

GENERATING SELF-EXPLANATIONS IN UNDERGRADUATE
NURSING EDUCATION

by

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ABSTRACT

The purpose of this study is to test the use of generating self-explanations in nursing education as it relates to student academic achievement in theoretical nursing courses. With the study being built upon a framework of cognitive constructivism, a mixed methods approach was used to examine the academic achievement of associate degree nursing students in a community college in northeast Texas. Unit exam grades and final exam grades were examined in two integrated theoretical nursing courses over the course of one semester. Demographic variables were considered, along with the semester of nursing school in which the student was enrolled. The quantitative portion of the study examined the amount of self-explanations generated as it related to academic achievement on unit exams and the final exam through a repeated measures approach. It also examined whether the semester of nursing school in which the participant was enrolled impacted the exam scores when generating self-explanations. While quantitative results yielded no significance, this non-significance and mean exam scores demonstrated that generating self-explanations can indicate knowledge retention and produce similar results to standard multiple-choice practice questions not-requiring self-explanations. Qualitative inquiry produced descriptive data, which highlighted four major themes and points of discussion including (a) activity design, (b) individual learners, (c) method of self-reflection, and (d) theory and practice. These qualitative data points augmented the quantitative results and provided valuable insight into the use of generating self-explanations in nursing classrooms and for areas of further research. With consideration given to quantitative and qualitative analysis, generating self-explanations should be considered as a tool to utilize in nursing classrooms.

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CHAPTER I: INTRODUCTION

In general, nursing educators, much like academic counterparts, focus on how students acquire knowledge, and many suggest transformation is needed in the methods of teaching as students work to build knowledge (Benner, Sutphen, Leonard, & Day, 2010). The differences individuals bring to classrooms and factors influenced by instructors can impact academic success (Redifer, Therriault, Lee, & Schroeder, 2016). Therefore, research is needed involving ideas faculty can use in the classroom, which is filled with variety, to help students build knowledge and the impact this can have on student achievement.

One such strategy, generating self-explanations, has been explored and tested within academic classrooms and in medical education. With positivity seen, one could argue researching this idea in nursing education is valid. One could also say it is even needed in order to further explore how students are constructing knowledge in nursing classrooms.

Generating self-explanations involves two ideas: generation effect and the self-explanatory principles. Generation effect is defined by a student attempting to answer a question or solve a problem, rather than having the information presented for selection (Brown, Roediger, & McDaniel, 2014). When a person has to generate (or construct) a solution on a familiar or unfamiliar topic then that person has to retrieve knowledge from memory, and a map is routed in the mind to fill in gaps and make connections to related material. It is believed this cognitive and learning strategy can lead to stronger learning (Brown et al., 2014).

The encoding phenomenon of generation effect underlies the idea of self-explanation (Rosner, 2012). The idea behind this is that students have to generate explanations (self-explanations) on how some material relates to prior existing knowledge and its current importance (Larsen, Butler, & Roediger, 2013). Through self-explanations, students actively engage in learning by either explaining components of a task or elaborating on why a fact is true, both of which connect prior knowledge and new material (Roediger & Pyc, 2012). This learning strategy is reusable and adaptable and can be used across age groups and domains to produce valuable improvements in learning (Jonas, Cernusca, & Collier, 2012). Self-explaining has demonstrated effects across different content materials and with different tasks, along with effects across a variety of learning outcomes, various measures of comprehension, memory, and even transfer (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013). It has also been noted that most students can benefit from self-explanations with minimal training (Dunlosky et al., 2013).

Generating self-explanations can provide benefit to clinical learning, as well as classroom learning. Students need to be able to read situations, draw on previously learned knowledge, and imaginatively see possibilities for a clinical situation. Articulation is a way to accomplish this and is one of the signature pedagogies of nursing education (Benner et al., 2010). Self-explanation could offer this to students and educators. For example, the student is posed the situation or question and is asked to validate the response for why the student chose to act in a certain way. Being able to state the rationale, allows for a way to check for faulty assumptions or a misguided grasp of the situation, and by being clear in the thinking about the rationale can even contribute to increasing safety in high stakes environments such as patient care (Benner et al., 2010).

Problem Statement

Nursing faculty need to understand knowledge cannot be transferred simply with words without first the existence of a meaning of such words and an experiential knowledge base (Yager, 1991). Identified learning strategies that can improve student learning and retention are not often applied in classrooms, and perhaps even ignored (Roediger & Pyc, 2012). Outside of cognitive psychology, many of these strategies are unknown and thus not being utilized (Roediger & Pyc, 2012). This could perhaps be the case in nursing education as it relates to generating self-explanations, which is a valuable learning strategy worthy of further explanation.

With a need to address how students are acquiring and building knowledge, faculty should encourage active-learning processes in the skills laboratory, classroom, and clinical environment to assist learners in creating and building knowledge (Brandon & All, 2010). The role of nursing educators needs to be that of a facilitator, developing creative education strategies to produce strong nursing students (Brandon & All, 2010). With constructivism the instructor is not central, but rather is a facilitator and the student has an active central role (Hunter, 2008). Students must avoid achieving shallow or inert knowledge, learning just enough to pass a test but lacking a deeper understanding of the material (Aleven & Koedinger, 2002). For students to obtain the greatest benefits from studying, then each should be working to actively construct an understanding of the material (Ainsworth & Burcham, 2007). Active learning processes have empirical support, which demonstrate better knowledge retention (McElroy & Slamecka, 1982; McNamara & Healy, 2000). With a need to increase active learning processes, one such learning strategy grounded in cognitive constructivism, generating self-explanations, has yet to be fully explored in nursing education.

Significance of the Problem

What is the cause of students failing to progress academically to completion of a nursing degree? Some suggest the rigorous curriculum of a professional nursing program can be to blame for poor retention and completion rates (Johnson, 2012). As a nursing curriculum demands successful completion of one or a combination of concurrently enrolled courses to be completed before progressing to the next course(s), individual course grades are an important consideration for retention of nursing students due to the risk of attrition a student obtains when failing a course (Jeffreys, 2004). Therefore, success in individual nursing courses is vital for a nursing student's progression and retention. According to Jeffreys (2007), during, and at the conclusion of each nursing course, a decision will be made to either voluntarily or involuntarily remain, persist, stop-out, dropout, return, graduate, take the licensing exam, and/or enter the nursing workforce.

If the demanding curriculum and mandated academic success in individual courses are possible causes of poor completion rates, then faculty and administrators should look at ideas aimed towards assisting students to gain achievement in the nursing curriculum. Ideas will need to be focused on what nursing faculty and instructors can do to help students become successful in coursework.

Theoretical Framework

Instructors need to know how students will react to examples, situations, exercises, and explanations, and a good theory of knowledge acquisition may improve the design of instructional opportunities and training of instructors (Van Lehn, Jones, & Chi, 1992). In order to explore how students are acquiring knowledge in nursing education, cognitive constructivism can provide a sound theoretical framework. The philosophical basis for cognitive constructivism

can support many students with different backgrounds, promote a respect for varied backgrounds, and allow for the building of knowledge from existing knowledge (Hunter, 2008). While there may be limitations in the nursing literature regarding constructivism, support for this learning theory exists in educational literature (Hunter, 2008).

Cognitive constructivism is a theory of how a student acquires knowledge and is grounded in the work of Jean Piaget (Powell & Kalina, 2009). Constituents of this theory believe that learning occurs if students are open, comfortable, and challenged. For cognitive constructivists, learning is based on the fact that ideas are constructed in individuals through personal experiences and processes and will have meaning for the student (Powell & Kalina, 2009).

According to Piaget, a person's cognitive make-up includes organized and related mental ideas known as schemas (Herman, 2012). There are three mechanisms (assimilation, accommodation, and equilibrium) present to associate life experiences with schemas. If life events, new knowledge, and/or situations are misunderstood by existing schemas, then a state of disequilibrium is present, which can motivate learning (Herman, 2012). From this state of disequilibrium, assimilation and accommodation are then able to work to achieve a cognitive equilibrium with existing schemas (Herman, 2012).

For Piaget, assimilation and accommodation are two important aspects of intelligence and/or knowledge acquisition (Piaget & Inhelder, 1969); in fact, to Piaget cognition is adaptive (Yager, 1991). Assimilation, in this case, is similar to biological assimilation in that newly established material and connections are integrated into an individual's existing scheme. Accommodation is the adjustment of such schemes to accommodate reality (Piaget & Inhelder, 1969). It is through the process of assimilation and accommodation the relationship to

generation self-explanations can be observed. The self-explanation can allow for accommodation to occur through reflective processes involved with the self-explanation and to associate prior schemes or knowledge with current reality or problems being faced.

Purpose of the Study

With nursing students constrained by a rigorous and structured curriculum, and the need to be successful in all classes (including theoretical courses), exploring cognitive constructivist learning strategies such as generating self-explanations can produce valuable data. These data could assist students in being successful in the professional nursing program. Therefore, the purpose of this study is to test the use of generating self-explanations in nursing education as it relates to student academic achievement in theoretical nursing courses.

Significance of the Study

By studying generating self-explanations in nursing education, a contribution could be made to the body of literature regarding nursing education and classroom strategies. If the results of this experimental study note a significant difference in grades for nursing students, then educators may have an additional strategy that can be used in classrooms and/or provided to students as a study skill or habit. This study can highlight the learning sciences in the classroom and in the study habits of students. It can provide a glimpse into how use of constructivist learning ideas could influence academic outcomes for nursing students faced with a rigorous nursing curriculum.

Research Questions

In order to address the identified problem and needs for nursing education, and with the underlying theoretical framework of cognitive constructivism in mind, four main research questions have arisen for this study.

1. Is there a relationship between demographic variables and generating self-explanations?
2. Is there a significant difference in knowledge transfer on unit and final exams for nursing students who practice the use of generating self-explanations on practice questions more throughout the semester compared to those who practice less?
3. Is there a difference in the academic achievement between first semester and third semester ADN students when generating self-explanations?
4. What are student perceptions of using self-explanations when answering practice questions?

Methods

In order to address the research questions, a mixed methods approach was utilized. Undergraduate nursing students enrolled in theoretical nursing courses were recruited to participate. Exam grades on unit exams and on the final exam comprised the majority of the quantitative data in this mixed methods study, and assisted in answering research questions associated with academic achievement. Quantitative data were obtained through participant demographic questionnaires, including age, ethnicity, grade point average, semester of nursing school, prior clinical experience including length and type of clinical experience. In an effort to validate the results obtained from the quantitative analysis, participant interviews through a focus group were held to acquire qualitative data. The qualitative data obtained were valuable in answering the research questions pertaining to prior clinical experience, and discovery of information about the student perceptions of self-explanations.

Assumptions

A variety of assumptions are held for this research study. A major assumption is the honesty of the participants. It is assumed questions on the demographic questionnaire and for the focus group were answered honestly.

In regard to the self-explanations and practice questions, it is assumed the participants gave a full and complete effort. It is also assumed that the only times the self-explanations were used is during the units assigned. This study also assumes that self-explanations and practice questions are important in the exam preparation and outcomes for undergraduate nursing students based upon the theoretical framework. The number of practice questions used is also assumed to be relevant and sufficient to meet the needs of the students for exam preparation.

Data analysis in this research study also contain assumptions. In answering the research questions regarding short-term knowledge retention and long-term knowledge retention, exam scores are being identified as the outcome measurement and assumed to be an appropriate measure. An assumption is also being made in regard to the definition of long-term knowledge retention. For the purposes of this study, long-term is determined to be weeks after content material and practice questions were presented and tested on at the conclusion of a 16-week semester.

Limitations

The following limitations have been identified for this mixed methods research project. First, the sample size is small, with 99 participants for the quantitative portion and 23 students for the qualitative interviews, with data collection occurring only during one semester. The sample also presents another limitation, in that this study is limited to undergraduate nursing students and participants from an associate degree nursing program. A focus of this study is on

theoretical nursing courses, and not clinical courses, therefore, a limitation on the type of nursing course is also in place.

Definition of Terms

Generation effect. For this study, the generation effect is associated with the generation of self-explanations. While there is a slight variation from the term “generation effect” originally coined by Slamecka and Graf in 1978, the central concept of generation remains the same through the participants generating self-explanations as rationales to questions, or in other words attempting an answer instead of having the information presented (Brown et al., 2014).

Self-explanations. A self-explanation can be defined as an explanation the learner generates themselves instead of one received by an external source (Jonas et al., 2012). In the context of this study, self-explanations refer to the justification for the answer selection by a student in response to a practice question posed by faculty. The participants in the study will construct or generate a self-explanation to each practice question answer in the assigned units of content material.

Knowledge transfer. The definition of knowledge transfer can be described as a cognitive process involving interpersonal processes and cognitive resources where knowledge is transferred between individuals (Aita, Richer, & Heon, 2007). In nursing science, cognitive skills require cognitive and intellectual capacities, along with prior experience, experience, values, and beliefs in order to apply knowledge in areas such as practice, research, and education (Aita et al., 2007). For this study, knowledge transfer is associated with the ability to transfer the information acquired through practice questions and self-explanations into achievement on exams in theoretical nursing courses.

Student academic achievement. Demonstration of academic achievement for a nursing student in this study refers to the exam grade achieved on unit exams and/or final exam content.

Practice questions. The term practice questions in this study refers to the questions comprising formative assessments conducted by faculty at the conclusion of a lecture presentation in a theoretical nursing course. Each practice question was multiple-choice in format. In relationship to the number of practice questions chosen, this decision was made by the instructor in charge of presenting the content. Correct answers and rationales for the practice questions were provided to all students (participants and non-participants) at the conclusion of the formative assessment exercise.

Prior nursing knowledge. Prior nursing knowledge was assessed to see if there is a relevance to the generated self-explanations. For this study, prior nursing knowledge is defined as having worked in the nursing field or having participated in a nursing clinical experience in nursing school.

Summary

New approaches to teaching that support active learning are needed in nursing classrooms today. This study examines the use of cognitive constructivism in those classrooms through the use of generating self-explanations. Chapter I provides a general overview of the research project and its need in nursing education. Chapter II focuses on a review of the literature involving cognitive constructivism, generation effect, and self-explanations. Chapter III establishes the chosen methodology for this research study and plans for participant recruitment and data analysis. Chapter IV displays the results obtained from the research project. Finally, Chapter V provides a discussion of the project and the implications held for nursing education.

It is hoped the data obtained from this study will arm nursing educators and administrators with a tool that can be used to assist students in becoming successful in the rigorous nursing curriculum.

CHAPTER II: REVIEW OF LITERATURE

In keeping with the purpose of the study to examine the use of generating self-explanations as it relates to student academic achievement in nursing school, there are three main focus areas for the review of literature. Each area builds upon the prior principle and theoretical framework in hopes of demonstrating ideas on how nursing students acquire knowledge and effective strategies that could lead to academic success.

A closer look at cognitive constructivism is explored first as it provides the base for this study. Next, the principle of generation is examined and the significance this principle has made to cognitive psychology and education. From the ideas of generation effect, comes the principle of self-explanation. The idea of self-explanation has seen positive results in classrooms and in medical education, and it is felt a thorough review of this material is relevant to the need of exploring this learning strategy in nursing education.

Cognitive Constructivism

Constructionism and cognitivism focus on learning at the individual level (Nathan & Sawyer, 2014) and can transform someone from a novice to an expert (Blais, 1988). Some research suggests a shift in nursing education to a constructivist paradigm in relation to contemporary practice needing reflection, adaptation, action, and critical thinking to deliver care (Peters, 2000). While generating self-explanations may be lacking in nursing education today, cognitive constructivism is present in a variety of ways and can have a tremendous importance (Handwerker, 2012). Brandon and All (2010) suggest cognitive constructivism can help in

improving critical thinking skills and encourage adaptation to changes in practice. Use of constructivism will work to make opportunities that encourage and support understanding, and if students have a better understanding and know how to think, then decision-making skills can be improved (Kala, Isaramalai, & Pohthong, 2010).

Peters (2000) suggests cognitive constructivism can take into account what students already know and have learned and will build new knowledge upon the previously learned information. This same idea was echoed in an article by Hunter (2008), noting this building of knowledge on previous knowledge is central to constructivist theory. With this idea, one can argue that use of cognitive constructivism can be beneficial for students progressing through a structured and rigorous nursing program. However, in order to be effective, faculty need to incorporate these ideas in the classroom.

Cognitive Constructivism in the Classroom

A variety of constructivist strategies are available for educators to implement in classrooms. Teaching methods employing this cognitive constructivism will promote ideas based on the premise that to have meaningful or real knowledge an individual needs the ability to reason, acquire, and accept information, and then retrieve that information, suggesting it has been constructed in memory (Powell & Kalina, 2009). Examples of using cognitive constructivism in the classroom can include concept maps, class discussions, problem-based learning, case studies, and collaboration (Handwerker, 2012).

Yager (1991) discussed four main areas where constructivism can be implemented in the classroom: invitation, exploration, proposing explanations and solutions, and taking action. The key focus in relation to this current dissertation research study is on proposing explanations and solutions. This component area involves such things as constructing and explaining a model,

reviewing and constructing solutions, assembling multiple answers and solutions, and constructing a new explanation (Yager, 1991). This by definition, is generating self-explanations.

Generation Effect

To develop a self-explanation, one has to construct or generate that self-explanation. Generation effect can be used in a variety of educational settings and classrooms, including nursing education. The effectiveness of generation effect can be related to a higher conceptual processing of a word (Jacoby, 1983). Another line of thought is that the effect results from greater semantic processing, because of the more extensive processing through semantic memory and because generating is not as automatic as reading (McElroy, 1987).

One example is having students answer fill-in-the-blank questions or short-answer questions instead of multiple-choice questions (Brown et al., 2014). These questions could be provided by the instructors as a classroom exercise or encouraged as a study habit. Through this simple activity, the relationship to cognitive constructivism is observed. By filling in the blanks to a question or writing a short-answer, the learner is constructing an answer by relying on prior knowledge and related pathways in the brain, thereby developing new knowledge and retrieval maps in the mind, as opposed to selecting an answer from a list of choices. This construction of a solution embodies the principles of cognitive constructivism focusing on previously learned information (Peters, 2000) through the retrieval map and connections in the mind.

The effectiveness of generation on knowledge retention and retrieval has been indicated from a variety of historical pieces of research. Generation effect was first established and defined in the works of Slamecka and Graf (1978). The researchers established this term through the discovery of a memory phenomenon that is present across a variety of encoding rules, testing

processes, and changes in situations. These results were seen through the conduction of five experiments that demonstrated words are better retained and recalled if that word(s) is generated as opposed to simply being read (Slamecka & Graf, 1978). The work of Crutcher and Healy (1989) confirmed this idea of a word generated is better retained and recalled as opposed to simply being read. These authors believed that by generating a word an individual has to search through one's memory for related words and symbols, thereby creating a path for later retrieval of the word or symbol generated. A variety of other studies incorporating various methods and hypotheses have also demonstrated the presence of a generation effect (Burns, 1990; Chen, Kalyuga, & Sweller, 2016; Foos, Mora, & Tkacz, 1994; Gardiner & Hampton, 1985; McCurdy, Leach, & Leshikar, 2017; McNamara & Healy, 2000; Mulligan, 2004).

A question to consider when exploring the generation effect is, when generating an answer does the student have to be correct in his/her answer? In the construction of an answer with generation effect, research has shown that students do not need to answer the supplied questions or prompts correctly. A deeper processing and learning can occur if an attempt is incorrect, especially after the correct answer is later supplied, because the result will be encoded in an individual's mind (Brown et al., 2014). This idea was explored in a study involving students being tested over material prior to reading related content, and the results producing stronger learning and knowledge retention (Richland, Kornell, & Kao, 2009). Generating answers can be a good idea, even if wrong, as long as students are corrected. It is important for educators to understand that when asking students to generate an answer, appropriate feedback should be provided to avoid any harm in learning (Metcalf & Kornell, 2007).

Research has shown generation to be effective in regard to better knowledge retention and retrieval. While some sources are slightly dated, the relevance to classrooms today cannot

be underestimated. With the generation effect being grounded in cognitive constructivist thought, and a need for a cognitive constructivist paradigm in nursing education, it would be wise to more closely examine this phenomenon at work in nursing education classrooms.

Self-explanations

Overview of Self-explanations

The explanation a learner generates themselves instead of an explanation received by an external source is defined as a self-explanation or self-generated explanation (Jonas et al., 2012). Self-explanations are associated with the encoding phenomenon of the generation effect (Chi, Leeuw, Chiu, & Lavancher, 1994; Renkl, 2002; Rosner 2012) along with the ideas of cognitive constructivism (Roediger & Pyc, 2012). An example of this relationship is that a student provides the rationale for an answer, as opposed to simply reading the rationale or having it presented to them. Self-explanation can be described as a student monitoring learning, and explaining or describing some features of a problem or learning, thus engaging in active learning (Roediger & Pyc, 2012).

Chi, Bassok, Lewis, Reimman, and Glaser (1989) hypothesize that students understand and learn from the explanations given while studying the material. The authors also suggest the use of explanations can reveal a student's understanding in four areas: "(1) the application of the actions (2) the consequences of the actions (3) the relationship of actions to goals (4) the relationship of goals and actions to natural laws and other principles" (Chi et al., 1989, p. 151). Self-explaining can enhance learning and allows for a deeper understanding of new knowledge or materials (Chi et al., 1994).

Relationship of Self-explanations to Cognitive Constructivism

When students are explaining why a concept is true or explaining the components of a task, the students will have to incorporate prior knowledge to assist in learning new material (Roediger & Pyc, 2012). Self-explanations facilitate the integration of new information with existing knowledge, or put another way, thinking with what an individual already knows (Chi et al., 1994; Dunlosky et al., 2013) thereby associating the idea of cognitive constructivism with self-explanations.

Ionas et al. (2012) implemented a project with 52 chemistry students tasked with solving a chemistry problem. Twenty-nine students were in the control group and 23 students were in the treatment group, with the treatment group solving the problem with questions designed to use self-explanation (Ionas et al., 2012). The results showed that more participants in the treatment group answered correctly. The researchers then used regression analysis to demonstrate that prior knowledge had played a role in a correct answer (Ionas et al., 2012). As many nursing programs may build on top of prior knowledge obtained in prerequisite courses and nursing courses, the Ionas et al. study may be relevant in that it demonstrates how self-explanation and prior knowledge are related.

With the ability to produce reflective self-explanations, cognitive constructivism and prior knowledge can be beneficial to students. Kwon and Jonassen (2011) conducted a study involving 33 college students taking multiple-choice tests and having to explain why the answers selected were correct or incorrect. The study found reflection ability was closely related to prior knowledge, and further supported the idea that reflection of a self-explanation can facilitate change by repairing flawed ideas or mental models (Kwon & Jonassen, 2011).

Classroom Research

Multiple studies have been conducted exploring the impact self-explanation can have on learning and knowledge retention, and the benefits obtained through the current research could be important in nursing education as well. Studies have demonstrated that self-explanation can have beneficial effects on knowledge transfer (Ainsworth & Loizou, 2003; Atkinson, Renkl, & Merrill, 2003; Renkl, Stark, Gruber, & Mandl, 1998; Rittle-Johnson, 2006). Studies have also demonstrated better performance, gains, and/or understanding of material when utilizing self-explanations (Bielaczyc, Pirolli, & Brown, 1995; Ionas et al., 2012; Kwon & Jonassen, 2011; Wong, Lawson, & Keeves, 2002).

In perhaps the first research on self-explanations, researchers examined “good” students versus “poor” students and the explanations produced while studying worked-out problems (Chi et al., 1989). It was found that “good” students tend to learn with understanding, generating more self-explanations, expanding on conditions of the problem, and monitoring their own understanding and misunderstandings. All of the factors in the “good” students led to a better understanding of principles. On the other hand, the “poor” students relied more on examples, and were unable to monitor learning and generate self-explanations (Chi et al., 1989).

Chi and VanLehn (1991) wished to determine the sources for self-explanations. In work conducted with physics students, the researchers determined two general sources for how and why students develop self-explanations. First, self-explanations can be produced from the knowledge acquired earlier from readings and associating it with current examples. Secondly, a student can generate a self-explanation by generalizing and extending beyond the current examples. The construction of these explanations can help the student yield new knowledge and complete a student’s understanding of the current concept (Chi & VenLehn, 1991).

Self-explanations can be used with text or diagrams. Ainsworth and Loizou (2003) examined whether or not there was a difference in explaining with text resources or diagram resources. The 25 subjects in the study involving the human circulatory system demonstrated that those students using self-explanations associated with diagrams performed better on posttests than those with text resources alone, and the diagram students also provided a greater number of self-explanations (Ainsworth & Loizou, 2003).

Prompting Self-explanations

Self-explanations can facilitate even when students are prompted to self-explain (Chi et al., 1994). In a study involving eighth grade students learning about the human circulatory system, the experimental group was asked to explain after reading each line of a text passage about the system, while the control group reread the text passage. All students had a pretest and posttest on the circulatory system and the students who performed self-explanations had a greater gain from pretest to posttest. The students who generated a large number of self-explanations demonstrated a greater understanding of the material through analysis of answering very complicated questions (Chi et al., 1994).

A question that has been posed in a few research studies involving self-explanations is whether or not it matters if one is explaining to themselves or to others or even in software. Three research studies have looked at the question. Chi (1996) explored the use of self-explanations in tutoring in a case study, and found that if the tutor prompts the co-construction of an explanation, there is a benefit for deeper learning, as this co-construction of explanations can clear up misunderstandings by the student. In one study, researchers found that if a child explained to his/her mom, there was a higher problem-solving accuracy at posttest and a higher problem-solving transfer, thus showing having a listener matters (Rittle-Johnson, Saylor, &

Swygert, 2008). Another study looked at a Cognitive Tutor (intelligent instructional software) and found that students who explained steps in the software program when problem solving learned with greater understanding, and were more successful when having to transfer the knowledge (Alevan & Koedinger, 2002).

Self-explanations in Medical Education

A frequent researcher of self-explanations is Martine Chamberland. Numerous studies have been conducted by Chamberland to examine self-explanation and its relationship to medical student education. The first study to consider explored self-explanation on medical students' diagnostic performance (Chamberland et al., 2011) utilized 36 medical students randomly divided into two groups solving 12 clinical cases on less familiar or more familiar topics. One week later, during an assessment phase, both the control and experimental group underwent diagnostic performance tests on the topics, and the results indicated a significant interaction between self-explanation and cases that are about a less familiar topic. The results of this study can be inferred to mean that even one week after utilizing self-explanation for an unfamiliar subject, retention of knowledge can be observed.

Chamberland et al. (2013) then expanded on the results of this study with a study focused on unfamiliar cases and the role of biomedical knowledge. Researchers analyzed the content of the self-explanations from the previous study and compared different segments as to whether a topic was familiar or unfamiliar, with unfamiliarity again noting a significant interaction. While the research aimed to explore more about the role of biomedical knowledge, it can still be seen that when students were presented with an unfamiliar topic and asked to self-explain, it resulted in more extensive and engaging thinking.

Next, a study was conducted on whether there was an added value of examples and prompts in to self-explanation (Chamberland et al., 2015). Fifty-four medical students were divided into three groups, and underwent a training and assessment phase, and all groups completed self-explanations. For the methods, one group listened to medical residents' self-explanations with prompts about the case, the next group listened to the residents' explanations without prompts, and the third group completed a self-explanation but did not receive any information from the residents, only additional study materials. All participants were then tested one week later, with all groups improving with self-explanations alone, and the group with self-explanations and prompts from the residents showing higher diagnostic accuracy and performance (Chamberland et al., 2015).

Summary

The literature review for this study has focused on three main topics: generation effect, self-explanation, and cognitive constructivism. Research with generation effect and self-explanation has been analyzed in a variety of settings, but is lacking in nursing education. Much of the research has centered on knowledge retention and/or long-term knowledge retention, and little attention has been paid to grades and academic achievement. Due to these ideas and gaps, the research questions were developed for this study in order to incorporate the needs of nursing education by discovering ways to assist students in being successful in the demanding curriculum.

CHAPTER III: METHODOLOGY

The purpose of this study is to test the use of generating self-explanations in nursing education as it relates to student academic achievement in theoretical nursing courses. A mixed methods approach was utilized to address the research questions. This chapter addresses the research method, setting, participants, and data collection for the study.

Research Method

An explanatory sequential mixed method approach was used for this research study. The mixed method approach allowed for checking the accuracy and/or validity of the data obtained (Creswell, 2014). This approach is valuable for studies that need further explanation of the quantitative results obtained in the first phase, and allows for expansion and the researcher to build upon the results from quantitative inquiry (Creswell, 2014).

The explanatory sequential mixed methods approach was particularly valuable for this study in order to address the research questions. The quantitative approach was used to assess demographic information, knowledge transfer, and prior knowledge as it relates to self-explanations and academic achievement. The qualitative data further explained the results from the quantitative data by expanding on how participants viewed the use of generation self-explanations and the impact it had on grades and knowledge transfer, along with the effect participants' prior knowledge had on generating the self-explanations.

Setting

A community college in northeast Texas was the site for the study. The state of Texas was chosen for logistical and convenience purposes, along with the demonstrated need in reviewing nursing workforce and education statistics. According to a report from the National Council for State Boards of Nursing (2017), Texas has the second highest number of licensed nurses in the United States. While the state has the second highest number of nurses, by 2030 there is a projected 20% deficit of nurses to meet the state's demand (Texas Center for Nursing Workforce Studies, 2016b). With these numbers it will be important for the state to continue to have students progress through nursing programs and graduate to help fill the healthcare needs of its citizens, but the state had a 3.9% decline in graduates in 2014-2015 (Texas Center for Nursing Workforce Studies, 2016a).

The reason for the selection of ADN students is related to statistical data and need. In the state of Texas, ADN programs represent the highest number of nursing education programs available to students. Based on reports from 2016, there were 69 ADN programs, 48 BSN programs, 1 Diploma program, and 1 Master of Science in Nursing Alternate Entry program (Texas Center for Nursing Workforce Studies, 2016c). It is the belief of the researcher that to meet the need for the state of Texas, a logical option would be to conduct research at the program level that provides the most opportunities for students.

The ADN program chosen to be the study site is very conducive to this type of research study because most of the courses are formatted in the same way in terms of exam structure and frequency. The program is an integrated program, discussing disease processes across the lifespan. There are two theoretical courses from which participants were recruited.

The first is a fundamental nursing course, which is the first semester nursing course for all students. The course is designed to be an introduction to the profession of nursing including: “the role of the professional nurses as provider of patient-centered care, patient safety advocate, member of the healthcare team, and member of the profession with emphasis on health promotion and primary disease prevention across the life span; essential component of the nursing health assessment; identification of deviations from the expected health patterns; the application of a systematic, problem-solving process to provide basic nursing care to diverse patients across the life span; and applicable competencies in knowledge, judgment, skills, and professional values within a legal/ethical framework (“Nursing 1, RNSG 1423, Spring 2018 Course Syllabi,” p. 3, 2018). Methods of instruction for the course include: “lecture/discussion, group processes such as role play, simulate client situation, study guides, audio-visual materials, computer programs, required textbooks, instructor-student conference, and written assignments” (“Nursing 1, RNSG 1423, Spring 2018 Course Syllabi,” p. 7, 2018).

The second is the third semester medical-surgical course. This course is taken after successful completion of the first and second semester courses in the traditional program and/or successful completion of the transitional entry courses for the LVN to RN program. The course is described as “application of a systematic problem-solving process, critical thinking skills and concepts to provide comprehensive nursing to diverse patients and families across the life span with complex healthcare needs including, but not limited to, complex childhood/adolescent disease, complicated perinatal care, acute mental illness, complex perioperative care, serious adult health problems, and health issues related to aging. Emphasis on tertiary disease prevention, health maintenance/restoration, and collaboration with members of the interdisciplinary healthcare team. Content includes the roles of the professional nurse and

applicable competencies in knowledge, judgment, skills, and professional values within a legal/ethical framework” (Nursing 3 Theory, RNSG 2414, Spring 2018 Course Syllabus,” p. 3, 2018). Methods of instruction for this course are similar to the first course option with the following methods being employed: “lecture/discussion, group process-role play, simulated client situations, study guides, audio-visual materials, computer programs, required textbooks, instructor-student conferences, and written assignments” (“Nursing 3 Theory, RNSG 2414, Spring 2018 Course Syllabus,” p. 8, 2018).

Both courses provided data as they pertain to cognitive constructivism and the building of nursing knowledge, as one course is the beginning of the program and students drew on his/her background and lecture content, while the second allowed the students to draw on two full semesters of nursing content along with new lecture content. With the similar structure of the courses, it allowed for ease of research design and set-up.

Participants

Ninety-nine Associate Degree Nursing students comprised the participants in this study. Participation in the study was voluntary with informed consent obtained. The only requirement for participation in the study was enrollment in a theoretical nursing course. No grade point average requirements were utilized as a requirement because self-explanations have been found to be beneficial for most students and across a variety of domains (Dunlosky et al., 2013). There are even suggestions as to the benefits of self-explanations for at-risk college students (Calais, 2008). Therefore, it was felt most students from a variety of backgrounds and differing levels of academic achievement could provide quality data for this study.

The setting for the study allowed for a diverse pool of possible participants. The ADN program averages around 250 students for the total program. The first semester and third

semester courses average 60 students each semester. A variety of ethnicities and ages are present, along with both male and female students. The ADN program is 84% female and 16% male. White, non-Hispanic students are the majority of the students, comprising 66% of the student population. African American students make-up 14% of the population, and Hispanics 13% of the total. There are also Asian students (2%), American Indian (2%), and other races (3%) in the student population. In regard to age, the largest age group is 21 to 25 years old (27%) followed closely by 26 to 30 years old (24%) and 31 to 40 years old (23%). Students aged 17 to 20 years old comprise 3% of population, 41 to 50 years old 17%, and 51 and older account for 5% of the student population in the total program.

As evidenced by Table 1, a variety of demographic variables were collected, allowing for a diversity of participants with differing backgrounds to provide data for the study. The most common age of participants was 21-25 years old, while White/Caucasian participants represented the greatest ethnic group in the study. The majority of participants had a reported grade point average of 3.01 to 3.5, and an overwhelming majority of participants reported having some form of experience in the healthcare field. A target population of 90 students was set in the quantitative portion of this mixed methods study. A G*Power analysis with a significance level of .05 and power of .80 suggested 78 participants were needed. However, to account for student withdrawal from the study and/or course, a target of 90 participants was established.

There were 121 participants recruited from the two possible nursing courses, and 106 participants consented to participate in the study. Over the course of the semester, 7 students withdrew from the course(s) and were removed from the study. From the first semester nursing courses, 51 of 56 students agreed to participant. The final total for the study was 47 students from the first semester course due to course and/or study withdrawal. The third semester nursing

course had a larger recruitment pool, with 65 possible student participants. Of those 65 students, 55 consented to participate. Three students were withdrawn from the study, leaving a total of 52 participants from this course. A total of 99 participants were involved in this study. Table 1 notes the demographic information collected from the consenting participants on the demographic questionnaire.

Table 1

Demographic Information of Participants

Variable	Number of Participants (n)	Percentage (%)
Age		
<18	0	0%
18-20	10	10.1%
21-25	33	33.3%
26-30	17	17.2%
31-35	12	12.1%
36-40	17	17.2%
41-45	5	5.1%
46-50	2	2.0%
51-55	2	2.0%
>55	1	1.0%
Ethnicity		
White/Caucasian	68	68.7%
Black/African-American	7	7.1%
Asian	1	1.0%
Hispanic/Mexican-American	7	7.1%
American Indian	1	1.0%
Mixed Race	9	9.1%
Unknown	6	6.1%
Grade Point Average		
2.0 to 2.5	2	2.0%
2.51 to 3.0	21	21.2%
3.01 to 3.5	37	37.4%
3.51 to 4.0	22	22.2%
Unknown	17	17.2%
Previous Experience		
No	27	27.3%
	71	71.7%
Unknown	1	1.0%

(table continues)

Variable	Number of Participants (n)	Percentage (%)
Type of Experience		
None	24	24.2%
School Clinicals	16	16.2%
Job	28	28.3%
Both	29	29.3%
Unknown	2	2.0%
Years of Experience		
None	25	25.3%
1 month to 1 year	22	22.2%
1 to 2 years	17	17.2%
2 to 3 years	12	12.1%
3 to 4 years	3	3.0%
4 to 5 years	5	5.1%
>5 years	15	15.2%

Focus Group

During the recruitment phase, students were asked to consider participating in a focus group at the end of the study. The target for each focus group was 6-7 students. A total of 23 study participants were present for at least one focus group. The first group with 8 participants was comprised of first semester nursing students. The second group with 5 participants was comprised of third semester students, while the third group with 10 participants, was a mixture of first and third semester students. Different ages, ethnicities, grade point averages, and experience made-up the focus groups, thus allowing for a variety of perspectives.

Procedure

After IRB approval (see Appendix D) was obtained, all participants were provided with the recruitment letter and an informed consent document to sign, and were given a copy of the voluntary consent form. Participants then completed a demographic questionnaire. The data collected from this questionnaire allowed the researcher to determine age groups, ethnicity, prior GPA, and how much prior knowledge (i.e., years of experience) was present and what type of prior knowledge and/or experience was present. As research has discussed the effectiveness of

self-explanations in a variety of domains and for most students (Dunlosky et al., 2013) and across age groups (Ionas et al., 2012), this demographic information assisted in checking for consistency with previous assertions. See Appendix A for the demographic questionnaire.

A split design was used and participants were randomized and divided into two groups. Neither group participated in unit one to allow for set-up of the study at the beginning of the semester and to provide control data. When assigned to the other units, the participants answered practice questions over subject material in that unit and utilized self-explanations to validate why an answer choice was correct. For units two, three, four, and five, participants from group A answered the supplied practice questions and generated a self-explanation for the answer choice. Participants in group B generated self-explanations for units four and five only, and all other times simply answered multiple-choice practice questions.

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Group A	Control	Self-explanations	Self-explanations	Self-explanations	Self-explanations
Group B	Control	Control	Control	Self-explanations	Self-explanations

Figure 1. Group assignments for each unit.

This design allowed for proper control to be obtained and to evaluate if improved academic achievement is noted through the use of generating self-explanations. Based upon the theoretical framework and supporting research, the following hypotheses were developed associated with this design and academic achievement on exams:

1. Unit 1 – Group A = Group B
2. Unit 2 – Group A > Group B
3. Unit 3 – Group A > Group B

4. Unit 4 – Group A = Group B
5. Unit 5 – Group A = Group B

One consideration that must be addressed and is mentioned as an assumption for this study, is that participants only generated self-explanations on the units assigned. In an attempt to account for this, a survey was incorporated at the conclusion of each exam, and participants were asked if they generated a self-explanation. The answers were compared to the group members to see if this was a unit assigned self-explanations or not and was accounted for in the data analysis of the study. See Appendix B for the survey at conclusion of each exam.

The end-of-exam survey also addressed another possible assumption for the study, which is effort of the participants. The survey asked the participants to rank their effort on a numeric scale when it came to generating the self-explanations to the practice questions. The results of this survey was then accounted for in the data analysis of the project. All students in the class, were given the opportunity to complete the end-of-exam survey, however, responsiveness varied.

The practice questions were developed by the faculty member presenting the lecture and were a classroom activity for all students in the class. In the first semester nursing course, there were five faculty members responsible for the development of practice questions for their assigned lecture and the dissemination of the practice questions. In the third semester nursing course, eight instructors developed questions for their assigned lecture and were responsible for distributing the practice questions. It was the expectation of the study design that each instructor would also review the answers to the practice questions and provide feedback, which did occur with one exception in the first semester nursing course, when one instructor failed to do so. This anomaly was accounted for when examining the exam grades associated with that one lecture, in that the grades were calculated minus the content area associated with the lecture that did not

have the practice questions. The practice questions and/or self-explanations for the practice questions were hand-written by the students and collected by the faculty of record for the course. To ensure no unfair advantage was given to students who were participating over those who elected to not participate, all students in the class received the practice questions and answers and correct rationales. As the practice questions were a classroom activity for all students, consent was obtained regarding the use of the students' demographic data, exam scores/performance, and end-of-exam survey data.

Practice questions were chosen as a classroom strategy to test the generation effect and self-explanations based upon known ideas and research. Practice questions and/or practice exams are a prime example of formative evaluation and the use of formative evaluation can help ensure students are learning and to improve instruction before the conclusion of a course (Caputi, 2010). While other forms of formative evaluation are available, practice questions have an added benefit of being associated with stronger learning through retrieval practice. A simple quiz after a lecture is an example of retrieval practice and produces better learning and remembering as opposed to merely rereading notes or text (Brown et al., 2014). This improved learning is felt to be the result of strengthened retrieval routes in the mind. Retrieval testing also lets learners know what is known and not known, and recalling information then causes the brain to reconsolidate memory and make connections to already known information and allows for easier recall in the future (Brown et al., 2014). Practice questions in the classroom can also be beneficial in providing the feedback that is needed when students generate an answer that is incorrect to prevent any harm in learning (Metcalfe & Kornell, 2007).

At the conclusion of the semester, focus groups were conducted involving those students who elected to participate. There were three focus group opportunities available. One focus

group was for first semester students only, another was for third semester students only, and finally, the third option allowed for both first and third semester students to attend. The focus group allowed for descriptive data to be obtained regarding student perceptions of generating self-explanations as it relates to academic achievement. The focus group offered a convenient method for assisting in validating the quantitative data and aiding in answering the proposed research questions.

Data Collection

Quantitative

The demographic questionnaire and end-of-exam survey results were collected and quantified as appropriate. However, the main quantitative data points for the study were unit exam grades and final exam performance on assigned units. At the conclusion of the semester, unit exam grades and final exam performance were collected and analyzed for all participants. The unit exam grades and final comprehensive exam grades can be demonstrative of knowledge transfer of information from the assigned units.

The ADN program selected for the site of this study uses a computer-based testing software for administration of all exams in the program. The software allowed for access to each participant's unit exam grade. In order to assess for exam performance on the comprehensive final exam on assigned units, the testing software allows for categorizations of questions. The categorization of questions was valuable on unit exams in the first semester nursing course, when on one lecture the instructor forgot to give practice questions, and the testing software allowed grades to be calculated on all other material on the unit exam and final exam that did receive practice questions. After the final exam was constructed by the faculty team, the researcher compared each question on the exam to the course calendar and categorized the question with the

appropriate unit. Following the completion of the exam, the testing software allowed reports to be created on participants to see how each performed on the questions associated with each unit.

Confidentiality of all student participants' grades, surveys, and demographic information were maintained and no identifying information has been included. All documents associated with the study were secured in either locked files and/or on computer(s), which are password protected. Only the researcher and the instructor for the course had access to the students' practice question answers and self-explanations. None of these answers or self-explanations were included in the written narrative of this research study.

Qualitative

Qualitative information was collected following the completion of the comprehensive final exam. As this study aims to be an explanatory sequential mixed methods study, the qualitative information aimed to build upon the quantitative results (Creswell, 2014).

A total of three focus groups were conducted, with each lasting approximately 30 to 60 minutes. The first semester nursing students had two options for attendance, and the third semester students had two options for attendance, with all focus groups occurring after the student's final exam was concluded. The focus group was conducted face-to-face in a private classroom in the Health Science building of the community college campus to allow for privacy, quiet surroundings, and free of distractions. The focus group was audio recorded and transcribed.

The focus group interviews were semi-structured interviews with open-ended questions. By using open-ended questions with a semi-structured plan, the interview could be guided toward the research goals and questions, and at the same time assess for themes. The aim of the questions was directed toward the students' prior knowledge base, outcomes of the students in

the theoretical nursing course, and how generating self-explanations is perceived by the participants. (See Appendix C for the pre-written questions and interview protocol.) It is important to note that while there are six pre-written questions established for the focus group, based upon the responses from the participant additional questions were asked to seek clarification or to see further data, if needed and warranted. The utilization of a focus group also elicited responses as participants elaborated on answers provided by other participants. These additional questions occurred spontaneously during the course of the focus group. Every effort was made to adhere to the pre-written focus group protocol questions; however, to provide a quality study, additional answers to questions were sought in answering the research questions.

Once again, confidentiality of the participants and focus group data were maintained throughout the study. The use of a private classroom, the use of a password protected computer to store audio recordings, and deletion of audio files from the recorder following transfer of files to the computer allowed for confidentiality to be maintained. The transcripts of the audio recordings were stored on a password protected computer and through data file storage that is protected. The names of the participants were changed and included first names only to further ensure privacy and confidentiality.

Data Analysis

Quantitative Data

The statistical software SPSS was used to conduct the statistical analysis of the quantitative data for this study. Participants' unit exam grades and final comprehensive exam grades were input into SPSS. Categories and groups were established from the demographic questionnaire for research question 1: "Is there a relationship between demographic variables and generating self-explanations?" These categories include age, ethnicity, grade point average,

and prior nursing/clinical experience, including number of years. For the prior nursing/clinical experience, a code of “1” was used if a participant answered “yes” and a “0” was used if the participant answered “no” to this question. A numeric value was assigned for the varying ethnicities and the age ranges. If the data from a repeated measures ANOVA presented a relationship between demographic variables and exam grades, the identified demographic variables became covariates for the study.

A repeated measures ANOVA was used in order to answer research question 2: “Is there a significant difference in knowledge transfer on unit and final exams for nursing students who practice the use of generating self-explanations on practice questions more throughout the semester compared to those who practice less?” The designation of a numeric “1” or “0” was used to signify whether or not a participant was assigned to generate a self-explanation on the practice questions for that unit. A repeated measures approach is needed because exam grades were taken at six different intervals (following each exam) throughout the course of the study. Each unit was also analyzed through a repeated measures ANOVA at two levels (one for the unit exam and one for the final exam unit content score) in relationship to reported use and effort.

A repeated measures ANCOVA was also used answer the third research question, “Is there a difference in the academic achievement between first semester and third semester ADN students when generating self-explanations?” However, in differing from question 2, the focus was on the semester the participant was enrolled in the ADN program. Similarly, to research question 2, covariates were accounted for if needed. The demographic questionnaire allowed the participants to select the current stage of their enrollment in nursing school.

The independent variable for group A and group B was whether or not self-explanations were used on a particular unit. The dependent variables were the unit exam scores and the final

comprehensive exam score on areas associated with the assigned unit. As noted above, the possible covariates for the study included the identified demographic variables: age, ethnicity, grade point average, prior nursing/clinical experience, and years of experience.

Qualitative Data

Qualitative data were used to answer the fourth research question, “What are student perceptions of using self-explanations when answering practice questions?” Informed consent was obtained for participation in the study, focus group, and for audio recording of the focus group. Transcription of the interviews allowed for data analysis. Field notes of observations obtained during the interviews were transcribed and analyzed because these observations can be very important in the collection of qualitative data (Creswell, 2013). When completing the data analysis, a constant comparative approach was used.

As this study was mixed methods, for the qualitative section, a case study approach to qualitative inquiry is reasonable and logical. When using the case study approach, the data were first organized into files, then text read through, and initial codes formed (Creswell, 2013). Next the data were described, then data and codes were placed into categories and aggregated to develop themes and patterns. A direct approach and naturalistic generalizations were used to interpret the data (Creswell, 2013).

Holistic or in-vivo coding of the transcripts and field observations was conducted. Holistic coding is when a single code is applied to a large amount of data, leading to an overall idea of contents and development of categories (Saldana, 2016). For in-vivo coding, the participant’s exact words and phrases were recorded and analyzed (Saldana, 2016). Both of these coding mechanisms allowed for the data to be categorized and aggregated to assess for themes and patterns.

Summary

The current study was an explanatory sequential mixed methods study focusing on generating self-explanations. The study participants were from an ADN program in Texas randomized into two groups and assigned to units in his/her respective theoretical nursing course. When assigned, students answered practice questions and validated answers generating self-explanations. Unit exam grades and final comprehensive exam grades were assessed to account for knowledge transfer. Participant demographic information was analyzed in relationship to the effect of self-explanations. Qualitative inquiry was used to expand or confirm the data obtained during the quantitative phase and to gather descriptive data about the use of generating self-explanations in nursing education.

CHAPTER IV:

RESULTS

To address the purpose of this study, which is to test the use of generating self-explanations in nursing education as it relates to student academic achievement in theoretical nursing courses, quantitative and qualitative data analyses were performed. This chapter provides the results of these data analyses. First, the quantitative results are provided, followed by the qualitative data.

Quantitative Results

To answer the first three research questions associated with the study, a variety of quantitative analyses were conducted via SPSS statistical software.

Demographics

Research question 1 asked, “Is there a relationship between demographic variables and generating self-explanations?” To address this research question and to determine if demographic variables were needed as covariates for additional analyses for the research questions, a repeated measures ANOVA was conducted in SPSS for each of the demographic variables available. There were six levels of the repeated measures ANOVA. The levels were for each unit exam and the final exam, as each of these exams was taken at different times in the semester. In SPSS this was designated as exam time. The dependent variable for each demographic test was the exam score for each unit exam and the final exam score. Missing values were considered and accounted for in the SPSS system so as to not interfere with analysis. When running the repeated measures ANOVA for each demographic variable, sphericity was not

met with Mauchly's Test indicating $p < .05$; therefore, Greenhouse-Geisser was used as a corrective measure (Field, 2009) for each of the tests.

Age. For the variable of age, participants were placed into six categories based on their reported age (see Table 2). Following this categorization, a repeated measures ANOVA was conducted at the six levels (exam time). When looking at the effect of exam time alone, no significance was seen, ($F(4, 380) = 1.62, p > .05$). When looking at exam time in combination with age, again, no significance was observed, ($F(34, 380) = 1.17, p > .05$). For the main effect of age, there was no significance ($F(8, 90) = .867, p > .05$). The following descriptive statistics were noted for age.

Table 2

Mean Scores for Ages

	Test 1	Test 2	Test 3	Test 4	Test 5	Final
All Categories (n=99)	79.1162	78.9555	77.2823	81.1736	79.9888	78.96
Age 18-20 (n=10)	80.5060	82.9650	80.3580	80.9500	81.9070	78.50
Age 21-25 (n=33)	78.6191	78.7358	78.2070	82.1052	78.7282	79.42
Age 26-30 (n=17)	79.5065	77.5006	75.0082	82.9894	83.5741	80.41
Age 31-35 (n=12)	80.0175	77.5675	75.8583	80.5825	82.5992	77.67
Age 36-40 (n=17)	79.5418	79.9735	79.2224	80.3424	79.3500	78.65
Age 41-45 (n=5)	75.1060	76.6440	72.8640	76.4280	75.3680	75.00
Age 46-50 (n=2)	73.3900	84.3800	75.0000	76.7850	67.7400	77.00
Age 51-55 (n=2)	81.6700	74.5750	70.0000	79.5450	76.7850	79.50
Age Over 55 (n=1)	83.3300	79.6600	80.0000	78.7900	75.0000	87.00

As observed in the table, the descriptive statistics note close means between exam scores and age groups, with exam scores increasing and decreasing throughout the six levels (or exam times). It was also discovered that for all age groups there was a decrease between test 2 and test 3, except

for the one student in the over 55 category, and that all groups improved exam scores between test 3 and test 4 for except for the over 55 category. With no significance observed for the main effects or interactions effects, age was not used as a covariate for the study.

Ethnicity. Ethnicity of the participants was examined in similar fashion to age, with participants being categorized according to reported ethnicities. For the main effect of exam time, no significance was observed, ($F(4, 365) = 2.23, p > .05$). The same was true for the main effect of ethnicity, ($F(5, 87) = .375, p > .05$). The interaction effect of exam time and ethnicity also yielded no significance ($F(21, 365) = 1.312, p > .05$). Table 3 below indicates the mean averages on the exams for the different ethnicity categories in the study.

Table 3

Mean Scores for Ethnicity

	Test 1	Test 2	Test 3	Test 4	Test 5	Final
All Categories (n=93)	79.2360	78.8531	77.1646	80.8661	79.8863	79.01
White/Caucasian (n=68)	79.6366	78.9790	77.7151	81.3453	80.1599	79.01
Black/African American (n=7)	79.4786	79.4571	81.3571	80.4814	77.0814	79.57
Asian (n=1)	70.000	66.1000	84.6200	81.8200	80.3600	76.00
Hispanic/Mexican American (n=7)	79.2229	79.2057	71.4986	80.8743	79.0800	77.14
American Indian (n=1)	66.6700	72.8800	76.9200	86.3600	82.1400	81.00
Mixed Race (n=9)	78.4533	79.2389	73.3500	76.8222	80.3256	80.11

As in the case with the age categories, the mean exam scores were relatively close in value and increased and decreased with various exams and age groups. Therefore, due to these descriptive statistics and because ethnicity demonstrated no significance for main effects and/or interaction effects, it was not used as a covariate in the study.

Grade point average. The same procedure was conducted for the categories of grade point average. The following mean exam scores were noted for the GPA categories in the study.

Table 4

Mean Scores for Grade Point Average

	Test 1	Test 2	Test 3	Test 4	Test 5	Final
All Categories (n=82)	78.8209	79.2660	77.1973	80.8689	80.2018	78.73
GPA 2.0-2.5 (n=2)	84.6800	84.3750	77.3450	79.4650	79.8400	85.00
GPA 2.51-3.0 (n=21)	74.7238	74.6643	70.7824	79.8919	78.3405	78.00
GPA 3.01-3.5 (n=37)	79.4770	80.9827	78.8673	81.0786	81.0595	78.70
GPA 3.51-4.0 (n=22)	81.0955	80.3068	80.4986	81.5764	80.5691	78.91

No significance was seen for the main effect of exam time ($F(4, 342) = 1.40, p > .05$).

The main effect of grade point average did note a significance ($F(3, 78) = 5.05, p = .003$) indicating that a participant's prior GPA was related to exam scores. Post hoc analysis noted significance between those participants in the GPA category of 2.51-3.0 and 3.01-3.5 and for participants with 2.51-3.0 and 3.51-4.0, with lower exam scores indicated for the students with a 2.51 to 3.0 grade point average.

The interaction effect of exam time and grade point average also noted significance ($F(13, 342) = 1.85, p = .034$), suggesting that a participant's GPA and when the exam was taken were related to the exam score. However, when within-subject contrasts were analyzed, there was only one level instance where significance was observed for exam time and the interaction of grade point average and that was between 3 and level 4 ($p = .005$). When examining the descriptive statistics, between test 3 and test 4, mean exam scores increased across all GPA categories. While this effect was noted to be significant, the partial eta squared value for the interaction effect of exam time and GPA was .066, which is not indicative of a meaningful effect. Due to these considerations associated with the descriptive statistics and effects, grade point average was determined to be not significant and was not a covariate for data analysis associated with other research questions.

Prior experience. The next demographic variable analyzed was whether the participants reported any prior experience in healthcare. Tests were conducted in the same manner as the other demographic variables. Table 5 below displays the descriptive statistics for prior experience in relationship to exam scores.

Table 5

Mean Scores for Prior Experience

	Test 1	Test 2	Test 3	Test 4	Test 5	Final
All Categories (n=98)	79.1499	78.9001	77.3535	81.2366	80.0973	78.91
No-Prior Experience (n=27)	81.4085	78.7930	80.3015	81.7656	78.1430	77.70
Yes-Prior Experience (n=71)	78.2910	78.9408	76.2324	81.0355	80.8406	79.37

Inferential statistics noted that for the main effect of exam time, significance was observed ($F(4, 410) = 3.20, p = .011$) but only for level 3 vs. level 4 ($p = .001$), and for level 4 vs. level 5 ($p = .030$). Descriptive statistics support this idea with mean exam scores showing improvement between test 3 and test 4, and then decreasing between test 4 and test 5. The partial eta squared value was .011 for this effect, again not suggestive of a meaningful effect. Significance was not seen for the main effect of prior experience ($F(1, 96) = .289, p > .05$). The interaction effect for exam time and prior experience showed a significance ($F(4, 410) = 4.28, p = .002$). Again, when examining the within-subject contrasts for the interaction of exam time and prior experience, significance was not seen at all levels. It was only observed for level 1 vs. level 2 ($p = .043$) and level 2 vs. level 3 ($p = .021$). A value of .002 was the partial eta squared value for the interaction effect, which is a very low meaningful effect. When considering all inferential and descriptive data, it is felt that prior experience was not needed as a covariate for the study.

Type of experience. In a follow-up as to whether or not students had prior experience, the type of experience the students reported was analyzed. The following descriptive statistics were seen for the demographic variable of type of experience.

Table 6

Mean Exam Scores for Type of Experience

	Test 1	Test 2	Test 3	Test 4	Test 5	Final
All Categories (n=97)	79.1268	79.1139	77.2927	81.1727	80.1463	79.00
None (n=24)	81.3183	80.1450	79.8192	81.3988	77.5537	77.58
School Clinicals (n=16)	76.5963	77.9162	77.1994	81.6688	81.9744	79.31
Job (n=28)	82.3136	81.3732	79.9600	81.2725	80.4682	80.36
Clinicals and Job (n=29)	75.6324	76.7400	72.6779	80.6155	80.9724	78.69

The main effect for exam time showed significance ($F(5, 420) = 5.04, p = .000$) for level 3 vs. level 4 ($p = .000$), with mean averages improving between test 3 and test 4. The partial eta squared value for this effect was .051. Significance was also seen for the main effect of type of experience ($F(3, 93) = 2.73, p = .049$), with .081 representing the partial eta squared value.

Bonferroni post hoc analysis shows significance for type of experience between the categories of job and clinicals and job, with higher exam scores noted for those categorized as job only. For the interaction effect of exam time and type of experience, significance was observed ($F(14, 420) = 3.30, p = .000$) with a partial eta squared of .113, suggesting the type of experience a participant held in relation to when the exam was given was significant to exam scores.

However, as in prior tests, the significance was not seen at all levels for this interaction, only for level 3 vs. level 4 ($p = .01$). Descriptive statistics support this idea, with exam scores improving from test 3 to test 4 in all types of experience categories. Again, due to poor meaningful effect

sizes, and a lack of significance throughout all levels, it was determined to not include type of experience as a covariate in the additional statistical analyses.

Years of experience. The final demographic variable analyzed was the number of years of experience in the healthcare field. Descriptive statistics for years of experience are displayed in Table 7 below:

Table 7

Mean Exam Scores for Years of Experience

	Test 1	Test 2	Test 3	Test 4	Test 5	Final
All Categories (n=99)	79.1162	78.9555	77.2823	81.1736	79.9888	78.96
None (n=25)	81.4204	80.0644	79.8764	81.4284	77.0968	77.52
1 month to 1 year (n=22)	80.2345	82.2986	77.8182	82.6118	82.2945	79.23
1 to 2 years (n=17)	76.4229	74.0647	75.2635	80.3247	81.6076	80.00
2 to 3 years (n=12)	77.8242	79.9392	77.7367	82.6233	84.0733	79.58
3 to 4 years (n=3)	79.0667	78.3667	69.6500	80.8633	74.5000	80.33
4 to 5 years (n=5)	76.0540	79.1440	75.0480	78.7120	80.6660	79.80
Over 5 years (n=15)	78.7520	77.0147	76.3687	79.3247	77.1967	78.73

The main effect for exam time yielded significance ($F(4, 399) = 4.97, p = .000$), with .051 representing the partial eta squared results. This again, suggests that the time in which the participant took the exam affected the exam scores. However, the significance was seen for level

2 vs. level 3 ($p = .011$) and for level 3 vs. level 4 ($p = .000$). The main effect of number of years of experience was not significant ($F(6, 92) = 1.09, p > .05$). The interaction effect for exam time and number of years of experience was significant ($F(26, 399) = 1.86, p = .007$) but only for level 5 vs. level 6 ($p = .049$). A value of .108 was the partial eta squared for this interaction effect indicating a low meaningful effect for when participants take the exam in relation to the number of years of experience held by the participant. When considering all data available, years of experience was not needed as a covariate for other analyses.

Summary. For the first research question, it was found that demographic variables have not demonstrated a meaningful significant relationship to the grades earned on exams. Therefore, since no meaningful significance was found between the grades and the demographic variables, no relationship between the variables and generating self-explanations can be established. However, even though a relationship between demographic variables and generating self-explanations could not be established, other statistical results cannot be overlooked as it pertains to generating self-explanations. Most notably, the descriptive statistics and significance observed in many of the demographic categories between level 3 and level 4. This is important to note because between level 3 and level 4 (or test 3 and test 4) is when the research design called for all participants to begin generating self-explanations. Thus, to observe mean exam scores increasing in multiple demographic categories between test 3 and test 4 is a very encouraging sign for the possible effectiveness of this strategy in nursing education.

Knowledge Transfer

In order to answer research question 2, “Is there a significant difference in knowledge transfer on unit and final exams for nursing students who practice the use of generating self-explanations on practice questions more throughout the semester compared to those who practice

less?,” a repeated measures ANOVA was conducted. The following null hypothesis was generated in relation to this research question: There is no significant difference in knowledge transfer on unit and final exams for nursing students who use generating self-explanations more to validate an answer with practice questions compared to those who use generating self-explanations less. To answer this research question and test this null hypothesis, multiple tests were implemented to examine student performance from unit 1 to the comprehensive final exam. Then, each unit exam was analyzed in comparison to the score on the final exam as a way of evaluating short-term and long-term knowledge retention. The results of these tests are discussed below.

All exams. First, a repeated measures ANOVA was conducted at 6 levels (exam time in SPSS) as each unit exam and final exam was taken at a different time in the semester, with the dependent variable being the exam grades. The between-factors (or groups) analyzed in this situation were the randomized Group A or Group B designation each participant received. A total of 52 participants were assigned to Group A and 47 participants to Group B. There was not a 50/50 split of the participants due to the withdrawals of students from the classes. The design of the study allowed for a comparison between the two groups, as each group had different assignments as it related to the units and generating the self-explanations.

For unit 1, no practice questions and/or self-explanations were conducted. For unit 2, those in group A completed practice questions with a self-explanation while those in Group B answered only multiple-choice practice questions. The same procedure was followed for unit 3. For unit 4 and unit 5, all students received practice questions and were asked to generate self-explanations to their answers. No practice questions were given prior to the final exam. The

following hypotheses were made regarding the exam grades for the group assignments on each of the unit exams:

1. Unit 1 – Group A = Group B
2. Unit 2 – Group A > Group B
3. Unit 3 – Group A > Group B
4. Unit 4 – Group A = Group B
5. Unit 5 – Group A = Group B

A repeated measures ANOVA was conducted. Sphericity was not met through Mauchly's Test of Sphericity ($p < .05$); therefore, Greenhouse-Geisser was used as a correction. Results indicate that significance was seen on the main effects for exam time alone ($F(4, 409) = 4.85, p = .001$), with significance for level 2 vs. level 3 ($p = .044$) and level 3 vs. level 4 ($p = .000$). A value of .048 as the partial eta squared indicates a very low meaningful effect. The main effect for the groups (Group A or B) was not significant ($F(6, 22) = .290, p > .05$). The interaction effect of exam time and group was not significant ($F(4, 409) = 1.033, p > .05$). Therefore, no significance was found between exam grades and the group to which each participant was assigned.

To expand on this area of the project, Table 8 provides descriptive statistics noting the mean scores for each unit in relation to the group assigned. Though the mean exam scores do not support the hypotheses for each unit as outlined, the descriptive statistics illuminate a similar feature seen in the demographic variable analyses with an increase seen in the mean exam score between test 3 and test 4 for both groups and the combined scores. It should also be noted that the highest exam scores were earned for test 4 (Group A) and test 5 (Group B), at which time all participants in the group were generating self-explanations.

Table 8

Mean Exam Scores for Group A and B

	Test 1	Test 2	Test 3	Test 4	Test 5	Final
All Groups (n=99)	79.1162	78.9555	77.2823	81.1736	79.9888	78.96
Group A (n=52)	78.9369	78.4948	77.0521	81.9631	79.1287	78.46
Group B (n=47)	79.3145	79.4651	77.5370	80.3002	80.9404	79.51

Unit grades. To further analyze the effect of generating self-explanations on knowledge transfer, each unit was analyzed by examining the grades (dependent variable) of each participant on the unit exam and the corresponding score on the final exam for that unit. It is felt that knowledge transfer can be assessed in two forms with this test, short-term transfer with the unit exam score and long-term transfer for the final exam score, as it was taken at a different time.

A repeated measures approach was used for each unit, with two levels being considered, again, designated as exam time in SPSS. Level one was the unit exam and level two was the content associated with that unit on the final exam, since the unit exam and final exam were taken at different points in the semester. The between-subject factor for each repeated measures ANOVA was the reported use on that designated unit. The covariate for these tests on the individual units included the reported effort on using the self-explanations when answering practice questions. A consideration for these tests, however, is the incomplete data received from students regarding use and effort. Students did not always report use and/or effort for each unit. The missing values were labeled in SPSS to help with this issue in data calculations.

Sphericity assumptions were not a factor in this case because there were only 2 levels, and therefore a correction test is not needed (Field, 2009). Table 9 below lists descriptive

statistics for unit grades on the unit exam and the unit content on the final with the associated reported use on the units, while Table 10 is the same with effort considered as a covariate. Tables 11-15 consider the main effects for exam time, use, and effort, and then associated interaction effects. Also included in these tables are the number of participants who were assigned self-explanations for the unit. This is important to note, because participants strayed from the study design and used self-explanations when not assigned, while others did not use the self-explanations when they were assigned. This factor needed consideration when interpreting the overall results of the study, hence, the reason it is included in the tables.

Table 9

Mean Scores for Reported Use

	Total	Reported No Use	Reported Use
Unit 1 Exam	n/a	n/a	n/a
Unit 1 Final	n/a	n/a	n/a
Unit 2 Exam	79.1411 (n=73)	76.5962 (n=13)	79.6925 (n=60)
Unit 2 Final	76.7127 (n=73)	75.2138 (n=13)	77.0375 (n=60)
Unit 3 Exam	77.7263 (n=81)	73.8000 (n=17)	78.7692 (n=64)
Unit 3 Final	77.1828 (n=81)	76.3488 (n=17)	77.4044 (n=64)
Unit 4 Exam	81.3453 (n=75)	81.0143 (n=7)	81.3794 (n=68)
Unit 4 Final	80.2140 (n=75)	81.2029 (n=7)	80.1122 (n=68)
Unit 5 Exam	79.5395 (n=66)	82.9233 (n=6)	79.2012 (n=60)
Unit 5 Final	81.3578 (n=66)	75.6067 (n=6)	81.9330 (n=60)

Table 10

Mean Scores for Reported Use with Effort as Covariate

	Reported No Use	Reported Use
Unit 1 Exam	n/a	n/a
Unit 1 Final	n/a	n/a
Unit 2 Exam	76.359	79.744
Unit 2 Final	74.294	77.237
Unit 3 Exam	74.384	78.614
Unit 3 Final	77.297	77.152
Unit 4 Exam	81.146	81.366
Unit 4 Final	81.613	80.070
Unit 5 Exam	83.380	79.155
Unit 5 Final	75.278	81.966

Table 11

Repeated Measures ANCOVA for Main Effect-Exam Time

Unit	Number Assigned	Number Who Reported Use	Degrees of Freedom	F Value	Significance
Unit 1	0	0	n/a	n/a	n/a
Unit 2	52	60	1,70	.413	.523
Unit 3	52	64	1,78	.630	.430
Unit 4	99	68	1,72	.878	.352
Unit 5	99	60	1,63	.008	.931

Table 12

Main Effect-Use

Unit	Number Assigned	Number Who Reported Use	Degrees of Freedom	F Value	Significance
Unit 1	0	0	n/a	n/a	n/a
Unit 2	52	60	1,70	2.96	.090
Unit 3	52	64	1,78	1.23	.271
Unit 4	99	68	1,72	.076	.784
Unit 5	99	60	1,63	.155	.695

Table 13

Main Effect-Effort

Unit	Number Assigned	Number Who Reported Use	Degrees of Freedom	F Value	Significance
Unit 1	0	0	n/a	n/a	n/a
Unit 2	52	60	1,70	2.47	.121
Unit 3	52	64	1,78	8.60	.004
Unit 4	99	68	1,72	2.17	.145
Unit 5	99	60	1,63	.004	.950

Table 14

Interaction Effect-Exam Time and Use

Unit	Number Assigned	Number Who Reported Use	Degrees of Freedom	F Value	Significance
Unit 1	0	0	n/a	n/a	n/a
Unit 2	52	60	1,70	.018	.893
Unit 3	52	64	1,78	2.52	.116
Unit 4	99	68	1,72	.190	.664
Unit 5	99	60	1,63	5.02	.029

Table 15

Interaction Effect-Exam Time and Effort

Unit	Number Assigned	Number Who Reported Use	Degrees of Freedom	F Value	Significance
Unit 1	0	0	n/a	n/a	n/a
Unit 2	52	60	1,70	1.08	.302
Unit 3	52	64	1,78	.871	.353
Unit 4	99	68	1,72	.810	.371
Unit 5	99	60	1,63	.241	.625

Analyses of these data reveal the only significance was seen on the interaction effect between exam time and reported use on unit 5 ($p = .029$). For unit 5, the following mean scores were noted in the interaction effect of unit 5 use and unit 5 grades. For those who reported no use of generating self-explanations, the mean was 83.380 on the unit 5 exam, and the mean was 75.278 on final exam content associated with unit 5. For the 60 students who reported use of

generating self-explanations for unit 5, the mean score on the unit exam was 79.155, with a mean score of 81.966 on the final exam content. The only other point of significance was the main effect for effort on unit 3 ($p = .004$). No other significance was seen for unit 3. The reported effort of the students was accounted for in all analyses.

While no significance was found on the unit exams, and with close means observed between unit exam scores and unit content on the final exam, it is argued that this could be indicative of long-term knowledge retention. Because there was not a significant difference between the scores, it can be interpreted that how a student performed on unit content was similar to how the participant performed on that same content week(s) later on the final exam.

Summary. Based upon the analyses looking at exam grades from test 1 to the final, and with each individual unit, no significance was found between the use of generating self-explanations or using only multiple-choice practice questions. Therefore, the null hypothesis is not rejected. However, even though no significance was found, merit can still be observed in this learning strategy, in that students are retaining knowledge as evidenced by the similar exam scores on unit specific content.

Semester of School

A repeated measures ANCOVA was used to answer research question 3, “Is there a difference in the academic achievement between first semester and third semester ADN students when generating self-explanations?” The following null hypothesis was developed in relation to this research question: There is no significant difference in the academic achievement between first semester and third semester ADN students when generating self-explanations. To test this hypothesis, a repeated measures ANCOVA was conducted analyzing the differences between Group A and Group B, with a covariate of the reported semester of nursing school.

Students were categorized into two classifications, either first semester students or third semester students. Following this classification and categorization, the repeated measures ANCOVA was conducted using six levels for each unit exam and final exam (exam time) with grades being the dependent variable. The groups were assigned to Group A and Group B. Greenhouse-Geisser was used as a corrective measure for sphericity violation.

Results indicate there was a significance noted for the main effect of exam time ($F(5, 439) = 9.745, p = .000$) with a partial eta squared valued of .092, and only seen for level 4 vs. level 5 ($p = .001$). The main effect for semester of nursing school designation was also significant ($F(1, 96) = 13.221, p = .000$) with .121 noted as the partial eta squared value. However, the main effect for the group assignment was not significant ($F(1, 96) = .382, p > .05$).

When looking at interaction effects, significance was seen between exam time and the semester designation ($F(5, 439) = 15.891, p = .000$). A value of .142 was the partial eta squared for this effect. The results for interaction between exam time and group demonstrated no significance ($F(5, 439) = 1.17, p > .05$). To examine the interaction effects more closely, the within-subject contrasts were analyzed, and the exam time and semester interaction was only significant for level 3 vs. level 4, and level 4 vs. level 5, with both having a significance value of .002. To amplify this idea, the following means (Table 16) for each unit exam and final exam are listed in association with the assigned group (Group A or B) and the covariate of whether the student is designated as a first semester or third semester student.

Table 16

Mean Exam Scores for Group A and Group B with Semester as Covariate

	Test 1	Test 2	Test 3	Test 4	Test 5	Final
Group A	78.898	78.452	77.009	81.952	79.145	78.465
Group B	79.357	79.512	77.585	80.313	80.922	79.507

The descriptive statistics note close means, with higher exam scores again seen between test 3 and test 4, and the highest exam scores for test 4 for Group A and for test 5 for Group B. With no significance seen at all levels and a low meaningful effect seen with the partial eta squared value, the null hypothesis is not rejected for this hypothesis.

Summary. In accounting for the semester of nursing school, whether the participant is a first semester or third semester student, in relationship to assigned group and academic achievement on exams, no meaningful significance was found. As in similar analyses, when accounting for the semester covariate the improved exam scores between test 3 and test 4 among both groups cannot be overlooked. As stated previously, at this time (between test 3 and test 4) is when all participants began generating self-explanations to the practice questions.

Quantitative Results Summary

In summary, the first three research questions were answered through quantitative data analyses. First, demographic variables did not note a meaningful significance in relationship to participants' exam grades. Second, when examining the effects of the amount generating self-explanations has on knowledge transfer on unit exams and final exams, no significance was found based upon the assigned group or reported use. When looking more closely at the individual units to answer this research question, no significance was found, which is interpreted to be a positive in support of this learning strategy. This is due to the idea that if exam scores did not change from the unit to the final at a significant level, then it can be argued that knowledge is retained. Finally, when considering the semester of nursing school and the academic achievement associated with generating self-explanations, no significance was found. While inferential statistics found no significance, the descriptive statistics, can assist in providing some insight into the impact this learning strategy had on grades. Most importantly, seen in many

analyses and in many groups and/or categories, there was grade increase between test 3 and test 4 when all students were to generate self-explanations on the practice questions. However, consideration must be given to the fact that participants in the study did not follow study design and could have impacted the overall results.

Qualitative Results

In order to answer the fourth and final research question of this study, “What are student perceptions of using self-explanations when answering practice questions,” focus groups were conducted to collect descriptive data from study participants. See Appendix C for focus group questions. The questions for each focus group allowed for a variety of data to be extracted which, in turn, provided student perspectives on the use of self-explanations with practice questions. The transcripts of the focus groups were then transcribed and coded using in-vivo and holistic coding techniques. Four major themes emerged: (a) activity design, (b) individual learners, (c) method of self-reflection, and (d) theory and practice.

Activity Design

From the coding process, a theme emerged of activity design. This theme is in reference to the set-up and design of administering the practice questions. The basis for this theme is in relation to frequent mentions of the time, the cognitive level of the practice questions, and the feedback from the instructor. Each of these subcategories will be discussed as it relates the design of the activity to the student perceptions of the self-explanations.

Time. In every focus group, the idea of time was mentioned. Time was discussed as it related to the time allowed for completion of the activity, as well as the timing of when the activity was conducted. On occasion, some students referenced these concepts together as an observation and/or perception of the study.

Focus group participants frequently mentioned the feeling of being “rushed” to complete the practice questions and “we didn’t get enough time, you just kind of jotted something down before they started going over the answers.” Students noted the frustration that accompanied this “rushed” feeling “. . . the frustration was that so many times I felt rushed doing the test afterwards because the teachers didn’t leave time . . .” and “. . . I felt really rushed, so I didn’t get the full benefit. What I would do was, I would go through and answer the questions and then would go back and put the explanations, because I knew that very seldom did I get time to put down on paper all the rationalizations.” In reference to the faculty planning the time allotment for the activity, another student noted, “Need to give you time to actually think like why you chose that, instead of since time is already up you just have to circle.”

Some students had differing opinions on when the questions should be distributed and/or conducted and the associated benefits. For example, “. . . I don’t know how beneficial it was to do it immediately thereafter as opposed to later.” While another student liked the questions right after, noting “. . . those questions out at the end of each lecture, and it’s still fresh in your mind, and so if you do it right then, right after the lecture, then it helps you determine when you get home what you need to focus on.” Another student wished for the questions to be distributed as a pre-test and a post-test. A couple of students preferred the practice questions to be conducted throughout the lecture as it progressed, as a form of “knowledge checks.”

On occasion, students mentioned both of these timing issues. As one student noted “I felt like it was all about timing too, it was like you have sat through this lecture for 2, 2 and 1/2 hours and now I have to do this and so I would I rush through it. You know I think it would have been more beneficial if I hadn’t done that.” Another student remarked “. . . time was definitely an

issue. Because it might be a long lecture, or whatever, so they were trying to hurry and get everybody out of there.”

Cognitive level. In reference to cognitive level of the questions, many comments were made by focus group participants regarding the difficulty of the question and the level of the question in relationship to his/her placement in the nursing courses. This relates to the activity design theme through the idea of the planning needed in selection of the practice questions.

Specifically, participants remarked about the “common sense” or they “know this” knowledge type questions. This was evidenced by such statements as “. . . then there are some questions that there was no, there wasn’t really, an answer to that question, it was just the right answer.” Regarding the knowledge level questions, another student remarked “. . . there is not a that’s why . . .” and “. . . it’s kind of like why I would I need to rationale that, it is what it is.” Students note the difficulty on writing a rationale to a knowledge question, “On writing the rationales, it’s very difficult to write the rationale on a black and white knowledge question, it’s much easier to give a whole lot of information on reasons why if you have got more, the more you have to work with,”

Students wanted more questions at the level and style of NCLEX-RN© questions or at the application level, feeling like complex questions would “. . . encompass more, more learning.” One student noted “. . . maybe if we had been exposed to more of those like NCLEX style questions based on the curriculum I think it would help me be a little more successful.” This was echoed by another student “I do kind of wish that the questions we got were a little bit harder, more like the tests. I mean I appreciated that we did get to see how much information we retained but if they were closer to how they were on the test or what we are going to see on NCLEX, I feel like that would be very, very helpful.” Another student noted, “I kind of I wish

there was more, like applying questions, rather than knowledge questions. I do feel like knowledge questions do help like solidify the basis of understanding, but I feel like applying really helps stick into my brain. . . .” Also said was, “So if they could make, instead of saying, we are going to do 6 questions, they could just make 3 really hard complex questions, give us a little more time to think them through and then use each question as a teaching tool, I think we would retain a lot more from real hard questions as opposed to what is the potassium level norms, or something, you know.”

The semester of nursing school became relevant to some students in answering the practice questions, so far as requesting “. . . the questions more directed to like the level of schooling that you’re at.” The level of school mattered in the approach students took to answering the questions, as seen through remarks such as “We are also looking at answering those questions as nursing 1 students” and “. . . they expected us to stay in that box of nursing 1 with information that they had taught us.” Or “They are looking for nursing 1 answers, not something you are going to experience in nursing 2 or 3.”

Instructor feedback. As part of the design of this activity, instructor feedback became a common topic among focus participants. There was discussion on the need for instructor feedback, along with the information provided in the feedback, and considerations for how it should be provided.

Receiving feedback from the instructors on what the correct answer was to the practice questions and the rationale behind the answers was mentioned frequently by students in all focus groups. For example, “I liked when the professors reviewed it with us and went over each of it and gave us the rationale.” Another student commented “. . . like I need to understand this, like I need, like I need it explained to me and sometimes they would be able to and other times it was

like refer to this in your book.” This feedback from the instructor was put to use by the students to further learning, “. . . then have the teacher go back with the answers and rationale and me writing down if I got it wrong, why it was wrong, that helped me more than trying to come with up why I picked the answer in the first place.” This was reiterated by another student with the statement “. . . well when they did the rationales, you know when the instructors would give the rationale then I could say okay, if my answer was incorrect why was I thinking that way and where was my thought process, so this is where I need to be leaning, and that way I could study effectively and correctly and not program the wrong information in my head.” Hearing the rationale from the instructor was helpful even if the student had the answer correct, “because we may have picked the right answer and not know why we picked, and so we really need to know why that is or try.”

Lack of a rationale had an impact on the study habits of students. For example, “The part of writing out the rationales still helped because you know why you picked that answer, but if you have it wrong, if you don’t have the feedback then you are going to have, you know, you are going to have to go figure out everything, this is what I thought, where is my thinking messed up? So you still you know, you go back to it and figure out what you did, but it’s really nice to have that rationale so that you can quickly determine where you went wrong instead of having to spend 2 hours of study time figuring out why you are wrong instead of moving forward to learning something new.” Also noted was “. . . and if you don’t get the rationale, you feel like well I kind of did that for no reason. . . .” and “When we did get explanations though, it did help but it wasn’t like we ever had an in-depth conversation on why a question was right or wrong.”

Not only did students discuss the need for feedback from the instructors, but they also elaborated on their interpretation of the instructor feedback. Multiple students remarked on

instructors not knowing the rationale behind an answer, “. . . because if they can’t come up with the answer, tell me why on a test they expect me to pass or whatever in order for me to become a Boarded Nurse and that makes me doubt. . . .” and “Because if they can’t give us their rationale for why that’s the right answer then how do they expect us to have our own rationale?” Experience of the instructors was also observed as a factor in the correct answer and rationale provided by the instructor and the impact this had on the understanding by the students, “Because I have, talking to the some of the professors that have been like, well this is like if you have had 10 years experience obviously you are going to know this, and I am like well I have 6 months experience.” Students seemed concerned with contradictory information provided by the instructors, as evidenced by the statement, “I think the only downfall to this would be that sometimes you have contraindicating like thoughts, you have a professor saying one thing and then a book saying something else, so it’s hard to, when I give a rationale and I have seen it in a textbook, I will be like, saw it in the NCLEX book and this is the right answer but this is what the professor said.”

Feedback on correct answers and rationales did not have to come in a verbal form. This was evidenced by the statement, “if the instructors don’t have the time to go through it maybe they could have the answer sheet and rationales on another paper that they could just hand out to everybody.” Another student remarked on this topic about posting the correct answers and rationales in a learning management system, “you are wanting that feedback so a posting would be really, really beneficial.”

Individual Learners

The next theme that emerged from the coding process was individual learners. This encompassed ideas revolving around the differing learning styles and preferences of the students. It also involves the perceptions self-explanations had on their learning.

Different learning styles. Throughout each focus group, students often remarked upon how each of them learned best. There was some commonality among them, most notably, whether the students preferred the self-explanations to be given in a written manner or a verbal manner.

Many preferred the written method for the practice questions and self-explanations. One student noted “. . . because writing helps me so much that I would go back and put the right answers and what I did wrong, a lot of times so I would remember.” This student further elaborated on this through this statement, “For me when I write it stays with me better. If we had a general discussion, I am not so sure how much I would have remembered. It takes that writing . . . so the writing really helped versus just having a discussion.” This was echoed by another student, “Pen to paper it helps, remember, recall.” Some noted the effect writing had on helping the student know “. . . where our thought process is . . .” and “. . . putting it on paper isolates it, for us to really look at what we are thinking about.” Writing also allowed the students with reinforcement of information, “I will write down my answers and go through it because that helps you reinforce everything.”

In contrast, others preferred to have group discussions for the self-explanations and the feedback from the instructors, “Because you are more likely, unless you have a photographic memory, you aren’t going to remember what you wrote down but you will remember more like, oh I was talking to this person about this and they said this and that stuck.” Group discussions

were a primary focus for some students, “All of us here, we worked together, and it was just like we talked the rationale out with one another as opposed to sitting there writing it and kind of bounced ideas off of each other and a lot of this information was new to us. I might have retained this bit of information from my reading, she might have retained something else and we would kind of be able to collectively come up with an answer.” Others noted, “...That’s how I learn is by talking it out with someone as soon as I get it and can talk it out with someone and can explain to them then I know it” and group discussions “makes you think deeper.” This was reiterated by another student, “You know when I have to explain something to somebody else, that is what I learn from and I feel like having that open conversation with your peers, you know, that helped me tremendously, that’s why group study helps me, because I feel like, yeah I may not know it’s the right answer but if I have to explain to you why it’s the right answer, then I have learned it.” Another comment was, “I think it was helpful just to talk, you know for the aspect of just talking about it in class, and actually going through the questions and rationales and that sort of thing, it kind of helped me to think about it more after the whole process, like after the class was over, it did help me.”

Perceptions on learning. Students discussed the impact the practice questions and self-explanations had on their learning. Specifically, the students addressed how these exercises affected critical thinking, approaches to questions, and the automatic process that was occurring in their minds.

After using the self-explanations, students became accustomed to developing these, “. . . I would say that it did help me like think of the thought process for like the test like, okay, and we got so used to it, that you would automatically do it and I think towards to the end, it would just be like okay why do I have to write it out, it was kind of like, it was a waste of time, because I

was already thinking it faster in my brain than I could write it out. But it did teach me to like do it, you know like think through it and stuff.” Another student agreed, “I got in the habit of just thinking of rationales, subconsciously, so I think it had a pretty big impact, especially towards whether I knew it or not, like, I was coming up with reasons as to why this was the right answer.” Some students stated they were already using this idea, but this added the element of writing it out, “I think for me, it was something that like you already do in your head, so like you read a question, and you see an answer choice, and in your head you are like, okay so contraindicated, this is why this isn’t right. And I think for me like writing it down, which was like easy because it was already something I was doing in my head, was helpful.”

Developing self-explanations allowed students to approach the practice questions in different ways. For example, “And just having to write, come up with a rationale that in itself helps you break the question down and think about different ways to answer it. You know, you have, it is more relaxing because you are not in exam situation, and then you can look at the questions, and see if it is things like you know if you can pick out a word from the question that matches the answer or and you know, one of your answers, you know just different ways to answer the question. They were, it was helpful.” Another noted the help it had with critical thinking, “Critical thinking, it helps develop critical thinking” and “this is the process for critical thinking.”

Method of Self-reflection

The third theme observed from the focus group was that the practice questions with self-explanations allowed the students to have a method of self-reflection. Two major concepts arose in developing this theme. First, students remarked about how reflecting back on these questions

and explanations aided in their studying. Next, students discussed how much learning actually occurred from getting questions wrong.

Study Ttool. Throughout all focus groups, multiple students noted how the exercises allowed for a method of “recall” and “focus” for studying. This allowed for students to know if they were on “the right track” and if their “thought process was going in the right direction. . . .” for the questions. One student noted, “It kind of helped me know where I needed to study too, when I got home, like I did poorly on these questions, I need to look at this first.” This was echoed by another student, “. . . I thought through each question when they gave them, so that like I would leave class and I would still be thinking about it, that kind of helped me to go into studying also after class.”

When discussing the self-explanations and the impact on learning new information, one student said, “I feel like they were beneficial to me because there were a lot of times that I would read the rationale and it may kind of trigger a new thought process for me to delve into that particular area a little deeper, maybe something that I didn’t catch in lecture, or something that you know this is just something that this is kind of understood, that we already have a good understanding but maybe I need to touch up on it or maybe need to refresh my memory. I definitely think it was beneficial in that aspect.”

Incorrect answers. Students frequently mentioned how getting questions wrong, aided in the overall learning process. Supportive statements of this idea include, “. . . when I got it wrong, I was able to underline what I got wrong and why I got it wrong, and wrote out next to it the correct rationale out beside it and was able to kind of mark out my rationale to see, you know, and look where I messed up in my thinking.” Another remarked about being wrong, “. . . you have to go back and re-train yourself which is unfortunate but it is also helpful because like

it can guide you rather than you just saying you are wrong.” Another student stated “. . . even if I don’t come up with the correct answer at least I can look at the rationale that is correct, and then go from there to determine if it was in fact, if I was way off or you know confused about a subject, it does help.”

The incorrect answers made impressions on the students. For example, one stated, “I felt like I learned better when I failed.” Another student agreed, “The ones that I would get wrong really stuck out in my mind, and that’s when I learned it, when I got them wrong.” A different student noted a similar response, “It’s the ones you got wrong that helped the most, they helped me the most, I don’t remember the ones I got right, the ones I got wrong, they stick.”

Theory and Practice

The fourth theme from the focus group relates to theory and practice. Major concepts associated with this idea include the discrepancy to ideas seen in practice versus what was discussed in the classroom and/or read in books. Next, concepts of how the practice questions and self-explanations can be applied to clinical practice.

NCLEX-RN© world and real world. This idea involves the multiple comments made across all focus groups with students noting the discrepancy between what they observed in the “real world” and what they observed in “NCLEX world.” Students remarked about the difficulty answering some questions and developing rationales due to this discrepancy. This was evidenced by “. . . where NCLEX world, it is what is, it is black and white, there is no gray, and it makes it hard to put the two together, I guess.” Another notes, “. . . you are like well I have seen this in the hospital and this is what I did in the hospital. And so obviously for the question in my head, that’s why that’s right, and so it’s hard to kind of separate in your head and with your rationales, your experience and stuff.” More specifically, students notice the difficulty as it

relates to application questions, “I think it’s harder when you get into more of like the applications, because you can, it is really easy to keep it like separate with like the knowledge based ones. And then the more you get asked about like your actions, it is more difficult to keep it separate.” The textbook information also presented difficulties when developing the self-explanations, “Or it presents one way in clinical and a totally different way in the textbook and so that’s hard too because you are like well I took care of a guy with bronchitis who had a barrel chest but it’s only for, or whatever you know what I mean. It’s like the clinical manifestations in the book are different because each patient is different so it’s hard to have like a standard like textbook presentation when you are seeing it different.”

Other students even remarked that prior clinical experience was a “hindrance” to developing explanations and answering questions correctly. For example, “I would say the only hindrance is that, you know speaking personally, is that you hear nurses and I know that I have heard nurses say well in nursing world it’s this but NCLEX world it’s this. So unfortunately we test right now in, you know, we have rationales and we test in NCLEX world, we don’t test in nursing world.” This hindrance was felt by other students, “To me it was a hindrance. I have been in the medical field for close to 15 years now and all of nursing school, my thought, knowledge that I had has been a very big hindrance to me. It is really hard to come in everyday and say okay I am a student, I know nothing and that’s what I basically have learned to do.” Another noted, “I definitely came to the harsh realization that the NCLEX hospital is much different than the one that I work in.” For another, basing answers off clinical experience was problematic, “I worked as a tech last summer, and last semester I was basing a lot of my answers on how I did my job, not the case, definitely not the case.”

Clinical practice. Some students noted the relevance these practice questions and self-explanations can have on one's clinical practice. For example, "There are some questions from the beginning of the semester that were on those sheets that still stick in my head, that stuff that I brought up in clinical, I would ask because I saw them on the sheet." Another student remarked, "As a nurse I think it is important for a test or in like clinicals, you have to be able to stand up for the answer you chose or the action you did, and so the rationales whether in clinicals or on tests is you're, you are standing up for what work you have put into it, why you didn't make a decision or why you picked an answer." Another remarked how the questions helped in clinicals, for example, "And understand stuff that was going on in clinicals, too"

Qualitative Results Summary

The qualitative data from the focus group provided rich data to answer the fourth research question relating to the perceptions of students using the self-explanations. Four major themes emerged from a variety of concepts and ideas. These themes ideas have provided the researcher with an understanding of student views, and considerations for future use and research.

CHAPTER V: DISCUSSION

A mixed methods approach was used to address the purpose of this research study, which was to test the use of generating self-explanations in nursing education as it relates to student academic achievement in theoretical nursing courses. This approach allowed for each of the four research questions to be addressed. This chapter provides a discussion of each research question and associated results, along with a discussion on the limitations of the study, implications for nursing education, and recommendations for future research.

Research Question 1

Analyses conducted regarding the relationship between demographic variables and generating self-explanations did not demonstrate any meaningful significance. The statistical tests for each of the demographic variables were analyzed in association with the grades on each exam. This approach was needed to determine if any of the demographic variables should be considered as covariates for the study. If significance was seen for the variable, then accounting for this in the grades for each participant would allow for a level field between the participants.

While results showed some possible significance for a few of the demographic variables (grade point average and areas related to experience), it was not observed consistently throughout the levels of the repeated measures test and partial eta squared results were low. Due to this lack of consistency and low meaningful effect sizes, the researcher believed that the demographic variables should not be labeled as being significant to the relationship of grades and considered as covariates for the study. Of note, descriptive statistics in almost all demographic

categories demonstrated the increase in exam scores between test 3 and test 4, the time in the study when all participants moved to generating self-explanations with the practice questions.

The results of these statistical tests can be related back to information regarding cognitive constructivism and the generation effect, which have formed the basis for this study. Peters (2000) suggests cognitive constructivism considers a learner's prior knowledge and that new knowledge will build upon the existing knowledge. This could be why slight significance was seen between the levels in the areas of grade point average and experience. The students have had their prior experiences with work and/or nursing school clinicals and they have been building new knowledge upon existing knowledge.

The focus group interviews provided a closer look at prior experience and can perhaps explain why significance was not seen at all levels. As noted in Chapter IV, results from the focus groups demonstrated ideas related to theoretical nursing and clinical practice. Specifically, students in the focus groups brought forth special attention to the ideas seen in practice versus ideas that are seen on exams and in the classroom and the disequilibrium between the two. Some research has noted that at least 30% of self-explanations are developed from integrating new information with old information (Chi et al., 1994). This leads one to wonder if perhaps these experiences were influencing the self-explanations, in turn, students grades in a positive and/or negative manner. Other limitations of the study (i.e., participant honesty and participation, study design, and personnel), discussed later in this chapter, must also be considered as to why no meaningful significance was observed.

Research Question 2

To answer research question 2, regarding the relationship between knowledge transfer on exam grades and generating self-explanations, a two-step approach was utilized. First, all exam

grades were evaluated in comparison to the assigned group for the participants to check for any significance, and none was found. The design of the study examined the exam scores for the unit exams and the comprehensive final exam, and the statistical results may have been impacted by the idea that generation effect may be more likely on delayed tests instead of immediate tests (Chen et al., 2016), producing no significance when analyzing the exam scores over the course of the semester.

Next, each individual unit was evaluated by looking at the unit exam score (short-term knowledge transfer) and the final score on unit content (long-term knowledge transfer) in association with student reported use and effort. This analyses demonstrated no meaningful significance. In this instance, this is interpreted as a positive, to mean that the exam score for the unit exam was not significantly different than the score for that unit's content on the final exam, indicating that the student retained the knowledge.

Descriptive statistics were also considered when answering this research question. The mean scores for the unit exams and final exam were analyzed, and as seen with many of the demographic categories, an increase was seen between test 3 and test 4. This was observed between the groups (Group A and Group B), and even on the individual units with unit scores higher between 3 and 4, and final exam content scores higher on unit 4.

The results for this research question have to be viewed with some caution, as the results indicated many participants did not follow the design of the study and complete self-explanations when assigned. The end-of-exam surveys revealed this potential issue. Many participants also did not complete the end-of-exam survey questions, thereby, affecting the statistical analyses and output. The end-of-exam surveys, not only evaluated reported use but also asked student participants to rate their effort in generating the self-explanations. Therefore, with incomplete

data on the end-of-exam survey, not only was reported use affected, but the covariate of student effort was also affected.

Information from the focus groups could also explain the results associated with this research question. Qualitative inquiry demonstrated students' perceptions on how long was given for the practice questions, along with when the practice questions were performed. The cognitive level of the questions and feedback (or lack thereof) from instructors were also discussed by students in the focus groups. It could also be possible, that the individual learning preferences or styles of students could have impacted the results, as some students were preferring the written method for the self-explanations, while others preferred group discussions, and the study design called for written self-explanations.

Research Question 3

With the ideas of cognitive constructivism in mind and the building of knowledge, the researcher also wanted to look at the semester of nursing school of each participant to see if there was an interaction between their academic achievement and generating self-explanations. Student participants were designated as first semester or third semester students. Statistical tests and interpretation revealed no such interaction between the assigned group and exam grades when using the reported semester of nursing school as a covariate. Similarly to the analyses run for the possible demographic covariates, this test noted a significance but only at two levels in the test for the interaction effect (exam time and semester) and one level for the main effect of exam time. Mean scores between the groups also demonstrated a very close range. With these factors in mind along with low meaningful effect sizes, it was determined that no meaningful significance existed.

As seen in the first research question, focus group information pertaining to prior experience could help explain the results of this research question. With multiple students noticing the discrepancy between experiences in the classroom and in the clinical environment, it begs the question on whether or not this had an influential effect on the exam performance.

The focus groups also identified the cognitive leveling of the questions as important in the study, with students noting the need for the question to pertain to the appropriate level of nursing school. The desire by the professors for the students to stay within the mindset of a specific nursing semester was also mentioned. The cognitive leveling effect on the exam scores could be supported by the idea that generation effect is a form of encoding where benefits will develop from a level of distinctiveness on tests that require similar discriminations; or put another way, maximum effects occur when students repeat or perform at the same cognitive level as what they did at study (Begg, Snider, Foley & Goddard, 1989; McNamara & Healy, 2000). Therefore, if the practice questions developed by faculty were not at the level of the students utilizing those questions (either too hard or too easy) then could this have also impacted the exam grades.

Research Question 4

In ascertaining information about the perceptions of students' use of generating self-explanations, focus groups were conducted with semi-structured interviews. These focus groups consisted of students from both the first semester and third semester nursing courses, and allowed for descriptive data to be analyzed and interpreted. These data also aided in explaining some aspects of the statistical data that were observed. Four major themes developed from the focus group: (a) activity design, (b) individual learners, (c) method of self-reflection, and (d) theory and practice.

First, in the theme of activity design the focus was on the implementation of the project and exercises by the instructors. Major ideas associated with this theme were time, cognitive level, and instructor feedback. Through the comments in each of these main ideas, it can be interpreted that the design of the activity has an impact on student perceptions, and can perhaps explain some of the statistical results.

In regard to time, students note the need for the appropriate amount of time to finish the activity, as many students in the focus group had the feeling of being “rushed.” Timing was also a consideration for when the practice questions are distributed. Students expressed individuality in this idea, with some requesting questions before lecture, while some wanted the questions throughout the lecture, and others wanted the questions immediately after or at other points following the lecture. The comments from students in the focus group regarding this issue could yield some perspective on exam performance, because research suggests that interspersing practice questions cause better performance in the beginning, while questions in the end led to better retention over time (Weinstein, Nunes, & Karpicke, 2016). For this study, practice questions were conducted at the end of the lecture; however, exam grades were assessed for each unit and in a summative final exam. Therefore, if the concept brought forward by Weinstein et al. (2016) is true, one could assume an impact was had on the overall statistical results. The qualitative information in relation to time has allowed for recommendations and considerations to include the importance of allowing the appropriate amount of time for the exercises and for consideration of when the exercises are conducted.

The cognitive level of the practice questions was discussed by multiple students in the focus group. Specifically, whether or not the question is written at the level of the student and the desire for a higher level of questioning, similar to those questions seen on the NCLEX-RN®

exam. As stated earlier, if students in this research project were not studying at the cognitive level in which they were to be tested, then maximum effects may not have been obtained.

This theme also allows for considerations to be given to the importance of instructor feedback, and the quality and information provided in this feedback. Metcalfe and Kornell (2007) noted the importance of appropriate feedback and its need to avoid harm in learning. Feedback is also important due to the continued learning that occurs when there is a conflict occurring between previously held knowledge by the student and the correct answer (Chi et al., 1994). The idea of appropriate instructor feedback is something the students desired and prior literature has substantiated the need; therefore, with this correlation, it warrants the attention in activity design.

The second theme focused on individual learners. Main concepts here revolved around the different learning styles of the students and their perceptions on learning. This theme has a relationship to the theoretical framework for this study in that cognitivism and constructionism focus on the individual level of learning (Nathan & Sawyer, 2014). Individual learning was evident in the interviews through the variety of ideas and perceptions on these exercises. This concept revolves around the comments made by students noting their preferences for the activity, whether it was written or group discussion. The current study was designed for written work; however, if a student has an intended audience then the explanation may improve (Rittle-Johnson et al., 2008). This idea could explain why some students gravitated toward the group discussions as having more benefit. Therefore, as noted above, consideration must be given to the fact that individual learning (whether this exercise was a preferred method of learning or not) may have impacted the outcomes of the statistical results and should be considered for future use in classrooms.

A method of self-reflection was the third major theme developed from the focus group interviews. This focused on the ideas of generating self-explanations as a study tool and that learning occurred even when answers were incorrect, each of which allowed for the participants to reflect and grow knowledge. The notion that incorrect answers were responded to favorably by students and as method for studying is similar to the ideas brought forth by Brown et al. (2014). The authors noted a deeper encoding process occurs when an answer is incorrect and stronger learning will result. With the ideas put forth by these authors, it can be reasoned why the focus groups comments noted the incorrect answers aided in the learning process. While it is difficult to relate this concept to statistical results, it does provide a unique perception of these exercises, one in which students acted favorable towards.

The final theme was theory and practice. This looked closely at the idea of NCLEX-RN® world and the real world, along with the effect generating self-explanations had on clinical practice. The discrepancies and theory-practice gap described by students could have directly impacted the statistical results of the study and, in turn, the research questions. Specifically, this could explain the inconsistency in the demographic variable associated with prior experience and the semester of nursing school. This problem between theory and practice was noted by many to be a consideration when answering the practice questions and building new knowledge. Prior research has supported this idea in regard to prior knowledge. If students are experiencing a theory-practice gap, and possess little knowledge on which the theoretical exam questions are formed, it can hinder performance, as is suggested by Ionas et al. (2012), who note that if the foundational knowledge is weak, then the self-explanation process can waver.

Limitations

Several limitations should be considered in this study. First, it should be noted that it is assumed all participants were honest and truthful in answering survey questions. Next, it was assumed that participants would answer questions as intended and assigned; however, the focus group allowed for the researcher to see that many students were answering the questions as a group, did not have time to answer, and due to time were only answering part of the questions or not at all and waiting to hear the answers. Finally, consideration needs to be given to the idea that not all students provided answers to survey questions, and while attempts were made to account for this in SPSS software, the impact this could have had on the overall statistical results should not be overlooked. Each of the factors could have played a role in the results of this study.

The personnel involved in the project can also be considered a limitation, in that multiple faculty members took part in this project from the two semesters. Each of these faculty members wrote their own practice questions at the cognitive level they felt to be appropriate and provided the answers to these questions. However, as noted by students, often times the instructor feedback was lacking and this could have played a part in the overall results. Just as the instructors are different people in the realm of writing questions and providing feedback, each instructor is also different in teaching styles and methods, and these could have also impacted the performance of some students on certain topics.

The design and set-up of the project could have also impacted the study. This idea relates to the comments made during the focus group noting that not enough time was given to complete the exercises. Again, this seemed to vary between instructors; however, it should be considered as a possible limitation to the study and its results. In one instance, an instructor in the first

semester course did not even provide the practice questions over one topic, due to oversight. While this error was accounted for through calculating grades of students while omitting the information for which they did not get questions, it highlights this limitation of this study and the varying performance of the instructors.

Implications for Nursing Education

This study explored the use of generating self-explanations in theoretical nursing courses. While statistical results varied between using and not using self-explanations, some positivity was seen regarding knowledge transfer, and focus group interviews demonstrated interesting perceptions and ideas for the learning strategy moving forward. With considerations in place, such as the activity design, time allotment, correct cognitive level of questioning, and providing instructor feedback, this tool could be utilized in nursing classrooms as an educational resource.

While the statistics varied and were complicated in this study, it should be noted that even results showing no significance have meaning when looking at the broader implications for nursing education. When comparing the idea of generating self-explanations to answering traditional multiple-choice practice questions, no significance was found in comparison to academic achievement. Therefore, generation may not produce higher exam scores, but it is on the same playing field as traditional practice questions. Why is this relevant? It can demonstrate that it is acceptable for nurse educators to break away from the traditional practice questions and employ a tool built on the ideas from the learning sciences and receive similar effects.

In examining the practicality of this idea, the data collected in this study brought forth several ideas for planning the use of self-explanations in the nursing classrooms. Appropriate time to answer questions, along with the proper placement of practice questions for intended results must be considered. Qualitative inquiry showed the importance the participants placed on

this idea and the benefit that can ensue. While these ideas can be easy to state here, planning and implementing such ideas could be problematic. If faculty are facing time restrictions for lectures or bound by curriculum requirements/activities, appropriate planning will be required.

Providing feedback to students was another critical area focus group participants wished to be considered in the future. Not only did the focus group participants stress the importance and need for some form of feedback, research has also suggested the overall learning process that can occur and the importance of correcting students to avoid harm in learning (Chi et al., 1994; Metcalfe & Kornell, 2007). Faculty need to consider the best way to provide feedback for students' self-explanations so that learning benefits can be achieved. However, one must consider, should the answers be provided to the student? Or should the students have to investigate for themselves and discover the answers? While the students desire having answers provided, it could be said that having students discover for themselves aligns with generation effect. Contrary to that, one could argue that providing the correct answers is aligned with cognitive constructivism and the building of schemas that is occurring leading to stronger learning, thus possibly putting the ideas of generation effect and cognitive constructivism in competition with one another. Faculty will have to determine the route that is best for their specific students and individual classrooms.

Another important concept to consider for nursing education classrooms in the future is the cognitive level of the questions. The interviews and research suggest having students practice at the level at which they will be tested (Begg et al., 1989; McNamara & Healy, 2000). Therefore, if application and analysis level questions will be utilized for exam purposes, consideration needs to be given to the practice questions and self-explanations being produced at the same application and/or analysis level. However, one must consider the difficulty of test-

item writing. Knowledge -based questions may be used as “knowledge checks” throughout a lecture or presentation as a means of formative assessment to see if students are comprehending certain material; however, is that acceptable if the exams are written at the application and analysis level? If no, and the faculty desires to have practice questions at the same level as the exam, then considerations must be given to the time and effort required to develop test-items at that cognitive level.

Recommendations for Future Research

Future research on generating self-explanations can be conducted in a variety of ways. A more specific and structured design with proper time and feedback could allow for results to be re-tested and/or expanded. A relatively small sample size was used in this study, and only involved Associate Degree Nursing students. The sample size could be expanded and include multiple programs consisting of Associate Degree Students. The research could be expanded to a Bachelor’s Degree program to see if the prior knowledge aspect becomes more relevant with additional pre-requisite courses and/or general knowledge held by the students.

Another consideration is the timeframe in which this study was conducted. This study was conducted over the course of one semester. This could be expanded to evaluate knowledge retention over the course of many semesters or even the relationship between generating self-explanations and performance on cumulative end-of-program exams or licensing exams.

An exploration of verbal versus written self-explanations could be conducted as many students had individual learning preferences geared toward group discussions as opposed to writing. Research could also be conducted with self-explanations and specific labeling of the cognitive level of each question and comparing the effects of knowledge practice questions

versus those of an application or analysis level. The theory and practice gap observed with these practice questions also merits further research.

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APPENDIX A
PARTICIPANT DEMOGRAPHIC QUESTIONNAIRE

Participant Demographic Questionnaire

1. Name
2. Age
3. Ethnicity
4. Grade Point Average
5. Semester of Nursing School
1st 3rd
6. Prior Nursing/Clinical Experiences (includes work history and/or participation in clinicals)
Yes No
7. What type of prior nursing experience do you possess?
_____ None
_____ Nursing school clinicals
_____ Prior work in healthcare, please specify _____
8. Number of years of clinical experience
_____ 1 month to 1 year
_____ 1 to 2 years
_____ 2 to 3 years
_____ 3 to 4 years
_____ 4 to 5 years
_____ Over 5 years
9. Are You Willing to Participate in a Focus Group at the Conclusion of the Semester
Yes No

APPENDIX B
END-OF-EXAM SURVEY

End-of-Exam Survey

1. Name: _____

2. Are you a participant in the research study involving self-explanations?

Yes No

3. Did you use self-explanations on practice questions for this exam?

Yes No

4. Please rate your effort in generating the self-explanations for the practice questions

_____ 1 = No effort, just “guessed”

_____ 2 = Developed a self-explanation in the time provided

_____ 3 = Developed a self-explanation in the time provided and continued to work on
the explanation following class

APPENDIX C
FOCUS GROUP QUESTIONS

Focus Group Questions

Date and Time of Interview:

Setting:

Interviewees:

1. What are your thoughts and impression about generating self-explanations to nursing practice questions?
2. As the semester has now concluded, were you able to achieve the outcomes you wanted for this semester? Will you be progressing to the next nursing course?
3. Did you find yourself generating self-explanations even when you were not assigned self-explanations for the unit?
4. How much of an impact do you feel the self-explanations had on your performance in the course?
5. Do you think the self-explanations had any impact on you learning new information and content, if so how?
6. Do you feel that your prior knowledge or clinical experience had any impact on the self-explanations you generated to the practice questions?

APPENDIX D
IRB APPROVAL

December 15, 2017

Jamie McKinney
ELPTS
College of Education
Box 870302

Re: IRB # 17-OR-431, "Generating Self-Explanations in Undergraduate Nursing Education"

Dear Ms. McKinney:

The University of Alabama Institutional Review Board has granted approval for your proposed research.

Your application has been given expedited approval according to 45 CFR part 46. Approval has been given under expedited review category 7 as outlined below:

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

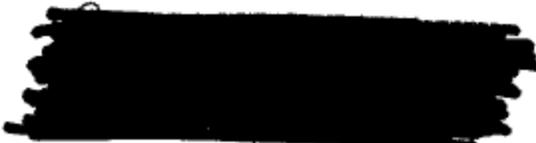
Your application will expire on December 14, 2018. If your research will continue beyond this date, please complete the relevant portions of the IRB Renewal Application. If you wish to modify the application, please complete the Modification of an Approved Protocol Form. Changes in this study cannot be initiated without IRB approval, except when necessary to eliminate apparent immediate hazards to participants. When the study closes, please complete the Request for Study Closure Form.

Please use reproductions of the IRB approved stamped consent forms to obtain consent from your participants.

Should you need to submit any further correspondence regarding this proposal, please include the above application number.

Good luck with your research.

Sincerely,

A large black rectangular redaction box covering the signature of the sender.



November 27, 2017

Ms. Jamie McKinney
6101 Grayson Drive
Denison, TX 75020

Dear Ms. McKinney:

RE: IRB Application #2017.02

I am pleased to inform you that your study, *Generating Self-Explanations in Undergraduate Nursing Education* has been reviewed and approved by the Grayson College Institutional Review Board (IRB) and will replace IRB Application #2016.02.

Your study appears to meet the requirements set forth for the protection of human subjects and individual rights. Your approval is valid for one year, beginning November 27, 2017. Any modifications to this study must be submitted for review and approval prior to implementation. Additionally, you must notify the IRB Committee immediately of any unanticipated incidents. At the conclusion of your study, please submit a copy of the signed consent forms and your final report to the Grayson College IRB.

Congratulations! We look forward to hearing from you and to receiving your final report.

Sincerely,

A large, solid black rectangular redaction covers the signature area, obscuring the name and any handwritten notes.

Institutional Review Board