix II

### Nursing Curriculum

<table>
<thead>
<tr>
<th>Level</th>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level I</td>
<td>Patient Centered Care: Basic Principles</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Foundations in Pharmacology &amp; Pathophysiology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Health Assessment of Diverse Populations</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Nursing in Today's world</td>
<td>2</td>
</tr>
<tr>
<td>Level II</td>
<td>Nursing Care of Older Populations</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Pharmacology &amp; Pathophysiology Across the Lifespan</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Nursing Care of Childbearing &amp; Childbearing Families</td>
<td>7</td>
</tr>
<tr>
<td>Level III</td>
<td>Nursing care of Acutely Ill Populations</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Nursing Research Methods</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Nursing Care of Mental Health Populations</td>
<td>5</td>
</tr>
<tr>
<td>Level IV</td>
<td>Population Focused Care in The Community</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Transition to Practice Seminar</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Managing Complex Nursing Care in Diverse Populations</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Improving Clinical Care via Leadership via Leadership &amp; Management</td>
<td>2</td>
</tr>
</tbody>
</table>
Appendix III

PRE-STUDY QUESTIONNAIRE

Please take a few minutes to answer the following questions. Be as specific as possible AND feel free to make any additional comments. Thank you!

1. Gender: Male _____ Female _____

2. Age:
   _____ 20-25  _____ 26-30
   _____ 31-35  _____ 36-40
   _____ 41-45  _____ 46-50
   _____ 50-55  _____ 55 +

3. Will this be your first degree?  Yes _____  No _____
   If no, what is your previous degree and why have you decided to change careers?

4. Do you currently work?  Yes _____  No _____
   If yes, how many hours a week do you work, and what type of work do you do?

5. Are you responsible for any children under 18 years of age?  Yes _____  No _____

6. Are you responsible for any family members besides your spouse and children?
   Yes _____  No _____

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7. How would you describe your ethnic origin?
   _____ Hispanic/Latino          _____ African-American
   _____ Asian or Pacific Islander _____ White or Caucasian
   _____ Prefer not to answer

8. What level/semester are you currently in?  Second _____  Third _____

9. Are you a full time student?  Yes _____  No _____

10. What is your current cumulative GPA? __________

11. What is your current nursing GPA? __________

12. Did you own a handheld computer (PDA) before beginning the nursing program?
   Yes _____  No _____

13. If so, how often do you use it?  Daily _____  Weekly __  No response: _____

14. What was your primary purpose for using it?

15. Do you own a handheld computer or PDA now that you are in the nursing program?
   Yes ______  No ______  If Yes, why did you purchase one?

16. How frequently do you use your handheld computer or PDA?
   Daily _____  Weekly _____
17. What is your primary purpose for using it?

18. How many MB of memory does it have?

19. Have you downloaded any nursing specific software for your PDA?
   Yes ____  No ____
   a. If Yes, what are the titles and why did you choose them?

   b. How often do you use them?

20. If you had the option of purchasing your nursing textbooks electronically for your PDA or as a hardcover textbook, which would you choose?
   Electronic PDA format _____  Hardcover text _____  Both _____

21. Explain your feelings about the possibility of requiring PDA’s of future nursing students.

22. Do you anticipate using your PDA throughout the nursing program? Why or why not?
Appendix IV

Think-Aloud Case Study

D. Z., a 65-year-old male, is admitted to medical floor for exacerbation of his emphysema (COPD). He has a PMH (past medical history) of HTN, which has been poorly controlled by Enalapril (Vasotec) for the last 6 years. He presents as a thin, poorly nourished man who is experiencing difficulty breathing. He c/o coughing spells that are productive of thick yellow sputum. D. Z. seems irritable and anxious when he tells you that he has been a 2-pack a day smoker for 38 years. He complains that he sleeps poorly and lately he feels very tired most of the time. His V.S. are 162/84, 124, 36, 102°F, SaO₂ 88%. His admitting diagnosis is chronic emphysema with an acute exacerbation; etiology to be determined. His admitting orders are as follows:

- Diet as tolerated
- OOB w/ Assist
- O₂ @ 2 L via N/C
- Chem 7
- Sputum C & S X 3
- ABGs in a.m.
- Maintain IV if D₂W @ 50 ml/hr.
- Theophylline level upon admission
- Chest X-ray in a.m.
- Prednisone 40 mg p.o. three times a day
- Cefuroxime (Zinacef) 1 gram IVPB every 8 hours
- Theophylline (Theo-Dur) 300 mg twice a day
- Albuterol aerosolized 2.5 mg (0.5 ml) in 3 ml NS every 6 h.
- Enalapril (Vasotec) 10 mg p.o. every a.m.
Appendix V

Instruction for Think-Aloud

The instructions included the following:

1) You have just arrived at clinical today. The patient that was assigned to you was discharged.
2) This is your new patient
3) What information do you want to know about this patient
4) How would you use your PDA to search out the information
5) While searching out the information, please verbally explain what you are looking up
6) Which text you are using
7) Why are you looking up the specific information.
Appendix VI

Think-Aloud

<table>
<thead>
<tr>
<th>Investigator's Comments</th>
<th>Participant's Comments</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>The first thing I would do is just the medicines that I'm not completely positive about.</td>
<td></td>
<td>P</td>
</tr>
<tr>
<td>I would look up especially for the adverse reactions or contraindications.</td>
<td></td>
<td>P</td>
</tr>
<tr>
<td>So I'm going to check, I want to know the Theophylline level is supposed to be so I'm going to look to see what that is.</td>
<td></td>
<td>P</td>
</tr>
<tr>
<td>I understand that it's a bronchodilator and it says here that Theophylline level upon admission.</td>
<td></td>
<td>M</td>
</tr>
<tr>
<td>So I'm assuming that there is some type of level that they are reading.</td>
<td></td>
<td>M</td>
</tr>
<tr>
<td>That is what I'm looking for and I'm looking under Assessment right now.</td>
<td></td>
<td>D</td>
</tr>
<tr>
<td>Is that in Davis' Drug Guide?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yeah, it's in Davis' Drug Guide.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>It says therapeutic plasma levels range from 10 to 15 mcg. per ml for asthma.</td>
<td></td>
<td>D</td>
</tr>
<tr>
<td>And 6 to 14 mcg per ml for apnea.</td>
<td></td>
<td>D</td>
</tr>
<tr>
<td>Drug levels in excess of 20 mcg per ml are associated with toxicity.</td>
<td></td>
<td>D</td>
</tr>
<tr>
<td>So that is good.</td>
<td></td>
<td>P</td>
</tr>
<tr>
<td>Now know that I don't want my levels to be over 20.</td>
<td></td>
<td>P</td>
</tr>
<tr>
<td>Then he's also going to be taking Prednisone 40 mg 3xday.</td>
<td></td>
<td>M</td>
</tr>
<tr>
<td>I understand that is a steroid but I still would like to know more specific adverse reactions so I'll go to Davis' Drug Guide and I want to look up side effects.</td>
<td></td>
<td>M</td>
</tr>
<tr>
<td>The side effects of Prednisone are hypertension, which he is being treated for but it can also cause depression, euphoria, decreased wound healing, muscle wasting, osteoporosis, and moon face.</td>
<td></td>
<td>M</td>
</tr>
<tr>
<td>So I'll be more aware of those and expecting and that way I will know why his blood pressure is going up after I give it.</td>
<td></td>
<td>M</td>
</tr>
<tr>
<td>So understand that.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cefuroxime – I'm going to look up the therapeutic action.</td>
<td></td>
<td>P</td>
</tr>
<tr>
<td>And that would be in Davis' Drug Guide again.</td>
<td></td>
<td>P</td>
</tr>
<tr>
<td>This is a second generation cefurophlorine and its to treat an infection so it seems, because he is coughing up thick yellow sputum they are taking precautions and just treating him until they know exactly what the infection is but this can treat up to stuff like respiratory tract infections, a lot of septicemia, OK.</td>
<td></td>
<td>M</td>
</tr>
</tbody>
</table>
Appendix VII

1. Is the participant accessing the PDA at the POC?
   a. If so, why?
   b. If not, why?

2. How did the participant identify the need to access the PDA at the POC?
   a. Did the participant begin the search based upon:
      i. A beginning or basic level of knowledge, such as knowledge primarily gained in the classroom?
      ii. Previously learned knowledge, such as knowledge gained from previous nursing courses, additional reading/learning prompted by goal setting, or the need to “know more”? 
      iii. Obtaining a higher level of understanding of the knowledge previously identified and/or acquired?
   b. Did the participant have to repeat a previous search, if so, why?

3. What programs/software is the participant accessing on the PDA at the POC?
   a. Is the participant accessing information from Nursing Central?
      i. If so:
         1. Why is the participant using the Nursing Central bundle?
         2. Which text is being accessed?
3. Which sub-heading/category is being used to locate the identified information?

b. Did the participant locate what he was searching for?
   i. If so:
      1. How did the participant identify the information as being useful?
      2. Did the information assist in meeting the participant’s learning goals?
      3. Did the participant use the information at the POC?
      4. Did the information assist with patient care?
   ii. If not, what did the participant do, if anything, to obtain the information needed?

c. Could the participant have sought out the information from:
   i. A faculty member?
   ii. Staff nurse?
   iii. Classmate/fellow student?
   iv. If so, why did the participant seek out the information from the identified resource?

4. How much time did the participant invest in searching out the “identified information” required?
   a. Did the participant give up searching for the information if it was not located in a short time frame—such as ≤ 5 minutes?
      i. If so, what did the participant do, if anything, to obtain the identified knowledge he was searching for?
b. Was the participant able to identify any other resource on the PDA that may have
been accessed?

   i. If so, did the participant follow-through with that search?

   ii. If not, why?
Appendix VIII

END-OF-STUDY QUESTIONNAIRE

This study may, in part, contribute to the decision of whether future nursing students will be required to own a PDA upon entering the nursing program, therefore, please take a few minutes to answer the following questions. Be as specific and detailed as possible. Feel free to make any additional comments pertaining to your experience with the PDA (to also include handheld computers) and the Nursing Central Bundle. Thank you!

1. Did you use the PDA throughout the entire semester while in the clinical setting?
   Yes _____ No _____
   If no, please explain why

2. When not in the clinical setting, did you use the PDA throughout the semester?
   Yes _____ No _____
   If yes, for what purpose?

3. Did you find the PDA easy to use in the clinical setting?    Yes _____ No _____
   Please explain.

4. Did you find the Nursing Central Bundle to be easy to use in accessing pertinent information about your patient?    Yes _____ No _____
5. Did you use the Nursing Central Bundle in preparing for clinical?
   Yes ____  No ____
   Please explain.

6. Do you feel that the nursing bundle assisted you in learning while in the clinical setting?
   Yes ____  No ____
   Please explain.

7. Do you anticipate using the PDA for the remainder of the nursing program?
   Yes ____  No ____
   Please explain.

8. Will you continue to use the PDA upon graduating and practicing as a nurse?
   Yes ____  No ____
   Please explain.
9. Please list the benefits/advantages, if any, of having the PDA and software available to you while in the clinical setting.

10. Please list the drawbacks, if any, of having the PDA and software available to you while in the clinical setting.

11. Did you search out and use any other nursing specific software for your PDA?
   Yes _____ No _____

   If yes, please list the software and provide a brief overview of it.

12. Would you recommend future nursing students to purchase a PDA and software bundle?
   Yes _____ No _____

   Please explain.

Please feel free to make any further comments in the space below.
REFERENCES


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McCannon, M., & O'Neal, P. V. (2003). Results of a national survey indicating information technology skills needed by nurses at time of entry into the work force. *Journal of Nursing Education, 42*(8), 337-340.


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