THE EFFECTS OF THE PAUSE PROCEDURE

ON CLASSROOM ENGAGEMENT

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CHAPTER I

INTRODUCTION

The purpose of this study was to examine an instructional strategy intended to enhance engagement in the college classroom. The effects of the pause procedure on classroom engagement and cognitive load were studied. The relationships between levels of classroom engagement and near-term learning outcomes, as well as engagement and cognitive load were investigated in the Net Generation (Net Gen) students. The goal of this study was to empirically link the Net Gen to classroom engagement and cognitive load through the use of the pause procedure. Figure 1 is a diagram that depicts the concepts of classroom engagement, cognitive load and the Net Gen; it was the overlap of these ideas this study attempted to explore.

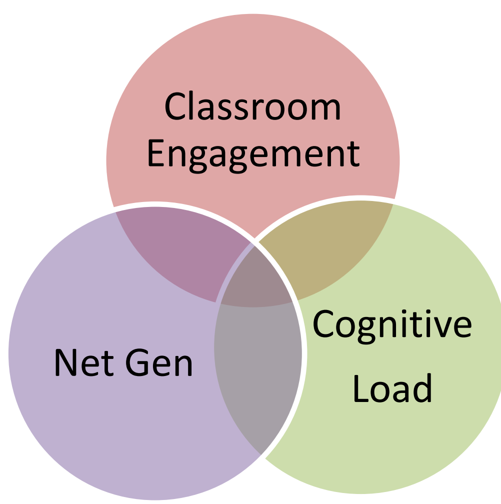

Figure 1. Overlap of Classroom Engagement, Cognitive Load and the Net Generation

The Net Generation

The Millennial generation, or Net Gen, was born between 1982 and 2000 (Howe & Strauss, 2000). As a group, they are confident in what they attempt in life; they are smart, but impatient, have a short attention span, and have high expectations of immediate feedback (Carlson, 2005). Achievement is another common characteristic of the Net Gen (Howe & Strauss, 2002). Making excellent grades in school is a prime goal for them, even if they are unsuccessful in earning them. Parents have become so involved with the achievement of their children, that they have been known to intervene on behalf of their child to obtain the desired grade, even at the college level (Carlson, 2005). At the age of 18, the Net Gen started college in 1998, and the last of the generation should complete their college experience by approximately 2025 (Howe & Strauss, 2000).

Reports noted in the literature have suggested different ways to facilitate the desired success of the Net Gen. One suggestion has been to transform their learning environment into segments of engaging activities (Carlson, 2005). Carlson further suggested beginning each lesson with a brief 10-15 minute lecture, and then creating discussion groups to further immerse students in the material. Planning group work and classroom discussion was also proposed by Atkinson (2004) and reiterated by Tapscott (2008). Promoting critical thinking and cooperative learning environments among the Net Gen learners was an idea promoted by Wilson (2004). To engage the Net Gen, Milne (2007) suggested peer interaction, discussions and game-based learning. Prensky (2005) advised against just the development of new lesson plans in favor of creating engaging and creative components to education. Each of these suggestions have the common element of group interaction to engage the learner.

The Net Gen not only thrives on group interaction, but they also are a generation that was born with ready access to digital technology (Prensky, 2001). Carlson (2005) recommend state-of-the art technology infrastructure to acknowledge the technological needs of the Net Gen. State-of-the art technological applications were again proposed by Milne (2007) as many current applications for the classroom form barriers to free-form engagement. Incorporating the use of the Internet and Internet-based assignments in the classroom was one suggestion to implement educational technology in the classroom (Leung, 2003).

Classroom Engagement

College-level faculty and administrators are urged to go beyond the status quo of lecture format classroom presentations and consider adapting their teaching methodology to meet the students' needs for engagement (Taylor, 2006). One proposed formula of engagement to consider when developing classroom instruction is "E = L (I + Cp + Ch) x Inv (A + Co + Cm) → IK/Ef → **E**, which means: Engagement = Learning (Interest + Competence + Challenge) x Involvement (Activity + Communication + Commitment) product Increased Knowledge and Effectiveness which results, typically, in increased Engagement" (Marcum, 2000, p. 59) Kearsley and Shneiderman (1998) suggested active cognitive processing promotes student classroom engagement. Additionally, they proposed that group activities need to have real-world application and include "creating, problem-solving, reasoning, decision-making and evaluation" (Kearsley & Shneiderman, 1998, p. 20). Student classroom engagement is related to active cognitive processing (Kearsley & Shneiderman, 1998).

> Students reported when faculty members created cognitively challenging environments they were then engaged in their own intellectual development (Umbach & Wawrzynski, 2005). When student engagement in the classroom setting was studied, the findings indicated a moderate to strong correlation between faculty-driven instructional design and student autonomy in the classroom, $r = .66\text{-}.85$ ($p < .01$). These relationships support the role of faculty members in student engagement (Reeve, Jang, Carrell, Jeon, & Barch, 2004).

Cognitive Load

Cognitive load is a "theory that emphasizes working memory constraints as determinants of instructional design effectiveness" (Sweller, van Merrienboer, & Paas, 1998, p. 251). Cognitive load theory (CLT) incorporates principles of cognitive architecture, metacognition, and instructional design; the theory includes three types of load: intrinsic, extraneous and germane (Paas, Renkl, & Sweller, 2003; Sweller, 1994; Sweller, et al., 1998). A fundamental tenant of CLT is "problem solving learning and problem solving difficulty is artificial in that it can be manipulated by instructional design" (Sweller, 1994, p. 295).

The aim of instructional design is to facilitate learning by decreasing extraneous load and enhancing germane load (Sweller, et al., 1998). Instructional effectiveness has been shown to improve when lessons are designed to build on the learner's existing schema (Kalyuga, Ayres, Chandler, & Sweller, 2003; Kalyuga, Chandler, Tuovinen, & Sweller, 2001). Learner motivation has been shown to improve with challenging instructional design (Rikers, van Gerven, & Schmidt, 2004). Motivating the learner, in this case the Net Gen, is a key element of successful instructional design for this generation.

Summary

Many of the students in today's college classrooms are members of the Net Gen (Howe & Strauss, 2000). They have high expectations of themselves (Carlson, 2005) and their learning environment (Oblinger & Oblinger, 2006). Net Gen learners were born into a world of technology and expect the same from the college classroom (Prensky, 2005). College faculty members need to consider teaching methodology to meet the needs of the current generation (Taylor, 2006). Methods identified to enhance classroom engagement include: group interaction (Atkinson & Renkl, 2007; Carlson, 2005; Milne, 2007; Tapscott, 2008), integration of multimedia (Jacques, Preece, & Carey, 1995) and computer-based instruction (Leski, 2009).

Problem Statement

The Net Gen thrives on technology and needs to be engaged in the college classroom. Reportedly the college classroom is, at times, not an engaging environment (Oblinger & Oblinger, 2006; Prensky, 2005). Net Gen students are different than previous generations of learners and require more engaging teaching strategies. These strategies will, in turn, have an effect on the learner's cognitive load.

Research Questions

1. Is there a relationship between student engagement and near-term learning outcomes during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university?
2. Will the introduction of the pause procedure during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university have any effect on cognitive load?
3. Will the introduction of the pause procedure during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university have any effect on near-term learning outcomes?

Significance of the Study

This study is significant because it attempts to fill the gap in the literature to empirically link the Net Gen to classroom engagement and cognitive load by way of intentionally introducing an instructional method that integrates educational technology and peer interaction. These factors were reported by Tapscott (2008), Oblinger (2006), Wilson (2004), Milne (2007) and Atkinson (2004), but little scientific rigor had been incorporated in any of the reported studies. The combination of teaching methodology, which includes audience response systems and the pause procedure, has not yet been identified in the literature. Engagement has been studied in relationship to recall, but these authors also suggested future research was needed on how engagement affects learning (Webster & Ahuja, 2006; Webster & Ho, 1997). Studies have been conducted on the effectiveness of the pause procedure as an instructional tool (Rowe, 1976, 1980; Rowe, 1983; Ruhl, 1996; Ruhl, Hughes, & Gajar, 1990; Ruhl, Hughes, & Schloss, 1987;

Ruhl & Suritsky, 1995). However, this study will attempt to link pausing with near-term learning. This study will examine how taking a break during class time, or pausing, to allow the students to reflect and discuss the content presented during a routine class session, affects cognitive load, engagement, and near-term conceptual learning.

CHAPTER II

REVIEW OF LITERATURE

The following literature review identifies the overarching concepts for this research study; there are broad theories and multiple sub-concepts relevant to the pause procedure. Literature reflecting classroom engagement, generational theory, and roles of faculty and student engagement in classroom engagement is pertinent to this study. Concepts will be presented that influence engagement such as: active learning, collaborative and cooperative learning, peer instruction, and an instructional technology, audience response systems. The ability to accurately self-report will be introduced, and as gender-related research will also be examined. Theory supporting note-taking and the sub-construct of the pause procedure will be stated; pausing as a teaching tool is imperative to this research and serves as the study's independent variable. A brief review of cognitive load will be presented. Many of these concepts are intertwined as the influence of the pause procedure on engagement, learning outcomes and cognitive load will be studied.

Generational Theory

Generational theory examines the differences in beliefs and philosophies of those born within a specific time frame and has been well-documented in studies by Howe and Strauss (Howe & Strauss, 2000, 2002, 2007). They contend that approximately every 20 years a new generation arises; each generation has their own core values and beliefs. Seminal events often stimulate a cultural change, which then gives rise to the next generation. While the time span assigned to each generation is somewhat fixed, there is also a phenomenon where those born around the turning point years may ascribe to the values and beliefs of their respective succeeding or preceding generation. deKort (2004) referred to the phenomenon as being *on the cusp* of a generation. Whether mid-generation or on the cusp of a generation, one goal of generational theory is to increase awareness of the core values of those who ascribe to each generation.

The intent of generational theory is not to stereotype but to understand. Howe and Strauss coined the term *generational persona*. Meaning, a persona is a way of "understanding attitudes about family life, gender roles, institutions, politics, religion, culture, lifestyle, and the future" (Howe & Strauss, 2000, p. 40). Each generation has a unique set of characteristics, and thereby forms its own persona. Howe and Strauss identified six living generations by name and range of years (see Table 1).

Table 1

Names of Generations by Years

Generation	Birth Years
Lost	1883-1900
GI	1901-1924
Silent	1925-1942
Boom	1943-1960
X	1961-1979
Millennial or Net	1980-2002

According to Strauss and Howe (1991), the *Lost Generation* knew World War I and, except for a very few centurions, the generation is extinct. The *GI Generation* fought in World War II and is also known as *The Greatest Generation.* This generation experienced the Great Depression which spanned from 1929 through the 1940s. The next generation is the *Silent Generation*. They had parents who fought in World War I, but they themselves were too young to fight in World War II. They spent their formative years living through the Great Depression which had a significant impact on how they lived and viewed life. Succeeding the Silent Generation is the *Boom Generation* or commonly known as *The Baby Boomers.* They were the children generally born to the veterans of World War II. They initiated the counter-culture movement of the 1960s and are associated with wide-spread social change. Following the Baby Boomers is the *X Generation*. They were the first generation to have a television in their home when they were born. They were also the first generation introduced to modern technology, e.g. the home computer, which is commonplace today. Their mothers went to work outside of the home, so when they were growing-up they were also referred to as *Latch-Key Kids*. Consequently, they are independent and generally non-trusting of authority. The *Millennial or Net Generation* (Net Gen) follows the X Generation. They are generally the children of the Baby Boomers. They were born into a world enmeshed in electronics and technology. Each of these six generations has their own general characteristics that supports the concept of generational theory (Strauss & Howe, 1991).

According to the theory, generations are much like links in a chain, individual in and of itself, but dependant on those before and after (Howe & Strauss, 2000). Mannheim (1952) also wrote of generational theory; he indicated early in life one lives in an environment that is shaped and influenced by one's elders. These are values that are often maintained throughout a lifetime. However, as one matures, individual thoughts and creativity are developed, and the new generation branches off of the previous generation. This act is the rising of new generational ideals. Mannheim called this the "period of his self" (1952, p. 283), which is a point in one's life where one can only relate to others of the same age. Mannheim ascribed a 30-year time frame to each generation.

Net Generation

The oldest members of the Net Gen are 29-years-old, and they have been in college for approximately ten years. As a result of this new generation of students, faculty members have noted a change in the characteristics of the current student body (Oblinger & Oblinger, 2006). Howe and Strauss (2000) ascribed seven traits to the Net Gen; they are: (a) special, (b) sheltered, (c) confident, (d) team-oriented, (e) achieving, (f) conventional, and (f) pressured. These attributes have classroom implications. The traits that most directly affect faculty members are: team-oriented, achieving and pressured. Instructional design to include classroom engagement is one way to consider the needs of the Net Gen and specifically these traits (Wilson & Gerber, 2008).

Engagement

Engagement Definition and Theory

Engagement generally reflects students' classroom behaviors (Higgins, Lee, Kwon, & Trope, 1995; Higgins & Trope, 1990; Jacques, et al., 1995). Activity engagement theory was one of the early engagement theories proposed (Higgins & Trope, 1990), suggesting an influence of motivation and interest toward an activity as contributing behaviors toward engagement. Approach to activities has been found to be another way to advance engagement theory (Higgins, Trope, & Kwon, 1999). This publication reported engagement as student orientation to an action that they perceived as relevant and informative:

> The state of mind that we must attain in order to enjoy a representation of an action. . . engagement entails a kind of playfulness—that ability to fool around, to spin out 'what if' scenarios. Such 'playful' behavior is easy to see in the way that people use spreadsheets and word processors. (Laurel, 1991)

Students self-reported their own engagement in their learning experience (Bronfenbrenner, 1992). They described engagement as an activity that " held their attention and they are attracted to it for intrinsic rewards" (Jacques, et al., 1995, p. 58). Additionally, curiosity, interest, confidence and surprise were factors reportedly influencing students' engagement (Jacques, et al., 1995).

In an effort to study engagement as a construct, Webster and Ho developed a tool to measure engagement in the classroom (1997). This self-report tool captured many of these aforementioned factors to measure engagement: attention and curiosity (Jacques, et al., 1995), orientation (Higgins, et al., 1995) and playfulness (Laurel, 1991). The findings of this study supported a similarity between engagement and playfulness. The authors suggested that instruction can be designed to engage the learners. They also advocated for future research to include how engagement affects learning.

To determine if relationship exists between engagement and learning, Webster and Ahuja (2006) used the same self-report engagement tool developed by Webster and Ho (1997). Learning was measured by the number of correct answers on a post-experiment questionnaire. The authors reported a positive relationship between engagement and scores on the questionnaire ($\beta = .35$), inferring factual learning had occurred.

Another theory for classroom engagement was proposed by Kearsley and Shneiderman (1998). They indicated that there are three essential components incorporated into the theory: relate, create and donate. Kearsley and Shneiderman stated "learning activities: 1) occur in a group context; 2) are project-based; and 3) have an authentic focus" (Kearsley & Shneiderman, 1998, p. 20). They indicated that all student-learning activities include active cognitive processes which include "creating, problem-solving, reasoning, decision-making and evaluation" (Kearsley & Shneiderman, 1998, p. 20). They contend that, if the instructional design includes active cognitive processing, then students will be intrinsically motivated to learn. Meaning will be created for the students by the instructional methods employed. Authentic projects that are creative and facilitate working together are elements that created a cognitively engaged learning environment.

Student Role in Classroom Engagement

Students and faculty members have a role in classroom engagement. In learning environments, three types of student engagement have been reported: behavioral engagement, emotional engagement and cognitive engagement (Fredricks, et al., 2005). Behavioral engagement was found to include the act of participation in activities. Emotional engagement was found to embrace the appeal that influenced one's desire to participate in an activity. This study also found that cognitive engagement comprised the notion of investment, or effort, involved in understanding complex ideas (Fredricks, et al., 2005; Linnenbrink & Pintrich, 2003). Cognitive engagement may be enhanced by the development of self-schemas and students regulating their own learning by using metacognitive strategies (Garcia, Pintrich, Schunk, & Zimmerman, 1994).

Cognitive engagement implies that students are intellectually involved in their own learning process (Flavell, 1979). One examination of how students were involved in their own learning was explored through educational gaming (Dickey, 2005). Some of the concepts studied were positioning, or point of view, the role of narrative, and methods of interactive design. While the goals of an educational environment vary from gaming, the overarching concepts were examined. The role of individual choice in gaming was identified as a common concept and an essential component of activity engagement theory (Higgins, et al., 1999). As elements of education, reflection and analysis are desired outcomes that can be applied to the educational environment and involve students in their own learning process (Dickey, 2005).

The study of student engagement has extended beyond the traditional learning environment and into the nursing classroom; engagement in the nursing classroom is necessary to meet the needs of the Net Gen as well as the requirements to practice in the current health care environment (Fetter, 2009; Oblinger & Oblinger, 2006). Health care facilities are steeped in technology; an identified educational priority for the nursing classroom is to include technology based instruction (Fetter, 2009). In a nursing program where computed based instruction (CBI) was implemented, a qualitative study revealed the following: CBI both enhanced and hindered learning, depending on the situation; effective application of CBI was conditionally dependent; and, certain elements of the curriculum benefit from CBI. The recommendations of the study indicated assignments should be appropriate and occur in a non-distracting environment (Leski, 2009).

Faculty Role in Classroom Engagement

One study indicated "faculty members play the single-most important role in student learning" (Umbach & Wawrzynski, 2005, p. 176). The role of faculty members in student engagement was specifically examined in multiple studies (Reeve, et al., 2004; Skinner & Belmont, 1993; Umbach & Wawrzynski, 2005). Reportedly, teacher classroom behaviors influenced student classroom engagement (Skinner & Belmont, 1993). When faculty members created challenging academic environments, identified learning activities as important and enriching, and used active and collaborative teaching strategies, students reported that they were engaged in their own cognitive development. Student engagement was correlated with multiple faculty driven instructional behaviors that fostered student autonomy in the classroom, $r = .66\text{-}.85$ ($p < .01$) (Umbach & Wawrzynski, 2005).

Instructional design was one facet of teaching that influenced classroom engagement, and another aspect was the support teachers offered their students (Skinner & Belmont, 1993). The researchers found high levels of teacher support correlated with intrinsic motivation in elementary school students. Reciprocal relationships between student motivation and teacher support was also identified in the study. These relationships were validated by another study that also studied faculty support and student engagement (Reeve, et al., 2004). The findings of the Reeve study further supported the role of faculty members in promoting student engagement in the classroom.

Intrinsic Motivation and Engagement

Faculty involvement in the classroom has been identified as a contributing factor for engagement; another student-related component of classroom engagement was intrinsic motivation (Conti, Amabile, & Pollak, 1995). Broadly defined, intrinsic motivation is an internal drive that produces the enjoyment of an activity (Cordova & Lepper, 1996). Intrinsic motivation was noted in multiple studies as a component of classroom engagement and isolated as a contributing variable in the learning process (Conti, et al., 1995; Cordova & Lepper, 1996; Jacques, et al., 1995; Skinner & Belmont, 1993). Conti, et al. (1995) studied creative task engagement to identify student behaviors associated with intrinsic motivation. Both short and long term recall were measured and the findings indicated intrinsic motivation was an influencing variable in student learning outcomes.

Intrinsic motivation, as it is related to the three complementary strategies of contextualization, personalization, and provision of choice, was examined by Cordova and Lepper (1996). Higher levels of intrinsic motivation were identified when students were involved in classroom activities designed to enhance student engagement. Also, observed in this study was the students' willingness to extend themselves beyond the designed activity. The students became more deeply involved in the activity and attempted more complex functions within the activity in a fixed amount of time.

Intrinsic motivation may take on many forms, as time-on-task with multimedia related to intrinsic motivation in students was examined (Jacques, et al., 1995). The finding of the study indicated that time-on-task was not a consistent indicator for intrinsic motivation. Some students took longer on a task, which was linked to their interest in learning more; a finding also noted by Cordova and Lepper (1996). While others spent-time-off task, they noted boredom as the contributing factor. The authors concluded that using learner-centered instructional design may influence intrinsic motivation (Jacques, et al., 1995).

Active Learning

Active learning is a frequently used term, yet it remains ill-defined in the literature. Rather than a definition, particular teaching strategies are more commonly associated with the concept of active learning. Such teaching strategies that are interactive and promote student engagement include, but are not limited to collaborative work/assignments (Bagchi, Johnson, & Chaterji, 2008), paired discussion (Qualters, 2001), inquiry/problem-based learning (Ebert-May, Brewer, & Allred, 1997), peer instruction (Bonwell & Eison, 1991; Fagen, Crouch, & Mazur, 2002), cooperative learning (Hinde & Kovac, 2001; Keyser, 2000; Mannison & et al., 1994), in-class essays (Kovac, 1999), interactive lecture (Ernst & Colthorpe, 2007), the pause procedure (Rowe, 1980; Ruhl, et al., 1987), and group problem solving (Meltzer & Manivannan, 1996).

Other terms associated with active learning are student involvement, engagement and student exploration (Bonwell & Eison, 1991). Students, who were interested in their own learning demonstrated improved learning outcomes and improved long term retention of material (Bagchi, et al., 2008; Hake, 1998; Prince, 2004; Qualters, 2001; Wilke, 2003).

Student Performance

Student performance on classroom examinations is often considered a measure of student learning and frequently is a primary concern of faculty members (Amrein & Berliner, 2002). Ernst and Colthorpe (2007) studied students enrolled in several sections of college-level physiology over a two year period of time. To encourage student engagement in a large lecture classroom, interactive lecturing was implemented, and student performance on the final examination improved over the period of study. In the first year of the study, students with a non-science background scored a 49.5% on the end-of-semester exam. Whereas, in the second year of the study, after interactive lecturing was introduced, the post treatment group with a similar background scored an average of 70.6% on the end-of-semester exam. This was a significant increase in final examination scores ($p < 0.001$). Additionally, the researchers noted that students self-reported an increased level of confidence in their learning abilities when they were engaged in their classroom activities.

In another study examining student examination performance, pre- and posttest scores from over 6000 introductory physics students were studied (Hake, 1998). Interactive instructional strategies were implemented in selected introductory physics courses. Students' scores from the treatment group were two standard deviations higher than the control group. A strong correlation (r = 0.91) indicated a positive relationship between interactive teaching methods and problem solving.

Bagchi, et al. (2008) studied student performance on group exams when three different active instructional strategies were implemented in junior-level engineering courses. When the effects of the strategies were separated out the instructional intervention of group examination review demonstrated the most significant improvement in exam scores.

Students from two classes were surveyed regarding the interactive teaching strategies implemented in a college-level lecture setting (Gedeon, 1997). The overwhelming majority of the respondents indicated an increased level of comfort with the material, 89% and 81%, as well as improved performance in the skills, 89% and 78%; the author did not report the statistical significance of the change.

Small-group cooperative learning strategies were studied at the university level (Mannison & et al., 1994). The results of the study indicated that small-group discussion was an effective learning strategy and that when students applied this strategy they developed enhanced memory skills. Similar findings of interactive learning strategies were reported by Qualters (2001).

Active learning strategies and student achievement were examined in a college-level human physiology course (Wilke, 2003). The findings yielded a statistically significant change in student exam scores. The survey results also noted that the students in both the treatment and control groups demonstrated positive attitudes toward learning when active learning strategies were employed in the classroom setting.

Collaborative and Cooperative Learning

Collaborative and cooperative learning are terms that some use synonymously. However, the teaching strategies are fundamentally different and need to be further defined for the purposes of clarification. According to Paintz (2009)

> collaboration is a philosophy of interaction and personal lifestyle where individuals are responsible for their actions, including learning, and people respect the abilities and contributions of their peers. Cooperation is a structure of interaction designed to facilitate the accomplishment of a specific end product or goal through people working together in groups. (¶ 3)

Classroom control is a fundamental difference between collaborative and cooperative learning. When learning is collaborative, the activity is student-focused; when cooperative learning strategies are employed, the faculty remain in control of the content and the classroom activities, and students work toward a common goal (Paintz, 2009).

Student outcomes were studied when cooperative learning activities were incorporated into college-level biology classes with enrollments of greater than 250 students (Armstrong, Chang, & Brickman, 2007). Small group learning was the method implemented to enhance cooperative learning. The results indicated students improved in their knowledge base when cooperative strategies were employed. Additionally, students' evaluations were favorable of the learning strategies implemented during class time.

In examining the rate at which students withdrew and/or failed early in their college experience, Chase and Okie (2000) studied academic success in freshman-level computer science courses. They studied the implementation of cooperative learning strategies paired with peer instruction. The withdraw-failure rate (WFR) for the three semesters preceding the institution of cooperative strategies was 56% and the WFR after was 32.5%, a statistically significant change. In this study, the differing variable was the teaching methodology.

Collaborative learning environments were examined in a computer-based classroom setting (Kester & Paas, 2005). To foster collaborative learning, scripts were developed to augment social and cognitive interaction. The results indicated learning outcomes did not change with the intervention; however, social and cognitive processes were enhanced. This study was built on the foundations of cognitive load theory and individual learning; the expertise-reversal effect supported the findings.

Peer Instruction

As a specific form of cooperative learning, a meta-analysis of peer instruction (PI) was conducted by Fagen, Crouch and Mazur (2002). Many university-level institutions were examined in this study; the findings indicated students demonstrated learning gains ahead of their counterparts who participated in traditional forms of instruction. The findings of PI were validated by students' scores on ConcepTest, as the results validated the use of PI as an acceptable teaching method.

Hinds, Patterson and Pfeffer (2001) sought to determine whether students learn as much, or as well, with peer instruction. Their findings indicated that faculty members, as experts in their field of study, talk/lecture/discuss in terms that are not easily understood by students. As faculty members have a wealth of knowledge, they tended speak in terms that were difficult for students to understand, thus leaving students struggling to make sense of the information presented. When students took on the lead role of educator, they had to immerse themselves in the content area. In that immersion process, the peer instructor developed expertise in the area. The student was acquainted with the content terminology and then converted the terms in to commonly understood phrases, more concrete, and even colloquial language. When the peer instructor presented the content, students demonstrated increased understanding of the content and outperformed their peers when compared to the students in the control group who received their instruction by more traditional didactic methods. This finding did not hold true when the same groups of students needed to demonstrate knowledge transfer on differing tasks within the same domain. The additional level of knowledge of the faculty members helped facilitate the required transfer of information within the body of knowledge (Hinds, et al., 2001).

In studying the effectiveness of PI, Piepmeier (1998) they note that peer facilitated discussions were conducted in a fashion that included more student-to-student interaction, and indicated peers were more empathetic when trying to understand difficult concepts. These findings were validated by the Hinds, et al., (2001) study. Both of these studies supported the basic premise of PI as ascribed by Mazur (1977).

Peer Instruction and Exam Performance

Improved performance on exams was a noted finding when PI was instituted in the classroom (Brueckner & MacPherson, 2004; Cox & Junkin, 2002; Crouch & Mazur, 2001; Fagen, et al., 2002; Hinds, et al., 2001). The findings of Hinds, et al., (2001), and Fagen, et al., (2002), were validated by the inquiry conducted by Brueckner and MacPherson (2004). Brueckner and MacPherson (2004) investigated PI among first-year dental students in the dissection laboratory. Peers led the dissection activities on a rotating basis. Analysis of grade data supported the validity of PI as a useful instructional method. Additionally, the investigators noted that the students indicated that they were satisfied with the PI approach to instruction and that rotating the dissection activities among their peers did not impede their performance (Brueckner & MacPherson, 2004).

In a college-level laboratory environment, Cox and Junkin (2002) examined pre- and posttest scores to identify student gains in knowledge among a treatment and a control group. The treatment group implemented PI and collaborative learning strategies, and the control group received their instruction by traditional lecture presentation. The study was conducted across two laboratory sessions using the same group of students and the same methods. Increases were noted in both laboratory experiments, as a post-test gain of 50-100% was noted in the PI group.

Additional evidence supporting PI was provided by Crouch and Mazur (2001). They reviewed ten years of studies where PI was implemented in college-level algebra-based introductory physics courses for non-majors. Consistently, across the ten years, in pre-and posttest administration of ConcepTests, students' scores improved statistically significantly when PI was introduced, especially in the group who scored below 70% on the pretest. Peer instruction at the college level appears to positively influence student learning outcomes. In addition, student learning outcomes, as measured by performance on examinations, was not the only beneficial effect of PI. Student satisfaction also emerged as a benefit.

Peer Instruction and Student Satisfaction

Increasingly, satisfaction with student educational experiences is becoming more important as the educational culture moves into considering students as customers (Bejou, 2005). After PI was implemented in the dissection laboratory, dental students were surveyed at midterm and at the end the semester. Eighty-eight percent of the students indicated on the midterm survey that they were satisfied with their instruction when PI was implemented. There was no significant difference in student satisfaction of instruction on the end-of-semester survey (Brueckner & MacPherson, 2004).

When referring to PI, Murray (1999) noted that “Among the benefits of this program are high student satisfaction, opportunities for development of leadership and organizational skills, and dramatically improved academic results” (p. 159). Students were able to clarify their misconceptions when PI was introduced, leading to enhanced student satisfaction with their educational experience (Piepmeier, 1998).

Audience Response Systems

Along with PI, the use of an audience response system (ARS) has also been demonstrated to clarify student misconceptions and enhance satisfaction with their learning experience (Caldwell, 2007; Sharma, Khachan, Chan, & O'Byrne, 2005). But, what is an ARS, and how can it be incorporated into the curriculum? Components of an ARS classroom are a wireless hand-held transmitter for each student (commonly known as *clickers)* a receiver to collect the student generated responses, an LCD projector, a classroom computer with Internet connection, and the appropriately loaded software (Conoley, Moore, Croom, & Flowers, 2006; Peterson, 2008). The faculty member generates an ARS question and projects it onto the classroom screen; students anonymously respond to the question using their hand-held device or Internet connection; students' responses are compiled by the computer and, with most programs, a histogram of the students' responses is generated on the screen. The faculty member can then view the collective responses and modify the classroom presentation to correct any student misconceptions (Duncan, 2007). Additionally, as ARS can track student performance, faculty members can assess individualized student learning.

The ideal types of ARS questions require the students to critically think about the topic and demonstrate an understanding of essential concepts (Beatty, Gerace, Leonard, & Dufresne, 2006; Caldwell, 2007; DeBourgh, 2008). Beatty, et al. (2006) encouraged faculty members to present meaningful ARS questions that encouraged deeper level thinking and class discussion, and they suggested questions should have purpose by relating directly to the content and stimulate metacognitive processing. DeBourgh (2008) implemented ARS in the nursing classroom and noted high level questioning promoted advanced reasoning skills.

Faculty members need to participate in the decision making process when campus ARS decisions are made (Barber & Njus, 2007). It is the faculty who must implement the technology and therefore should have input in the selection process. In addition, more than one system per campus places an additional financial burden on the student (Barber & Njus, 2007). The cost to the student is often the hand-held transmitter or Internet connection, though some educational institutions have purchased a class set of transmitters, so there is no out-of-pocket cost to the students (Duncan, 2005).

The Net Gen reportedly thrives on classroom interactivity and engagement (Oblinger & Oblinger, 2006). With increased use of ARS, students are more engaged in their classroom environment (Barbour, 2008; Bergtron, 2006; Caldwell, 2007; DeBourgh, 2008; Dufresne & et al., 1996; Martyn, 2007; Presby & Zakheim, 2006; Stein, Challman, & Brueckner, 2006; Trees & Jackson, 2007; Woods & Chiu, 2002). As Tapscott (2008) indicated, educational programs integrated with technology can engage students in their own learning. Audience response systems provide engagement by connecting faculty members and students (Kumar, 2003).

On multiple occasions research has demonstrated student classroom participation increased when ARS technology was implemented in the classroom (DeBourgh, 2008; Freeman, Blayney, & Ginns, 2006). DeBourgh (2008) noted increased levels of student participation improved the effectiveness of student-faculty interaction. In-class communication was fostered by the desire to clarify student misunderstandings of the presented content. Studies that investigated further the reasons for the increased participation noted two underlying factors: discussion and anonymity (Boyle & Nicol, 2003; Dufresne & et al., 1996; Judson, 2002; Sharma, et al., 2005).

From the student's view, classroom discussion with ARS was more meaningful when deeper processing of information was facilitated (Sharma, et al., 2005). Audience response systems technology helped trigger discussion that would not have previously taken place in the classroom environment (Boyle & Nicol, 2003). The results from the students' responses stimulated classroom discussion, active learning and overall classroom communication during lecture sessions (Dufresne & et al., 1996). Freeman, et al. (2006) isolated student anonymity as the driving factor in student willingness to participate in classroom discussion. Judson (2002) found ARS as a promising tool to facilitate sincere classroom discussion.

Students reported they were actively engaged in the classroom environment when ARS was used in the classroom (Caldwell, 2007). They also perceived that they learned more when ARS technology was implemented (Crossgrove & Curran, 2008; Nelson & Hauck, 2008; Preszler, Dawe, Shuster, & Shuster, 2007). Judson (2002) and Trees and Jackson (2007) found immediate feedback was another positive feature that students reported when ARS technology was employed in the. Their studies also indicated students' misperceptions were clarified when they received immediate feedback. This, in turn, led to both enhanced discussion and improved student engagement. The questions remains, does increased perception of learning equate to improved learning outcomes?

While this researcher did not locate a study that identified a decrease in exam scores when ARS technology was implemented in the classroom, two studies were found that reported no change in examination performance (Barbour, 2008; Stein, et al., 2006). However, the studies that demonstrated improved examination performance far outnumbered the studies that reported no change (Conoley, et al., 2006; Crossgrove & Curran, 2008; Martyn, 2007; Nelson & Hauck, 2008; Poirier & Feldman, 2007; Preszler, et al., 2007; Schackow, Chavez, Loya, & Friedman, 2004). Quiz scores with and without the use of ARS in the classroom were compared using the same group of family medicine residents (Schackow, et al., 2004). The quiz scores with ARS were reported as significantly higher, M = 4.25 without ARS and M = 6.5 with ARS at the $p < .001$ level of significance. Performance on examinations is a measure valued by both students and faculty and, as the student benefits of ARS technology have been clearly delineated, there are also definite benefits to faculty members who elect to implement ARS technology in their classroom.

In multiple studies faculty members reported increased satisfaction with their role as an educator when ARS technology was used in the classroom. They had the opportunity to clarify questions and misunderstandings that were immediately relevant to the topic (Abrahamson, 1999; DeBourgh, 2008; Judson, 2002; Presby & Zakheim, 2006; Roschelle, Penuel, & Abrahamson, 2004; Trees & Jackson, 2007). Class attendance improved when ARS technology was implemented (Preszler, et al., 2007; Woods & Chiu, 2002). ARS technology was identified as a powerful learning tool that encouraged the students to critically think about the concepts that were presented in the lecture (Bergtron, 2006).

Not all of the reports in the literature identified a change in the classroom environment or in student performance when ARS was implemented in the classroom. Lasry (2008) evaluated ARS against methods of peer instruction (Lasry, 2008). A group of students who used questions with ARS technology was compared to a group of students who used questions with flashcards; both groups discussed the questions. The end result of the study was that the ARS did not make a difference in student outcomes; peer instruction was as effective as ARS technology. The author of the study stated, “Pedagogy is not technology” (Lasry, 2008, p. 244).

Martyn (2007) compared ARS compared to class discussion. She was unable to identify a statistically significant when the two methods were compared; however, students did report there was perceived value in the ARS technology when it was used in the classroom. Woods and Chiu (2002) examined the use of ARS technology combined with paired discussion in a class of over 250 students. The student's indicated their input on questions mattered and they felt a part of the large classroom environment when ARS technology was implemented. Large-class interactivity and student participation increased when ARS technology was used in the classroom (Woods & Chiu, 2002).

A similar study compared large class discussion to small peer group discussions when ARS was implemented in the classroom (Boyle & Nicol, 2003). The small group discussions facilitated increased student interactivity; the large class discussion allowed the faculty member to assess the students' understanding of the content presented. Duncan's research (2007) supported the findings of the Woods and Chiu (2002), and Boyle and Nicol (2003) studies. These studies reported the use of ARS, in conjunction with small or large group discussion, facilitated the formulation and explanation of the concepts that were presented in class. Caldwell (2007) recommended that faculty members recognize and plan for a change in classroom management, as discussion level increased lecture time decreased accordingly. Exclusive use of ARS technology in the classroom, without discussion, was not recommended (Johnson, 2005).

Gender Differences

Gender differences in education have been studied since as early as 1974. At that time, it was noted that "girls tend to underestimate their own intellectual abilities more than boys do" (Maccoby & Jacklin, 1974, p. 41). These findings were validated in a later study which empirically demonstrated gender-based cognitive differences were not supported by the findings; however, female attitudinal differences were identified (Fennema & Sherman, 1977). To continue the work on gender-based differences in education, a gender-based theory of schematic processing was developed (Bern, 1981). Findings related to self-schemata proposed past experiences facilitated the development of self-schemata, which were cognitive generalizations about the self (Markus, 1977). One of the driving factors noted in the development of gender-based schematic processing was the values our society placed on gender development: females develop their own identity of their gender through a social lens. Cognitive differences have not been identified as being gender related; however, the way females perceive themselves in educational environments has been identified as gender specific (Beyer, 1998a, 1998b).

Two additional studies validated earlier research on gender-based learning (Beyer, 1998a, 1998b). Beyer noted negative recall bias when performance and accuracy of self-evaluations were controlled for in the study, females recalled their mistakes more frequently than males. Additionally, females continued to underestimate their performance on examinations. When imagining a failing grade on an examination, females felt increased feelings of failure than did their male counterparts. The males in the Beyer studies indicated they could be more successful on exams, whereas females valued studying and paying attention in class (1998a, 1998b).

Knupfer and Rust (1997) studied male-female relationships and the computer culture. The researchers identified males are the predominate users of the computer and view it as a tool; females tended to focus on the utility of the computer. The authors also indicated that females were not well represented in technology-based professions.

Despite nearly thirty years of gender-based research, the findings remain consistent (Knupfer & Rust, 1997).

Vankatesh and Morris (2000) studied gender implication of post graduation technology use by introducing a new software program in the workplace. Gender differences remained in men's and women's perceptions of the application's usefulness. Men indicated that they tended to employ the new system based on its perceived usefulness, whereas women's usage was related to ease of the application (Venkatesh & Morris, 2000). These findings substantiated the Knupfer and Rust 1997 study.

In an attempt to explore if gender differences exist in the electronic classroom, male and female participation in on-line discussions boards was examined over the course of a semester (Davidson-Shivers, Morris, & Sriwongkol, 2003). The researchers identified male early acceptance of the application as they tended to make more entries on the discussion board, despite the female to male ratio of 2:1. However, by the end of the semester, there was no difference in the male-female participation in on-line discussions.

More recently, gender differences were investigated related to instructional gaming (Bonanno & Kommers, 2008). While gender variations continued to be identified, the gap appeared to be closing in the college classroom. Males in the study indicated more positive attitudes towards electronic gaming in the classroom; female's attitudes were identified as more neutral, not negative. These findings were hypothesized as possibly being related to the male-oriented gaming culture of the entertainment industry at that time. However, females in the study indicated they may seriously consider gaming as an educational medium if it had relevance to their pursuit of academic excellence. Regardless of gender, a time honored way of enhancing academic excellence is by the practice of taking notes (DiVista & Gray, 1972).

Note-Taking

To capture information presented in class, note-taking has been a long-standing student practice; notes taken in class can then be reviewed to facilitate knowledge transfer and ultimately knowledge acquisition (Aiken, Thomas, & Shennum, 1975; Crawford, 1925; DiVista & Gray, 1972). Notes are the visual evidence of external storage. The theory behind external storage includes the concept that it is more important to have notes rather than to take notes (Carter & Van Matre, 1975). The benefit of reviewing notes was tested by Carter and Van Matre (1975), Kiewra (1985), Kiewra, et al. (1991) and Benton, Kiewra, Whitfill, & Dennison (1993). Later, with the advent of technological innovations, specifically the cut and paste feature in word processing programs, the concept of having notes rather than producing notes was again tested (Igo & Kiewra, 2007; Igo, Kiewra, & Bruning, 2008; Katayama, Shambaugh, & Doctor, 2005).

External Storage

Carter and Van Matre (1975) found that the external storage of notes "assumed primary importance" (p. 900) over the encoding functions of note-taking. Subjects enrolled in a college course were divided into four groups and listened to a 17 minute recorded lecture. One group took notes and was allowed to review their notes for five minutes before testing; one group took notes and mentally reviewed the lecture content without viewing their notes; one group listened to the lecture, took no notes and was allowed to mentally review the lecture content; the final group took no notes and was given an activity to divert their attention away from the lecture material. Short term and long term recall of the lecture material were tested. The note-taking with review group significantly out scored all other groups, thereby supporting the theory of external storage. Kiewra (1985), Kiewra, et al., (1991) and Benton et al. (1993) further validated the findings of Carter and Van Matre and an additional dimension of encoding plus external storage with review was added as a feature of note-taking as a result of these studies.

Encoding

The "encoding function suggests that the process of taking notes is facilitative" (Kiewra, 1989, p. 147). When students took notes in class they demonstrated improved recall when compared to the no notes control group (Aiken, et al., 1975). Barnett, DiVista & Rogozinski (1981) studied encoding as a function of note-taking; they indentified note-taking was an effective learning strategy. Benton, et al., (1993) also studied encoding as a function of note-taking with complementary facilitative learning activities as seen in immediate or delayed writing. Students' writing improved for coherency and cohesiveness when they were allowed to write from their notes as compared to students who were not allowed to use their notes.

Recall

Recall is one expression of the encoding function subsequent to note-taking. Howe (1970) examined recall fourteen days after the students listened to a 160-word passage from a novel. Students who did not take notes scored significantly lower on the long term free-recall of material than students who took notes with a review; $t = 4.09$, $p < .01$. Fisher and Harris (1973) studied both short term and long term recall in relationship to note-taking. Recall in this study was positively correlated at $r = .73$, $p < .01$, as evidenced by students who took good quality notes or notes with many points, increased recall when compared to students who did not take notes, and/or students with poor quality notes, or notes with few points.

To study immediate and delayed recall, Weiland and Kingsbury (1979) divided undergraduate college students into groups: one group with and one group without notes. The group that took notes demonstrated improvement on both the immediate and delayed quizzes, $F = (1, 50) = 7.47$, $p < .001$ for the immediate recall and $F (1, 50) = 4.14$, $p < .05$ for the delayed quiz recall.

Note-taking and recall with prior knowledge was also studied by Shrager and Mayer (1989). College students were divided into two groups, note-taking and non-note-taking. Students in each group identified if they had prior knowledge of the subject matter prior to short term recall testing. High knowledge note-takers outperformed the low knowledge non-note-takers. The same result was not identified with high knowledge note-takers, indicating that recall was statistically the same among students with prior knowledge.

Kiewra, Benton, Kim and Risch (1995) studied note-taking and recall. Complete notes and a review, in this case a comparative essay, generated immediately after the presentation of material, demonstrated significantly improved long-term retention of the presented material. The format of the notes did not make a difference in the outcome as long as the notes completely reflected the main points of the presentation. The findings from Fisher and Harris (1973) were validated by the Kiewra, et al., (1995) study.

Comprehensive Note-Taking

The studies cited previously by Fisher and Harris (1973) and Kiewra et al. (1995) both identified the need for comprehensive or complete note-taking. Additional studies also substantiated the importance of complete note-taking (Locke, 1977; McDonald & Taylor, 1980; Morgan, Lilley, & Boreham, 1988; Peverly, et al., 2007). An empirical study of complete note-taking was conducted by Locke (1977). In a college classroom of the same course and lecture, the notes from 161 college students were compared to an ideal set of notes. The findings from the study showed that students with more complete notes strongly correlated with a higher grade at the end of the course, $F(3,157) = 11.84$, $p < .001$. These findings validated of one of the first studies conducted on note-taking (Crawford, 1925). Also noteworthy in the Locke study was the fatigue factor; indicating notes taken during the later third of the lecture were more incomplete when compared to notes taken by the same students during the first third of the lecture hour.

Morgan, et al. (1988) examined the importance of detail in note-taking. Four groups of dental students each were provided with varying levels of detailed notes ranging from complete text of a lecture presentation to no text, or self-generated notes. The group of students who were provided with the complete text outperformed the no text group on a long term recall exam; $M = 21.27$ for the students with complete set of notes compared to $M = 14.38$ for the students with self-generated notes. The findings were noted as significantly different at the p .01 level. All students were aware of the exam and therefore had the same opportunity to review their notes prior to the scheduled test.

A similar study examined detailed note taking in veterinary education students (McDonald & Taylor, 1980). The authors reported that the subjects' notes depicted approximately half of the important points identified by the faulty. No correlation between notes and performance was conducted in this inquiry.

Peverly, et al. (2007) validated the need for complete note-taking. The subjects were students enrolled in a lecture class of introductory psychology at a large university. The variables of verbal working memory, transcription fluency, semantic fluency, and letter and composition fluency were measured in relation to quality of note-taking. The findings indicated that the only variable excluded was transcription fluency, or the rate at which notes were produced. Complete notes were found to be a predictor of short term recall, as measured by exam performance.

Use of Technology

The explosion of technology in the late twentieth century has had an impact on note-taking (Igo & Kiewra, 2007; Igo, et al., 2008; Katayama, et al., 2005). The focus of note-taking study turned toward identifying the differences between electronically keying in notes and the cut-and-paste function of a word processing program. Again, the issues of the encoding function and external storage were questioned with the advent of electronic note-taking.

Katayama, et al. (2005) had one group key in their notes using a word processing program and the second group used the cut-and-paste function to generate their notes. Each group was exposed to computer-based study materials for the same amount of time. Each group was allowed to review their notes prior to a multiple-choice test administered one week after initial note generation. The results of the study indicated an advantage for the group of students who keyed in their own notes. This study supported encoding function over external storage.

Building on the Katamya, et al. (2005) study, Igo and Kiewra (2007) restricted the subjects to high-achieving students and studied their electronic note-taking behaviors. This was an attempt to control for cognitive ability. One group was allowed unlimited space to cut-and-paste their notes from electronic text, while the second group was restricted in the amount of text that could be cut and pasted. The authors' hypothesized restricted cut-and-pasting would force the subjects to focus on the material rather than just mindless gathering of information; the encoding function was being examined. Two days after electronic note generation without the benefit of any review, students were administered a series of three different types of tests. The results of the study did not support any significant difference in the performance of the groups. The researchers noted that the group selected to participate in the study may have influenced the findings. High achieving students who were unrestricted in the cut-and-paste function of electronic note generation demonstrated selective behaviors, regardless of the lack of limitations on space for text. Encoding function was supported in this study.

Pause Procedure

As early as 1970, faculty members were interested in making the process of note-taking more useful by pausing in class. At that time, little research had been conducted on the effectiveness of note-taking. However, a small study out of the University of Alberta took the process of studying note-taking one step further (Howe, 1970). Using scientific methodologies, Howe studied the recall of information provided on a taped recording in a laboratory setting. College-age students were assigned to an intervention group and were allowed to discuss among each other, the notes they took from the pre-recorded information. The control group of students was allowed no such discussion. The results of the study demonstrated after 14 days students' recall was significantly higher for the review group ($t = 4.09$, $p < .01$). There was little information provided in the article regarding the equivalency of the control and study groups, but this was the one of the first notations in the literature of what would eventually become the pause procedure.

The pausing principle was formalized in the physics classroom at a two-year college (Rowe, 1976). The researcher noted students were leaving class with incomplete notes, and they did not have an understanding of the lecture content during class time. As a faculty member concerned with student success, Rowe built on Howe's study and formalized a procedure to facilitate student learning in class. Rowe's methodology included pausing for two minutes, no less than three times, during a sixty minute lecture period. During the two minute pause, students compared notes with those adjacent to them. The efficacy of verbal note sharing was founded on the premise of improved student performance related to overt verbalization of notes (Weener, 1974). The faculty member did not interrupt or offer any additional information during the student sharing or pause time. While hypotheses of improved learning outcomes were suggested, the research did not report any empirical findings.

Early empirical research of pausing during note–taking was conducted by DiVista and Smith (1979). They noted sound academic values supported Rowe's assertions and tested the principles of lecture pausing in the laboratory. The study design included interspersed and post-lecture pausing. The study groups were small, as they were comprised of three college-age subjects per group. The three independent variables studied were: no review of notes during the interspersed lecture pause, individual review of notes during the interspersed lecture pause, and verbal peer review of notes during the interspersed lecture pause. The pauses were timed at precisely seven minutes intervals. Short term learning was measured by the use of free-recall, and cued recall was tested at the conclusion of the presentation. When compared to groups without peer discussion, the findings of noted significantly improved performance on recall testing for interspersed lecture pausing coupled with peer discussion. Mean results in test scores for no peer discussion were M=5.25 compared to mean results of test scores with pause and peer discussion M=9.33. Natural breaking points, rather than precisely timed pauses in lecture presentation were suggested as a result of this study; timed pauses seemed artificial (DiVista & Smith, 1979).

To validate previous hypotheses, Rowe again studied the pause principle in a science classroom of a two-year college (1980). The researcher stated concern for lapses in student learning related to the difficulty of the material, the ability to maintain attention during class, and flow of ideas during class. The assertions were these variables distracted the learner during class from gaining information necessary for success. The pause procedure was implemented as described previously; however, a third student was added to the pause peer discussion group. The addition of the third student during the discussion time was thought to be beneficial; three sets of notes offered enough variety for a thorough representation of the content. Rowe reported increased learning, improved performance on exams, and improved long term retention; however, the study lacked statements of empirical findings. The suggestion was made to systematically replicate the research (Rowe, 1980).

Studies were later developed to empirically test the pause procedure in groups with special learning needs at the college level (Ruhl, 1996; Ruhl, et al., 1990; Ruhl, et al., 1987; Ruhl & Suritsky, 1995). In each of these studies the basic concepts of the pause procedure were followed by offering two minute pauses during lecture presentations at varied intervals. Effects of the pause procedure were examined by analyzing immediate free-recall and long term recall through objective testing (Ruhl, et al., 1987). A significant difference in immediate free-recall among the groups with the pause procedure was identified; M = 22.972 compared to the no pause group M= 16.639, F (1, 68) = 40.86, p = .0001. Long term recall was also significantly improved with the pause group; M = 84.39 compared to the no pause group M = 76.28, F (1, 68) = 4.44, p = .039.

The pause procedure was again tested in a similar study in the college classroom (Ruhl, et al., 1990). Performance of short term free-recall and long term recall as measured by performance on objective testing was examined in two populations, students with and without learning disabilities. Significant differences were noted in the pause group in free-recall (F = 9.1, *df* = 2, p < .01) and in the pause group long term recall measured by objective testing (F = 10.45, *df*= 2, p < .01).

Ruhl and Suritsky (1995) investigated the effect of pausing in class on the completeness of notes and free-recall of college-level students with learning disabilities. Applying the multiple analysis of variance (MANOVA) test to the data, performance of the treatment group with the pause procedure demonstrated significant improvement (F =

3.891, *df*= 3/29, $p < .01$). Rowe and Ruhl studied the pause procedure in various groups of college age students with reported significant increases in the performance demonstrated in each study. What this researcher has not discovered the literature, however, is any effect of the pause procedure on engagement or cognitive load.

Cognitive Load

Cognitive load is a "theory that emphasizes working memory constraints as determinants of instructional design effectiveness" (Sweller, et al., 1998, p. 251). Cognitive load theory (CLT) incorporates principles of cognitive architecture, metacognition, and instructional design. Cognitive load theory includes three types load: intrinsic, extraneous and germane (Paas, Renkl, et al., 2003; Sweller, 1994; Sweller, et al., 1998). A fundamental tenant of CLT is "problem solving learning and problem solving difficulty that is artificial in that it can be manipulated by instructional design" (Sweller, 1994, p. 295). Cognitive load theory has been empirically tested with promising results reported.

Cognitive Architecture

An understanding of cognitive architecture is necessary and foundational to cognitive load theory. There are two generally accepted repositories of memory: long term memory, which has an unlimited capacity for storage, and working memory, also known as short term memory, with a limited storage capacity (Paas, Tuovinen, Tabbers, & van Gerven, 2003). Working memory has also been referred to as active consciousness (Sweller, et al., 1998). It is believed that active working memory only has a capacity for approximately seven elements (Miller, 1956). Interaction between elements places an additional load on working memory thereby functionally reducing the number of elements that can be simultaneously processed in working memory. Long term memory is a complicated structure of interworking actions, not single bits of information stored in isolation. Information stored in long term memory occurs in the form of schemas (Sweller, et al., 1998). A schema is an ordered unit of memory (Norman & Bobrow, 1976). Thoughts and behaviors have predictable results as empirical evidence has demonstrated that individuals' process information based on preexisting cognitive information (schema). Also, individuals resisted information that was counterintuitive as it opposed preexisting developed schema (Markus, 1977). Skilled performance is fostered by the development of increasing complex schemas; schemas are not stagnant, but ever increasing units of memory. The formation of schemas can reduce working memory load by the process of automation (Paas, Renkl, et al., 2003). Automation occurs when conscious processing is no longer necessary to solve a problem (Sweller, et al., 1998). Metacognition plays a role in conscious information processing (Bannert, 2002).

Metacognition

The term metacognition is sometimes used interchangeably with the associated terms of self-regulation and self-regulated learning. At the root of the terms are intentionality and self-awareness (Dinsmore, Alexander, & Loughlin, 2008). Self-regulated action is the broad construct under which the sub-constructs of metacognition, self-regulation and self-regulated learning occur. The sub-constructs are not necessarily exclusive of each other, rather they have dimensions of overlapping meaning (Kaplan, 2008). According to Flavel (1979),

> Metacognitive knowledge is one's stored knowledge or beliefs about oneself and others as cognitive agents, about tasks, about actions or strategies, and about how all these interact to affect the outcomes of any sort of intellectual enterprise. Metacognitive experiences are conscious cognitive or affective experiences that occur during the enterprise and concern any aspect of it--often, how well it is going. (p. 906)

Conscious awareness of learning is at the core of metacognition. There are three elements to consider for conscious or regulated learning awareness: the person involved in the regulating; the regulated object; and the regulating process involved (Fox & Riconscente, 2008). In an educational setting, the person involved is the learner. The regulated objects are the instructional materials, and the processes are the methods to connect the learner to the materials. Being aware of one's own process of actively learning is metacognition. As one becomes involved in the learning process, the principles of active learning and engagement are employed (Kaplan, 2008). Cognitive load can be managed by a learner's self-regulation and metacogitive processes (Bannert, 2002). Through instructional design, educators can facilitate self-regulated action to foster metacognition and self-regulated learning.

Schema Development

The goal of instructional design is to decrease extraneous load and facilitate germane load by schema development (Sweller, et al., 1998). To construct original schema, information is processed in working memory. As mentioned previously, working memory is finite; if the goal of instructional design is for learning to transpire, then the limits of working memory cannot exceede the total load created by combined intrinsic, extraneous and germane load (Paas, Renkl, et al., 2003). "The ease at which information may be processed in working memory is a prime concern of cognitive load theory" (Sweller, et al., 1998, p. 259). The intrinsic nature of the material may affect working memory; intrinsic load is the inherrent nature of instructional material. Element interactivity is incorperated into intrinsic load (Sweller, et al., 1998). If many elements simutaneously interact in working memory, the material has high element interactivity. If there are few interacting elements in working memory, the material has low element interactivity (Paas, Renkl, et al., 2003). Intrinsic cognitive load, as determined by relative element interactivity, is impacted by learner expertise (Kalyuga, et al., 2003; Kalyuga, et al., 2001). The more the learner is familiar with the material, the lower the element interactivity in working memory as schema already exist and working memory is freed (Ayres, 2006; Paas & Kester, 2006). It was initially thought that intrinsic load could not be impacted by instructional design (Sweller, et al., 1998); however, later research inicated that schema acquisition and automation can reduce intrinsic load (Paas, Renkl, et al., 2003).

Extraneous Load

To understand extraneous load, consider a faculty member who is teaching new content to a class. If the faculty member discusses the content, reiterates the content with diagrams, rediscusses the content again, and follows the instruction with an example, then extraneous load would likely be high. When information is presented, represented in a different format, and possibly yet again presented in a subsequent format, these multiple presentations of the same information in different formats creates high extraneous load. When information is not supplemental, but repetative, extraneous load is created (Sweller, et al., 1998). High element interactivity must exist to produce intrinsic load (Sweller, 1994). The instructional designer must be mindful to direct learners toward methods that are meaningful to learning and avoid redundency.

Measurement of Cognitive Load

Measurement of cognitive load currently is an enigma, as researchers have yet to agree on standardized tools to consistently and effectively measure conitive load (DeLeeuw & Mayer, 2008). Paas' tool (1992) has been commonly used to measure cognitive load has been well validated in the literature, and is simple to implement. The tool is a single question measure based on a 9 point scale with scores that range from a 1, signifying very very low mental effort, to a 9, representing very very high mental effort. The initial reliability coefficient was reported to be 0.90 (Paas, 1992). The subsequent reliability of the tool was reported at 0.84 (Paas & van Merrienboer, 1994), and the continued documented usefulness and reliability of the tool was reported (Paas, Tuovinen, et al., 2003).

More recent research has indicated that increasingly sensitive tools are needed to support the *triarchic* theory of cognitive load, or the three types of cognitive load (intrinsic, germane and extraneous) processing. To evaluate the sensitivity of each measure to the three different types of cognitive load processing, DeLeeuw and Mayer (2008) applied different assessments in two similar experiments. In this study, Paas' Mental Effort Tool demonstrated validity in measuring intrinsic load, but did not address the remaining germane and extraneous loads. The redundancy effect was measured by performing a secondary task (pressing the space bar when the screen goes dark) to ascertain extraneous load, and overall difficulty ratings were used to determine germane load. Statistically significant differences were found in the differing loads and the researchers concluded “different measures of cognitive load should not be assumed to measure overall load, but may be effectively used to measure different types of load” (DeLeeuw & Mayer, 2008, p. 234).

Cognitive Load Effects

There are multiple effects noted in the literature that affect extraneous load. However, redundency, split-attention, and the expertise reversal effects are noteworthy as they relate to this body of work. Sweller, et al. (1998) noted the redundancy effect when the faculty member retaught the same information in multiple formats with little evaluation of student attentiveness throughout the instructional process. If materials were presented only using a picture, instead of supplementing the information with both a picture and words, then redundency was avoided (Sweller, et al., 1998). Upon examining the findings, improved performance was noted when the redundant material was eliminated (Sweller & Chandler, 1994).

The split-attention effect is simular to the redundency effect. “Split-attention occures when two or more sources of information must be processed simutaneously in order to drive meaning from the material” (Sweller, et al., 1998, p. 282). “The destinction between the split-attention and redundency effects hinges on the distinction between sources of information that are intelligible in isolation and those that are not” (Kalyuga, Chandler, & Sweller, 1998, p. 2). Lower learning outcomes were demonstrated when the split-attention effect was evaluated related to extraneous load (Cierniak, Scheiter, & Gerjets, 2009). What was once viewed as harmless additional detail, resulted in the split-attention effect and was further identified as distracting and impairing further schematic develoment (Kalyuga, et al., 1998).

Kalyuga, et al. (2003) and Rikers, et al. (2004) noted instructional techniques that were effective with inexperienced learners, had a decreased effect on experienced learners, and they referred to this phenemon as the expertise-reversal effect. The learner was exposed to unnecessary load through this effect as completely developed schema already existed and no new information was offered during instruction. The way to overcome the expertise reversal effect is to design instruction with the learners in mind (Kalyuga, et al., 2003; Rikers, et al., 2004).

Instructional Design

The aim of instructional design is to facilitate learning by decreasing extraneous load and enhancing germane load (Sweller, et al., 1998). To improve germane load, the instructional designer must present informtion that is directly relevant to the learning condition (van Merrienboer & Sweller, 2005). The primary mechanism for learning is through the acquistion and automation of schema (Sweller & Chandler, 1994). One way to facilitate schema development is by way of chunking information into logical and managable pieces (van Gog, Paas, & van Merrienboer, 2004). "A chunk is a collection of elements having strong associations with one another, but weak associations with elements within other chunks" (Gobet, et al., 2001, p. 236). According to Gobet et al., (2001), learning occurs by comparing information to preexisting schema. If a complete schema exists, no learning occurs. If no schema exist, then information is processed by working memory. A third, and more likely possibility, is that partially developed schema exist in long term memory. A stimulus facilitates schema transfer into working memory and new information is added to an existing schema. When chunking was tested, the findings supported improved learning outcomes (Furukawa, 1972). Chunking by intentional intructional design can facilitate germane load. It is the role of the instuctional designer to build appropriate educational materials to meet the needs of the learner.

Deliberate instructional design implies developing educational materials with an awareness of the learner's educational needs. To avoid the expertise reversal effect, instructional designers must know their leaners (Kalyuga, 2006; Kalyuga, et al., 2001; Paas, Renkl, et al., 2003; Renkl, 1997; Rikers, et al., 2004). And, as learners cognitively mature, their needs change (Paas & Kester, 2006). Instructional design that once was useful for inexperienced learners has been shown to decrease effectiveness, and even result in negative consequences, when implemented with experienced learners (Kalyuga, et al., 2003). Instructional effectiveness improved when lessons were designed to build on the learner's existing schema (Kalyuga, et al., 2003; Kalyuga, et al., 2001). Learner motivation improved with challenging instructional design (Rikers, et al., 2004). Knowing the learner is a key element of instructional design.

Designing educational materials to improve instructional effectiveness has been demonstrated in multiple studies. Some of the instructional methods include worked-out examples (Atkinson & Renkl, 2007; Grobe & Renkl, 2007; Paas & van Gog, 2006; Renkl, 1997; van Gog, Paas, & van Merrienboer, 2006), problem solving (Kalyuga, et al., 2001), instructional fading (Atkinson, Renkl, & Merrill, 2003; Renkl & Atkinson, 2003), deliberate practice (van Gog, Ericsson, Rikers, & Paas, 2005), review of real life tasks (van Merrienboer & Ayres, 2005) instructional sequencing (Kester, Kirschner, & van

Merrienboer, 2006; van Gog, Paas, & van Merrienboer, 2008), and self-explanation (Kalyuga, 2009; Renkl, 1997).

For the advanced learner, instructional design builds on existing schema. One way to accomplish effective design for the advanced learner is through self-expalnation.

> Audio narration will be most helpful when the cognitive load is highest. If the instructional goal and/or content are relatively simple, presenting words with text will be as effective for learning as presenting words with audio. ...(A)udio version helped learning on the more complex operations and had little effect on questions that did not require much mental effort. (Clark, Nguyen, & Sweller, 2006, pp. 67-69)

Learners abilites were improved by knowledge transfser when self-explaination was implemented (Kalyuga, 2009; Renkl & Atkinson, 2003). Self-explaination is an instructionally effective tool that can enhnace germane load (Kalyuga, 2009).

Summary

The Net Gen is a group of students who thrive on engagement and are achievement oriented students (Carlson, 2005; Prensky, 2005). Instructional design that incorperates ARS technology in the classroom has both engaged students and improved learning outcomes (Hake, 1998; Schackow, et al., 2004). Active learning and peer instruction have been correlated with improved student performance outcomes (Crouch & Mazur, 2001; Ernst & Colthorpe, 2007). Note-taking during class has been shown to facilitate external storage (Carter & Van Matre, 1975). Having a complete set of notes has also been correlated with improved learning outcomes (Kiewra, et al., 1995; Locke, 1977). Introduing the pause procedure has been demonstrated as an active learning strategy that facilitated complete note taking and improved learning outcomes (Rowe, 1976, 1980; Ruhl, 1996; Ruhl, et al., 1990; Ruhl, et al., 1987; Ruhl & Suritsky, 1995). The pause procedure (Ruhl & Suritsky, 1995) has the potential to address the Net Gen's need for enhanced classroom engagement (Prensky, 2005) as well as their drive for high achievement (Carlson, 2005).

Cognitive load in the classroom needs to be considered when designing instruction (Kalyuga, 2006; Sweller, et al., 1998). An instructional design that decreases extraneous load, but increases germane load has the potential to improve student perfromance (Sweller, et al., 1998; van Merrienboer & Sweller, 2005). Adding the component of audio narration to an instructional design can help enhance germane load (Clark, et al., 2006; Kalyuga, 2009; Renkl & Atkinson, 2003). It may be possible for the the pause procedure to decrease extraneous load and enhance germane load while incorperating an audio naration component of cognitive load theory. This study will examine the pause procedure for effects on classroom engagement and cognitive load.

CHAPTER III

METHODOLOGY

Introduction

This research project attempted to empirically validate the claims that the Net Generation (Net Gen) needs to be engaged in the classroom. Three research questions were formulated in an attempt to confirm this assertion. This study was accomplished by introducing the pause procedure during regularly scheduled class sessions of a senior level nursing class at a small, private, liberal arts university. Specifically, the following research questions were addressed:

1. Is there a relationship between student engagement and near-term learning during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university?
2. Will the introduction of the pause procedure during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university have any effect on cognitive load?
3. Will the introduction of the pause procedure during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university have any effect on near-term learning?

This quasi-experimental, within-subjects design used both repeated and non-repeated measures. The independent variable was the pause procedure, and the dependant variables were engagement, cognitive load and near-term learning. Webster's Engagement Tool (Webster & Ho, 1997) was used to measure classroom engagement, and cognitive load was measured by administering the Mental Effort Rating Scale (Paas, 1992). Both the Mental Effort Rating Scale and Webster's Engagement Tool were administered every week of the study as repeated measures. To determine near-term learning, weekly, electronic ten-question quizzes were administered. Statistical analysis was conducted to answer the research questions.

Definitions

The *pause procedure* periodically places a two-three minute break during the lecture/discussion portion of a class, during which time a group of 3-4 students review their notes taken during the preceding lecture/discussion session.

*Engagemen*t is both a physical and intellectual act of focus. Cognitively, the participant is mentally involved and thinking about the presentation material. Emotionally, the participant desires involvement with the presentation. Behaviorally, the participant displays a posture of interest by facing the presenter; often eye contact is exchanged. Engagement has an element of playfulness while keeping the participant's attention, curiosity and level of interest during a presentation.

Cognitive load is the constraint on working memory resulting from instructional design.

Near-term learning is a measure of conceptual knowledge as measured by performance on ten-question quizzes.

An *audience response system* is an electronic polling technique to anonymously collect and tabulate student input. The system has two forms: it is either a hand-held apparatus, which resembles a television remote control that sends a signal to a receiver connected to a local computer, or the polling takes place over the Internet through a web browser.

A *class session* is a regularly scheduled, 150 minute time block when students and faculty meet face-to-face in the classroom. One class session is equivalent to 1 week of class for a 3 credit hour, semester-long class. The 150 minute time block is based on the Carnegie unit, which integrates the 50 minute class hour. Students meet face-to-face with an instructor for 50 minutes and then take a 10 minute break; class reconvenes for an additional 50 minutes, followed by a ten minute break and then resumes for the final 50 minutes.

Participants

A convenience sample of nursing students in the first semester of their senior year was selected for this quasi-experimental, within-subjects research study. Demographic data was collected on the study participants (Appendix A). The majority of the subjects were female. A large portion of the students originated from the surrounding Midwest area.

The study was conducted in the Family Health Nursing (FHN) class of first semester of the senior year. Instruction was designed for the advanced learner. To avoid the redundancy effect, the participating faculty member was cognizant that information presented in senior level nursing courses builds on knowledge from previous prerequisite and nursing program courses. High element interactivity was a considerable factor as the content included subject matter from anatomy, physiology, microbiology, psychology, sociology, nutrition and lower level (foundations and beginning medical-surgical) nursing courses. Elements from previous subjects interact with each other to generate the higher level concepts germane to senior level nursing classes.

The subject population was relatively homogeneous. The students who participated in the study were all simultaneously enrolled in three clinical nursing courses for a total of no less than sixteen credit hours of nursing course work. All of the students were admitted into the nursing program using the same criteria**:** a grade point average of at least a 3.0 in all of the required coursework prior to starting nursing courses in their junior year. As a requirement for entry into the nursing program at the junior level, students may only have six hours of remaining general education coursework. In this particular program, all of the nursing courses are offered only in the junior and senior levels of nursing school. To progress to the senior level of the nursing program, all of the students must have completed twenty-six hours of nursing coursework with no less than a 75% exam average on internally, faculty developed exams administered during the junior year, and they must have successfully completed all clinical requirements. Upon review of the attrition rates from the three previous years, it was less than 5% of the students enrolled at the senior level.

Research Site

Prior to initiating the study, permission to conduct the investigation was obtained from the Institutional Review Board (IRB) (Appendices B and C) from both the university where the study was conducted and from the researcher's educational institution. The study was conducted in the senior nursing FHN class at a small private university (hereafter referred to as the University) in the Midwest with a total undergraduate and graduate enrollment of approximately 3,800 students, 2,100 undergraduate and 1,700 graduate students. The nursing school offers a bachelor's degree in nursing, with an enrollment of 256 undergraduate students in the fall semester of 2009.

Each section of undergraduate nursing classes averages approximately 35-40 students. The classroom selected for the study had a rectangular configuration and was adequate to accommodate the 29 enrolled students. It was furnished with moveable oblong tables that each seated 2 students, situated in rows with side isles every 2 to 3 tables, all facing forward toward a podium. The classroom had an electronically equipped podium with a computer, monitor, DVD/VCR, and camera pad. Additionally, the classroom had a ceiling-mounted projector, screen and speakers. The classroom computer had a full complement of Microsoft products and Internet access.

Audience Response Systems Technology

Undergraduate nursing students were required, as per program policy, to bring a laptop computer to each class session. It was compulsory for each laptop to have Internet access. The Internet provided access to LiveClassTech (LCT), an interactive audience response systems product. LiveClassTech was equipped with not only the traditional ARS technology of response to questioning but also had multiple additional features. Students could key in a question to the faculty member during a classroom presentation. LiveClassTech had a student-initiated stop button built into the program, which, when activated, indicated to the faculty member a topic was unclear a student. A ditto button was also a unique feature of this program; it was used when more than one student wanted the faculty member to stop and review the presented material or when another student had the same question. Students gained access to LCT via a unique username and password. This Internet-based product alleviated the need for the hand-held transmitter and the receiver that are germane to many other ARS products. A histogram was generated in response to student answers at the conclusion of each question. As this was an Internet-based product, there was no need for faculty to provide LCT with class lists or student code numbers to use the product, and all the LCT data was encrypted.

Instrumentation

Three instruments were used in this study: one tool measured engagement, one tool measured cognitive load, and the third set of tools were 10-question quizzes which measured near-term learning. The instruments were selected based on their relevance to the study and their reported reliability.

Engagement tool. Engagement was determined by Webster and Ho's (1997) engagement tool; it is a seven question survey specifically designed to measure engagement in the classroom (Appendix D). Permission to use the tool was obtained (Appendix E). When Webster and Ho (1997) used the tool the first time they assessed engagement by using two different types of multimedia software during the same class session. In the first half of the class, one presentation medium was used, and in the second half of class, a second presentation medium was used. In the original study, engagement was measured twice each class session, with students completing the survey at the conclusion of each presentation. Correlations were determined based on student responses at two intervals during the same class session. The tool was determined to be highly reliable with a documented coefficient of $r = 0.90$ (Webster & Ho, 1997). This engagement measure has been used in other studies (Webster & Ahuja, 2006; Webster &

Hackley, 1997) that reported reliability over 0.80 and engagement related to other constructs as expected (demonstrating validity).

Cognitive load tool. Cognitive load was measured by the Mental Effort Rating Scale (Appendix F) as developed Paas (1992). Permission to use the tool was obtained from the author (Appendix G). The tool is a single question measure based on a 9 point scale, ranging from a 1, signifying very, very low mental effort, to a 9, representing very, very high mental effort. The initial reliability coefficient was reported to be 0.90 (Paas, 1992); subsequent reliability of the tool was reported at 0.84 (Paas & van Merrienboer, 1994), and continued documented usefulness and reliability of the tool was reported (Paas, Tuovinen, et al., 2003).

Near-term learning tools. Near-term learning was measured by weekly quizzing. A ten-question quiz was administered each week that incorporated information presented from the class session and/or the corresponding assigned readings; the quiz was delivered at the conclusion of the lecture/discussion portion of each class session (Figure 3). Six different ten-question quizzes were developed for the study. Validity of the quiz questions was established by three nursing experts: two experts in the content area and one expert in question item development. One of the content nursing experts has 30 years of nursing experience in the content area, and has been a nurse educator for 13 years. The second content expert has 15 years of nursing experience in the area and has been a nurse educator for nine years. To determine if the questions were relevant to the class session material, the content experts reviewed the questions using the Item Evaluation Tool (Appendix H). To determine content expert agreement, data were aggregated by adding the reviewers' scores. Only questions indicating agreement, as represented by a total score of 4 or less, were selected.

The questions also were reviewed by a veteran nurse educator of 15 years and test item development expert. She holds the appointment of Testing Coordinator; as the coordinator her job is to review all test questions delivered in the University's nursing program for compliance with standards as set forth by the National Council of State Boards of Nursing. She reviewed the quiz questions used in this study using the same compliance criteria, and she also indicated if questions were written at the knowledge or application level.

The quiz questions developed for the study were designed to test content information at both the knowledge and application level. Each ten-question quiz, given at the conclusion of the lecture/discussion portion of the class session (Figure 3), contained five knowledge-level questions and five application-level questions. Knowledge-level questions test factually based information and occurred as questions one through five on each quiz. Application-level questions test how information could be used in a clinical setting, and these questions occurred after the knowledge level questions. Each quiz reflected the preceding lecture/discussion content and/or the assigned reading. No quiz question was administered more than once throughout the study. Course points were assigned to some of the questions on each quiz. The questions with points were undisclosed to the students to help motivate them to perform their best on each question.

Mid-semester questionnaire. It is the practice of the participating faculty member to administer a mid-semester questionnaire. This is a voluntarily, informal assessment conducted at approximately week seven of the semester. Most of the questions are open-ended to solicit individual input. The intention of the survey is to make any mid-course corrections based on the students' input and to collect data on pausing in class. The mid-semester questionnaire was administered to students participating in the study, and they responded to the following:

1. The **one thing** I like about this class is:
2. The **one thing** about this class I wish the professor would change is:
3. I liked the following activity/activities (circle as many as you like):
    a. Crossword puzzles
    b. Teaching with questions (Postpartum class)
    c. Teaching with pictures (Newborn class)
    d. Case studies in D2L
    e. Fact or Fabrication Activity (Fetal Development class)
    f. PowerPoints with lecture (Pregnancy and Labor classes)
    g. Other: ____________________
4. I do/do not like pausing during class because:
5. I do/do not like "table talk" because:
6. I do/do not like the 10 quiz questions at the end of class because:

Data generated from these questions was first reviewed by the participating faculty member and then shared with the researcher. No mid-course corrections were necessary as a result of the information provided by the study participants.

Learning Content

The learning content for the study fell within the domain of maternity nursing. Six class sessions were selected for the study. The topics selected for each three-hour long class session were:

1. fetal development, genetics, and maternal nutrition
2. maternal adaptation during pregnancy, and nursing management during pregnancy
3. labor and birth process, and nursing management during labor and birth
4. postpartum adaptations and nursing management during the postpartum period
5. newborn adaptations and nursing management of the newborn
6. contraception and sexually transmitted infections

Faculty must consider the total cognitive load when designing instruction. Specifically regarding the nursing class sessions selected for the study, the following major concepts were integrated into the content for each respective class session.

Class Session	Concepts
1	Anatomy, physiology, sociology, genetics, nutrition, and foundations and maternity nursing
2	Anatomy, physiology, psychology, sociology, and foundations and maternity nursing
3	Anatomy, physiology, microbiology, psychology, sociology, and foundations, beginning medical-surgical and maternity nursing
4	Anatomy, physiology, microbiology, psychology, sociology, microbiology, and foundations, beginning medical surgical and maternity nursing
5	Anatomy, physiology, psychology, sociology, pediatrics, and foundations, beginning medical-surgical and maternity nursing
6	Anatomy, physiology, microbiology, psychology, sociology, and foundations and maternity nursing

As there were many major concepts incorporated in the aforementioned content for each class session, there was potential for high element interactivity.

Procedure

Consent. One week prior to the first week of class, all students enrolled in FHN nursing at the University received an email explaining the study (Appendix I). On the first day of FHN class, the students were asked by the researcher to participate in the study. After the research study was fully explained, consent to participate in the study was obtained (Appendix J). Students had the option to participate in the study, and it was made clear to them that they could elect to opt-out at any time. As the planned intervention was a teaching technique, all students enrolled in FHN received the pause procedure teaching intervention. There was no cost to the student to participate, as the fee for LCT was waved. There was little student risk related to participating in the study.

Incentive to participate. As an incentive to participate in the study, students who elected to take part in the study received 50 alternative assignment points. There were 1000 total FHN course points. Of the total course points, there were 100 alternative points. To receive all of the alternative points, students had to arrange two related FHN experiences, e.g., attend a Le Leche class, birthing class, etc. If a student elected to participate in the study, (s)he needed to arrange only one alternative FHN experience. If a student elected not to participate, (s)he needed to arrange two alternative FHN experiences. To receive the 50 points, the student must have submitted six surveys, one survey per class sessions. No partial credit was available unless there were extenuating circumstances, which was be determined by the participating faculty member.

Class sessions. A class session is identified as a regularly scheduled, 150-minute time block when students met face-to-face with a faculty member in the classroom. One class session is equivalent to one week of class for a 3-credit-hour, semester-long class. The study included six total class sessions: three class sessions with the pause procedure intervention and three without the intervention.

To lend some degree of randomization to the study, the lottery method determined which class session received the pause procedure intervention. A diagram of the study follows, where "C" is a class session, "P" is the pause procedure intervention, and the number is the occurrence:

C1 C2 C3P1 C4P2 C5 C6P3

Instructional strategy. When developing the instructional strategy, efforts were made to anticipate as many extraneous variables as possible. A consistent instructional pattern was designed. Preparatory material for each class session was relatively stable. Content experts were assigned to the course and delivered all of the content. The classroom seating arrangement and student group assignments were controlled.

Each 150 minute class session in the study followed the same instructional pattern as follows: 20-25 minutes lecture/discussion of content followed by an ARS question with a table discussion among the students, electronically generated student responses followed by a review of the responses; repeat lecture/discussion and ARS question sequence for a total of four-to-five total lecture/discussions segments (see Figure 2).

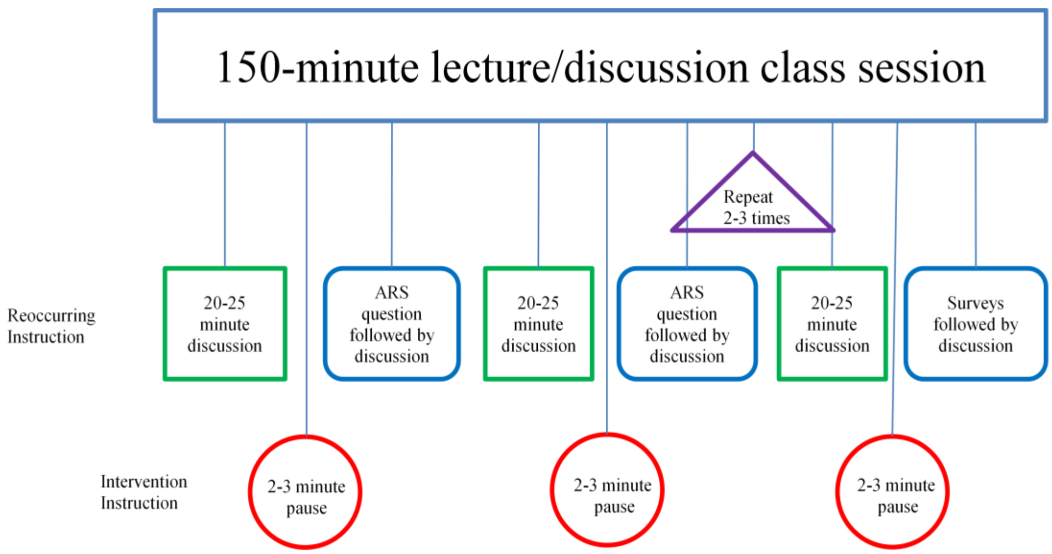

Figure 2. Pattern of Instruction.

After the last lecture/discussion class segment, students participated in the ten-question quiz. Each quiz question was presented separately; and the participants discussed the question with those sitting at their table but responded to the question individually using LCT. After all of the responses were received, each question was discussed by the presenting faculty member. The time from the launch of one question to the launch of the next question was approximately three minutes. This time remained consistent for all six class sessions. After the ten-question quiz, paper copies of Webster's Engagement Tool (1997) (Appendix D) and Paas' Mental Effort Rating Scale (1992) (Appendix F) were distributed, and then collected anonymously. All students enrolled in FHN participated in the study and submitted weekly both the engagement and mental effort surveys.

To control for length of advance preparation, the reading assignments were approximately the same number of pages. As a result of a change in texts, the reading assignment for the first class was shorter than the remaining assignments, and additional material was supplemented with in-class discussion and activities. The class content with the corresponding reading assignments was as follows:

1. fetal development, genetics, and maternal nutrition- 34 pages
2. maternal adaptation during pregnancy, and nursing management during pregnancy-64 pages
3. labor and birth process, and nursing management during labor and birth-70 pages
4. postpartum adaptations and nursing management during the postpartum period-50 pages
5. newborn adaptations and nursing management of the newborn-70 pages
6. contraception and sexually transmitted diseases-58 pages

One faculty member was assigned to teach all of the assigned content. That primary faculty member became ill on two occasions and was unable to teach the third and fourth classes. The researcher substituted for the primary faculty member when she was absent. The researcher has 28 years of clinical experience in family health nursing and has taught at the college level for 15 years. The primary faculty member has nine years of experience as a clinical instructor, and at the beginning of the study, she had just started her second year of college-level classroom instruction. She is an expert in family health nursing with 15 years of experience in this specialized area of nursing. The primary faculty member worked with the researcher to ensure the instructional pattern was implemented as per the design of the study.

To decrease confusion, room configuration and student group assignment remained stable throughout the duration of the study. Tables in the nursing classroom were moveable and configured at the discretion of the faculty member. In the first class session of the semester, the participating nursing faculty configured the tables so three-to-four students sat together in a group. Each table sat two students**,** and two tables were placed together to accommodate up to four students. Group assignment for the study followed the pattern as described in Rowe's 1980 publication of the pause procedure. Students self-selected their group the first day of class, and each group remained the same for the duration of the study.

Pause intervention. Class sessions three, five and seven were randomly selected to receive the pause procedure intervention; the pattern for pausing and evaluation was fashioned after Ruhl, Hughes and Schloss' 1987 study. For this study, the pause procedure occurred after a lecture/discussion segment and before an ARS question (Figure 3). Just prior to the first pause, the faculty member read the entire script describing the pause procedure (Appendix K) (Ruhl, et al., 1990). Just prior to the first pause of subsequent class sessions, the faculty member read the last paragraph of the pause script. At 20-to-25 minute intervals, times determined appropriate by the faculty member, a two-to-three minute pause after the lecture/discussion occurred. During the pause, the self-selected groups of three-to-four students discussed the content previously presented, compared and added to their notes accordingly. The faculty member remained silent during the pause time; she did not add any information to the students' discussion or respond to any students' questions. Each pause was followed by an ARS question and subsequent review of the student responses. During the review of each ARS question, the faculty member entertained any student questions that remained. The final pause for each class session was followed by a ten question content/reading-related quiz and review of student responses (see Figure 2).

Participant Protection

The identities of each participant were protected by numerically coded data. After students agreed to take part in the study, the participating faculty member assigned a code number to each student. The participating faculty member maintained a list of student names and corresponding identification codes electronically in a password-protected program. After each class session the participating member coded the data and provided it to the researcher. All data in print form was void of any students' names and locked when not in use. Data will be destroyed after five years. Student anonymity was protected during class questioning by the ARS, LiveClassTech.

Data Analysis

Data was entered into Predictive Analytics Software (PASW) version 16.0 for Windows. Descriptive statistics were conducted on demographic data. Descriptive statistics included frequency and percentages for nominal data and means/standard deviations for continuous data. Standard deviation measures statistical dispersion, or the spread of values in a data set. If the data points are all close to the mean, then the standard deviation is close to zero. The arithmetic mean is defined as the sum of scores divided by the number of scores.

Four Cronbach's alphas were conducted to assess reliability and internal consistency for each of the three sub-sets of and total engagement scores: absorbed/attention, curious/imagination, fun/interesting and total (Appendix D). George and Mallery (2003) suggested the following rules of thumb for evaluating alpha coefficients: > .9 Excellent, > .8 Good, > .7 Acceptable, > .6 Questionable, > .5 Poor, < .5 Unacceptable.

Data from pause and no pause classes were compressed into two independent data sets to answer the research questions and test the following hypothesis:

RQ1: Is there a relationship between student engagement and near-term learning during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university?

$H1_o$: There is no relationship between student engagement and near-term learning during the lecture/discussion portion of the upper level nursing classes at a small, private, liberal arts university.

$H1_a$: There is a relationship between student engagement and near-term learning during the lecture/discussion portion of the upper level nursing classes at a small, private, liberal arts university.

To examine hypothesis 1, five Pearson *r* correlations were conducted to assess the relationship between student engagement and near-term learning during the lecture/discussion portion of the upper level nursing at a small, private, liberal arts university. Pearson *r* correlation was the appropriate analysis for examining the relationship between two continuous variables.

RQ2: Will the introduction of the pause procedure during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university have any effect on cognitive load?

$H2_o$: The introduction of the pause procedure during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university will have no effect on cognitive load.

$H2_a$: The introduction of the pause procedure during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university will affect cognitive load.

To examine hypothesis 2, an independent sample t-test was conducted to determine if mean differences exist on cognitive load. The assumption of normality was assessed for each research variable. The Levene's test was employed to test for homogeneity of variances.

An independent sample *t*-test for means was appropriate statistical analysis since the two samples were independent of each other (Pagano, 1990); in this study the research variables were subject to with and without the pause procedure. The alpha was set at 0.05 with a corresponding confidence interval at 95%. The independent samples test of the mean differences assumes normal distribution or a curve that is bell shaped and symmetrical. The assumption of normality was examined with the Kolmogorov Smirnov (KS) test.

RQ3: Will the introduction of the pause procedure during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university have any effect on near-term learning?

$H3_o$: The introduction of the pause procedure during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university will have no effect on near-term learning.

$H3_a$: The introduction of the pause procedure during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university will affect near-term learning.

To examine hypothesis 3, a dependent sample t-test was be conducted to determine if mean differences exist on near-term learning outcomes, measured by using students' scores on each ten-question quiz. The assumption of normality was assessed for each research variable.

An independent sample *t*-test for means was appropriate statistical analysis since the two samples were independent of each other (Pagano, 1990); in this study the research variables were subject to with and without the pause procedure. The alpha was set at 0.05 with a corresponding confidence interval at 95%. The independent samples test of the mean differences assumes normal distribution or a curve that is bell shaped and symmetrical. The assumption of normality was examined with the Kolmogorov Smirnov (KS) test.

Sample size. The most stringent sample-size requirement is with the Pearson *r* correlation, where the sample-size requirement is larger than for the independent sample *t*-test. Cohen (1992) notes that for statistical power of .80, a medium effect size, and at alpha =.05, the desired sample size is 85 participants. Data for the pauses classes and the non-pause classes was compressed into one sample set each and yielded a sample that exceeded the desired size of 85 participants.

To assure the sample size consisted of only those of or around the millennial generation, data from students older than 32 years were excluded from the analysis. There were 29 students enrolled in FHN and data from two students were not included in the analysis.

Role of the Researcher

The principle investigator (PIR) assumed the role of observational researcher for the majority of the study. The PIR has 15 years of experience teaching nursing and has been a registered nurse for 28 years. The PIR is a full time faculty member of the University and was assigned administrative duties for the FHN course. However, on two occasions, for classes three and four, the researcher had to substitute for the primary faculty member, who she became ill and was unable to teach the class.

Threats to Validity

Controls for threats to validity were described in the design of the study. Briefly reiterated, the same group of subjects was studied to control for homogeneity. A natural classroom setting was selected for the study. The independent variable, pause procedure, was implemented in separate class sessions which were randomly selected by using the lottery method. A consistent instructional pattern was instituted. A quiz reflective of the class content and/or reading material was delivered at the conclusion of the lecture/discussion portion of each of the six class sessions. Each quiz had a consistent design: five knowledge-recall level questions and five application level questions. There were 27 eligible subjects enrolled in the FHN course. The participating subjects took each of the surveys on six occasions; a large data set was produced which enhanced the relevance of the statistical analysis. The confidence interval was identified at 95% to reduce the possibility of a type I error. The quiz questions used for near-term learning were subject to measures which enhanced content validity. Reliable tools were selected to measure engagement and mental effort.

In this study, threats to validity did exist. A convenience sample of nursing students was selected for study. This sample may be biased, and generalization of the study's findings may be limited to other like populations. The behavior of the subjects may have changed knowing they were being observed for this a study. Social desirability may have been a concern, as students may have viewed participating in this study as a way to please the participating faculty member. The researcher may have unintentionally convinced students to participate when the study was described on the first day of class. Students may have behaved differently in class when the pause procedure was implemented, because it was new and different. Because the sample was largely female, and females generally underreport when using self-report measures, the researcher must consider there was potential for a type II error. As senior nursing students, who are advanced learners, the ceiling effect may have influenced student behavior. Since the same instruments were administered on six separate occasions, and students may have become familiar with the study questions, student responses may have differed across time in anticipation of the questions. The data collected when the primary faculty member was present may differ from the data from when she was absent.

Assumptions

Assumptions were considered for this study. The study subjects were nursing students in the first semester of their senior year. The first assumption was that these students, at the senior level, were motivated to complete their studies and therefore wanted to perform well on examinations. Another assumption was that students will pre-read the assigned material before coming to class to help them perform well on examinations. The study population was primarily female, so another assumption was that self-report issues related to gender may influence the results of this study (Beyer, 1998b; Maccoby & Jacklin, 1974). Demographic information was collected; however, an assumption was that the majority of the students enrolled in the nursing class was of the Net Gen and ascribed to the characteristics of their generation related to the desire for an engaged learning environment (Oblinger, 2006; Prensky, 2005). A final assumption was that the study participants complied with the nursing school's computer requirement and brought their laptop to class, since data was collected electronically via each student's laptop.

Limitations of the Study

The study was conducted at a small, private university. Students who attend private universities may not be comparable to students enrolled at public universities. The majority of the subjects in the study are female and therefore, a related limitation of the study relates to the accuracy of female ability to self-report (Beyer, 1998b; Maccoby & Jacklin, 1974).

The study was conducted in a nursing classroom over a six week period of time and followed the pattern of pausing as set forth by Rowe (1980), Ruhl, et al. (1990) and

Ruhl, et al. (1987). As the class selected for the study convened once a week for three hours instead of three times a week for one hour, the amount of data collected was limited to six class sessions. The length of the study was approximately one-third of a semester, which is relatively short in relationship to an entire nursing curriculum.

The participating faculty member was originally assigned to teach all of the content for the duration of the study. As the participating faculty member became ill, the primary investigator taught class sessions three and four. The participating faculty member had one year of experience teaching at the college-level. The primary investigator had 15 years of college-level teaching experience. The primary investigator also had a vested interest in the study. These factors are limitations of this study.

CHAPTER IV

FINDINGS

The purpose of this study was to examine an instructional strategy intended to enhance engagement. Three research questions were studied in an attempt to confirm these assertions. This study was accomplished by introducing the pause procedure during regularly scheduled class sessions of a senior-level nursing class at a small, private, liberal arts university. This chapter presents the results of data collected and the subsequent statistical analyses carried out for each of the three research questions.

Demographic Findings

Descriptive statistics include frequencies and percentages for nominal data and means and standard deviations for continuous data. 77.8% of participants were 27 years old or younger. The rest of the participants were 28 to 32 years old. The majority of participants were female (77.8%). Most of the participants were either single and never married (63.0%) or married (25.9%). Participant ethnicity was predominantly non-Hispanic white (59.3%) or Asian/Asian American (18.5%). Most participants resided in either Oklahoma City (44.4%), in the state of Oklahoma (22.2%), or within the United States (29.6%). A majority of participants were working on their first degree (63.0%). A majority of participants worked less than 10 hours per week (66.7%). Descriptive statistics of demographic data are presented in Table 2.

Table 2

Descriptive Statistics of Demographic Data (n=27)

Variable	Category	Frequency	Percent
Age	27 or younger	21	77.8
	28-32	6	22.2
Sex	Female	21	77.8
	Male	6	22.2
Marital Status	Single and never married	17	63.0
	Married	7	25.9
	Divorced	1	3.7
	Other	2	7.4
Ethnicity	American Indian or Alaska Native	2	7.4
	Asian or Asian American	5	18.5
	African or African American	2	7.4
	Non-Hispanic White	16	59.3
	Hispanic or Latino	1	3.7
	Other	1	3.7
Permanent Residence	Oklahoma City	12	44.4
	Oklahoma	6	22.2
	A state that borders Oklahoma	2	7.4
	Within the United States	6	22.2
	Outside the United States	1	3.7
Educational Background	No degree	17	63.0
	Associate’s degree, non-nursing	4	14.8
	Bachelor’s degree, non-nursing	6	22.2

Survey Results by Week

Near-term learning was measured by administering ten-question quizzes at the conclusion of the lecture/discussion portion of each class session. After each ten-question quiz, the surveys to measure engagement (seven point scale), and cognitive load (nine point scale) were distributed. The pause procedure was implemented on weeks three, four and six. Figure 3 summarizes the overall mean score of each measure by week.

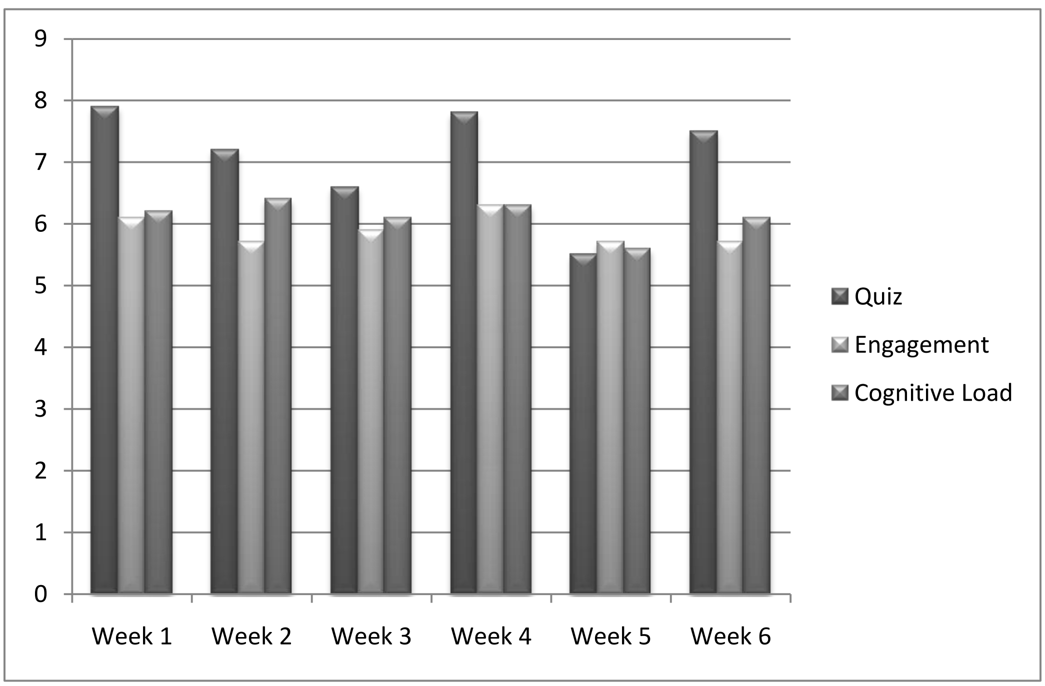

Figure 3. Average of Quiz, Engagement and Cognitive Load Scores by Week.

Results of the Mid-semester Questionnaire

A semi-structured interview was conducted with the study participants in the form of a mid-semester questionnaire. Many the participants responded positively by offering rich descriptions of the pause procedure. Their replies to the question *the **one** thing you like about this course is*: “the pause procedure;” “pausing in class;” “taking time to review my notes in class with my classmates,” and “knowing my notes are complete.” Additionally, direct questions were included on the questionnaire that reflected the pause procedure, table-talk and quizzing at the end of class. Twenty-seven out of 29 participants expressed they liked pausing, table-talk and quizzing. The majority of the participants’ responses to pausing during class were positive.

Research Questions

Engagement Relative to Near-term Learning

Is there a relationship between student engagement and near-term learning during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university?

Null Hypothesis

There is no relationship between student engagement and near-term learning during the lecture/discussion portion of the upper level nursing classes at a small, private, liberal arts university.

Reliability and internal consistency for the absorbed/attention, curious/imagination, fun/interesting and total engagement scores were assessed with four Cronbach’s alpha. A Cronbach’s alpha of 0.911 indicates *excellent* reliability and internal consistency for the Absorbed/Attention engagement scores. A Cronbach’s alpha of 0.842 indicates *good* reliability and internal consistency for the Curious/Imagination engagement scores. A Cronbach's alpha of 0.794 indicates *acceptable* reliability and internal consistency for the Fun/Interesting engagement scores. The total Cronbach's alpha for Total score was 0.943, which was *excellent*. A summary of the Cronbach's alpha are presented in Table 3.

Table 3

Results of Cronbach's Alpha for Each Engagement Score

Engagement Score	Cronbach's Alpha	Number of Items
Absorbed/Attention	0.911	2
Curious/Imagination	0.842	2
Fun/Interesting	0.794	2
Total	0.943	7

Results

To examine hypothesis 1, five Pearson *r* correlations were conducted to assess whether relationships exist among student engagement factors (absorbed/attention vs. curiosity/imagination vs. fun/interesting vs. engaging vs. total). The relationship between absorbed/attention, curiosity/imagination, fun/interesting, and total scores with near-term learning outcomes were not statistically significant. A statistically significant relationship does exist between the sole engaging score and near-term learning outcomes, $r = 0.182$, $p = 0.025$, suggesting that as the Engaging score increases; near-term learning outcome will also increase. The results are presented in Table 4.

Table 4

Pearson r Correlations between Absorbed/Attention, Curiosity/Imagination, Fun/Interesting, Engaging, and Total Scores with Near-term Learning Outcomes

		Near-term Learning Outcomes
Absorbed/Attention	Pearson Correlation	.119
	Sig. (2-tailed)	.150
	N	147
Curiosity/Imagination	Pearson Correlation	.035
	Sig. (2-tailed)	.671
	N	150
Fun/Interesting	Pearson Correlation	.046
	Sig. (2-tailed)	.577
	N	151
Engaging	Pearson Correlation	.182*
	Sig. (2-tailed)	.025
	N	151
Total	Pearson Correlation	.090
	Sig. (2-tailed)	.280
	N	146

Note: * Correlation is significant at the 0.05 level (2-tailed)

Pause Effect on Cognitive Load

Will the introduction of the pause procedure during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university have any effect on cognitive load?

Null Hypothesis

The introduction of the pause procedure during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university will have no effect on cognitive load.

Results

To examine hypothesis 2, an independent sample t-test was conducted to determine if mean differences exist on cognitive load by pause day (Yes vs. No). Initially, the assumption of normality was assessed with a Kolmogorov-Smirnov (KS) test. KS test was significant, thus violating the assumption of normality; however, according to Stevens (2002), samples with N > 50 assume normality. The assumption of homogeneity of variances was assessed with Levene's test. Levene's test was not significant $F = 0.183$, $p = 0.669$, thus verifying the assumption of homogeneity of variances. The results of the *t*-test were not significant, $t\ (149) = -0.584$, $p = 0.560$, 95% CI [-0.56, 0.30] suggesting that the non-pause group ($M = 6.21$, $SD = 1.37$) did not statistically differ compared to the pause group ($M = 6.33$, $SD = 1.31$). The results are summarized in Table 5.

Table 5

Independent Sample t-test for Cognitive Load by Pause Day

	Non-Pause		Pause				*95% CI*	
Variable	*M*	*SD*	*M*	*SD*	*t* (149)	*p*	*LL*	*UL*
Cognitive Load	6.21	1.37	6.33	1.31	-0.58	.560	-0.56	0.30

Pause Effect on Near-term Learning

Will the introduction of the pause procedure during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university have any effect on near-term learning?

Null Hypothesis

The introduction of the pause procedure during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university will have no effect on near-term learning.

Results

To examine hypothesis 3, an independent sample t-test was conducted to determine if mean differences exist on near-term learning by pause day (Yes vs. No). The assumption of normality was assessed with a KS test. The KS test was significant, thus violating the assumption of normality; however, according to Stevens (2002), samples with N > 50 assume normality. The assumption of homogeneity of variances was assessed with Levene's test. Levene's test was not significant $F = 2.526$, p = 0.114, thus verifying the assumption of homogeneity of variances. The results of the *t*-test were not significant, t (149) = -1.348, $p = 0.180$, 95% CI [-0.75, 0.14] suggesting that the non-pause group ($M = 6.91$, $SD = 1.31$) did not statistically differ compared to the pause group ($M = 7.21$, $SD = 1.44$). The results are summarized in Table 6.

Table 6

Independent Sample t-test for Near-term Learning Outcome by Pause Day

	Non-Pause		Pause				*95% CI*	
Variable	*M*	*SD*	*M*	*SD*	*t* (149)	*p*	*LL*	*UL*
Near-term Learning Outcome	6.91	1.31	7.21	1.44	-1.35	0.180	-0.75	0.14

CHAPTER V

DISCUSSION

The results of this study are presented in sections relative to the research questions and are discussed as follows: (a) Engagement Relative to Near-term Learning, (b) Pause Effect on Cognitive Load, and (c) Pause Effect on Near-term Learning. Each section presents the discussion and the limitations of each research question. The significance of the study is examined and the recommendations for future research are discussed.

Engagement Relative to Near-term Learning

Discussion

Research question one: Is there a relationship between student engagement and near-term learning outcomes during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university? The first research question sought to examine the relationship between engagement and near-term learning. For the purposes of this study, near-term learning was a measure of conceptual knowledge assessed by performance on ten-question quizzes. Reportedly, teacher classroom behaviors influenced student classroom engagement (Skinner & Belmont, 1993). When faculty members created challenging academic environments, identified learning activities as important and enriching, and used active and collaborative teaching strategies, students reported that they were engaged in their own cognitive development (Umbach & Wawrzynski, 2005). Additionally, student performance on classroom examinations is often considered a measure of student learning and frequently is a primary concern of faculty members (Amrein & Berliner, 2002). This measure was exemplified when examination performance was studied over a two-year period in students enrolled in several sections of college-level physiology (Ernst & Colthorpe, 2007). Improved exam performance was the noted outcome of this study. The researchers also found when students were engaged in their classroom studies they reported an increased level of confidence in their learning abilities. Webster and Ho (1997) measured classroom engagement relative to various multi-media, but they did not attempt to link engagement and learning outcomes.

Research question one attempted to link engagement to near-term learning outcomes. To examine this relationship, each class session kept to the same instructional pattern: the lecture/discussion portion of each class session was followed by an audience response system (ARS) question with table discussion, the results of the ARS question were presented and subsequent class discussion ensued. This pattern was repeated four-to-six times over a two hour class session. On the days that the pause procedure was introduced, it was inserted between the lecture/discussion and the ARS question. To examine the relationship between engagement and near-term learning, ten-question quizzes were administered at the conclusion of the final lecture/discussion portion of each class session. An engagement survey was completed by each subject after the ten quiz questions were thoroughly reviewed. The analysis of the data demonstrated the four factors of engagement, absorbed/attention vs. curiosity/imagination vs. fun/interesting vs.

total, were highly reliable questions. However, no statistical significance was found in the relationships between the factors absorbed/attention, curiosity/imagination, fun/interesting, total and near-term learning. The *overall* factor of engagement (hereafter referred to as the *sole* engagement factor) demonstrated a statistically significant positive correlation with near-term learning. This finding was similar to what was reported in the Skinner and Belmont study (1993) and the Ernst and Colthorpe study (2007). Multiple factors need to be considered respective to these findings.

The sole category of engagement on Webster and Ho's tool (1997) yielded a positive correlation to near-term learning. The Net Gen is a generation that was born with ready access to digital technology, and this medium reportedly engages them; the term *engagement* is a concept that is readily understood by the Net Gen (Prensky, 2001, 2005). Including the use of the Internet and Internet-based activities in the classroom were suggestions made to implement educational technology in the classroom (Leung, 2003). The use of an Internet-based ARS in the classroom incorporates both Prensky's and Leung's suggestions. Therefore, the Net Gen can easily relate to this concept, and they responded accordingly to the survey question.

Another related factor to the significant finding was the use of ARS in the classroom. The Net Gen thrives on classroom interactivity and engagement (Oblinger & Oblinger, 2006). With increased use of ARS, students were more engaged in their classroom environment (Barbour, 2008; Bergtron, 2006; Caldwell, 2007; DeBourgh, 2008; Dufresne & et al., 1996; Martyn, 2007; Presby & Zakheim, 2006; Stein, et al., 2006; Trees & Jackson, 2007; Woods & Chiu, 2002). As Tapscott (2008) indicated, educational programs integrated with technology can engage students in their own learning. Audience response systems provide engagement by connecting faculty members with students (Kumar, 2003). The significant sole engagement factor is supported by these findings.

There are three types of engagement that have been reported in the literature: behavioral engagement, emotional engagement and cognitive engagement (Fredricks, et al., 2005). Behavioral engagement includes the act of participating in activities. Emotional engagement embraces the appeal that influences one's desire to participate in an activity. And, cognitive engagement includes the notion of investment, or effort, involved in understanding complex ideas (Fredricks, et al., 2005; Linnenbrink & Pintrich, 2003). As ARS facilitate both behavioral and cognitive engagement, the significance of the engagement factor was supported by the findings of the reported studies.

The participants reported the instructional pattern which was implemented for this study was different than instructional strategies used in any other nursing classes. This difference could have influenced the positive correlation between engagement and near-term learning. Peer instruction and audience response systems were unique instructional tools and the significant finding is similar to the previously reported research (Brueckner & MacPherson, 2004; Conoley, et al., 2006; Cox & Junkin, 2002; Crossgrove & Curran, 2008; Fagen, 2003; Hinds, et al., 2001; Martyn, 2007; Mazur, 1977; Nelson & Hauck, 2008; Preszler, et al., 2007; Schackow, et al., 2004). A positive correlation between engagement and near-term learning could indicate that the students were actively participating in their own learning process, a finding also noted by Wilke (2003).

It is the practice of the participating faculty member to distribute an informal mid-term questionnaire to determine if any major course corrections are necessary for the remainder of the term. The mid-semester evaluation was conducted prior to the analysis of the data collected from the quizzes, and Paas' and Webster's tools. When asked what the *one* thing students liked about this course, there were many remarks in support of the pause procedure. The mid-term evaluation also included the question: *Do you like the pause procedure*? Twenty-seven out of 29 students responded "yes" to the question. While not studied, there may be a connection between engagement and preferences for instruction.

Possible indications for the lack of correlation between the remaining engagement factors and near-term learning could include both faculty and student indicators. As identified in the threats to validity section of this study, the Hawthorne and social desirability response effects may explain some of the factors that influenced student behaviors. On the day that the study was explained the researcher offered an explanation of the study, and indicated that student engagement would be measured by administering a survey at the end of each class session. Consequently, students were aware that engagement was a topic of study. The Hawthorne effect indicates subjects' behavior changes in response to the fact that they are being studied (Burns & Grove, 2007). Thus, knowing that engagement was being measured, the students may have scored this indicator higher than the remaining factors on the engagement survey.

Social desirability response bias may also have been a factor that influenced student behavior. Again, students knew engagement was a variable examined in this study. In an effort to please, or the social desirability response, they may have selected the sole engagement indicator on the survey, and responded differently to the remaining factors on the engagement survey, not believing that these factors were reflective of engagement.

Another possible indicator for the non-statistically significant findings for each of the engagement survey factors, except for the sole engagement indicator, may have been the participants' preconceived expectations of the nursing classroom. The participants reported, that the FHN class was the first nursing class where group work, peer instruction and audience response systems questions were instructional methods consistently implemented in each class session. And, they indicated their other experiences with nursing classes were most often lengthy PowerPoint presentations with the faculty member as the primary presenter. The notions of absorbed/attention, curiosity/imagination, fun/interesting may not have been descriptors previously considered for a nursing classroom. Consequently, students had no frame of reference and imposed some of their preconceived notions on their weekly survey responses.

The lower quiz scores noted on weeks three and five may have been a result of a faculty-driven factor for the findings. The quiz scores also corresponded with lower-than-average engagement and cognitive load scores (Figure 4). When compared to all of the class sessions, the researcher observed fewer student/faculty interactions and a generally flat affect of the subjects in each of these class sessions. Upon review of the students' schedule, it was noted that they had an upcoming exam in a subsequent nursing class. When the researcher shared these observations with the participants, the general consensus they voiced was that they were concerned about their performance on an up-coming exam in a subsequent nursing class, and they had trouble focusing on the material presented in FHN class sessions three and five.

The mean score for all of the ten-question quizzes was 7.1. Given the 3.0 grade point average necessary for admission into the program, and the required 75% exam average to progress to the senior year, this finding seemed low to the researcher. Upon further review, there are two possible indications for this seemingly low quiz score. A student-related indication, validated by further questioning, was that less than 50% of the students read the assigned reading materials before coming to class when the weekly ten-question quiz score was under 7, as evidenced in weeks three and five. A faculty-related factor associated with the quiz questions was related to the content presented during the lecture/discussion portion of the class session. Upon classroom observation, the content was not always presented during the lecture/discussion portion of the class session. This consideration coupled with the reported decreased reading factor potentially gives rise to question the validity of the ten-question quizzes as a true measure of near-term learning.

Limitations

The instructional plan for this course was different from any of the courses the participants had previously experienced; extraneous load was likely high early in the semester. In an attempt to control for extraneous load, the participants consistently worked in self-selected groups. However, they also participated in table-talk, used ARS technology for the first time, and took a ten-question quiz for course points in every class. These unfamiliar instructional strategies may have been too much, too new, and too fast to be effectively measured in six class sessions. The instructional pattern may have become more routine and familiar to the students if the study continued throughout the entire semester , thereby decreasing extraneous load and potentially enhancing germane load. The precautions regarding extraneous load that Sweller (1994) and Sweller et al.

(1998) warned against may ultimately have been some of the contributing factors which led to the lack of significance found in the relationship between overall engagement and near-term learning outcomes.

Another limitation to consider is the inconsistency of the faculty members who taught the content during the study. As much as the instructional design was the same, the number of years of experience teaching at the college level and vestment of the faculty members who taught during the study were different. The length of the study was too short to withdraw the data from class sessions three and four, the days the participating faculty member was ill, which also happened to be the two of three days when the pause procedure was implemented.

Pause Effect on Cognitive Load

Discussion

Research question two: Will the introduction of the pause procedure during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university have any effect on cognitive load? The second research question attempted to identify an effect of the pause procedure on cognitive load. To this researcher's knowledge, this was the first study to examine this specific relationship. Regarding the pause procedure, there is one feature of this classroom approach that can be linked to the aspect of self-explanation found in cognitive load research. Learners' knowledge transfser improved when self-explaination was implemented (Kalyuga, 2009; Renkl & Atkinson, 2003). Also, Kalyuga (2009) identified self-explanation as an instructionally effective tool to enhance germane load. During the pause procedure students engaged in a verbal exchange of their notes and, thereby, implemented a form of self-explaination.

According to Paas' Mental Effort Rating Scale (1992), a single question measure based on a 9 point scale: the score ranges from a 1, signifying *very very low mental effort*, to a 9, representing *very, very high mental effort*. Figure 4 depicts the mean range of mental effort at 5.6 on week five and at 6.4 on week two; when the weekly scores were averaged together the overall mean mental effort was 6.1. This data indicates subjects reported *rather high mental effort* during the course of the study.

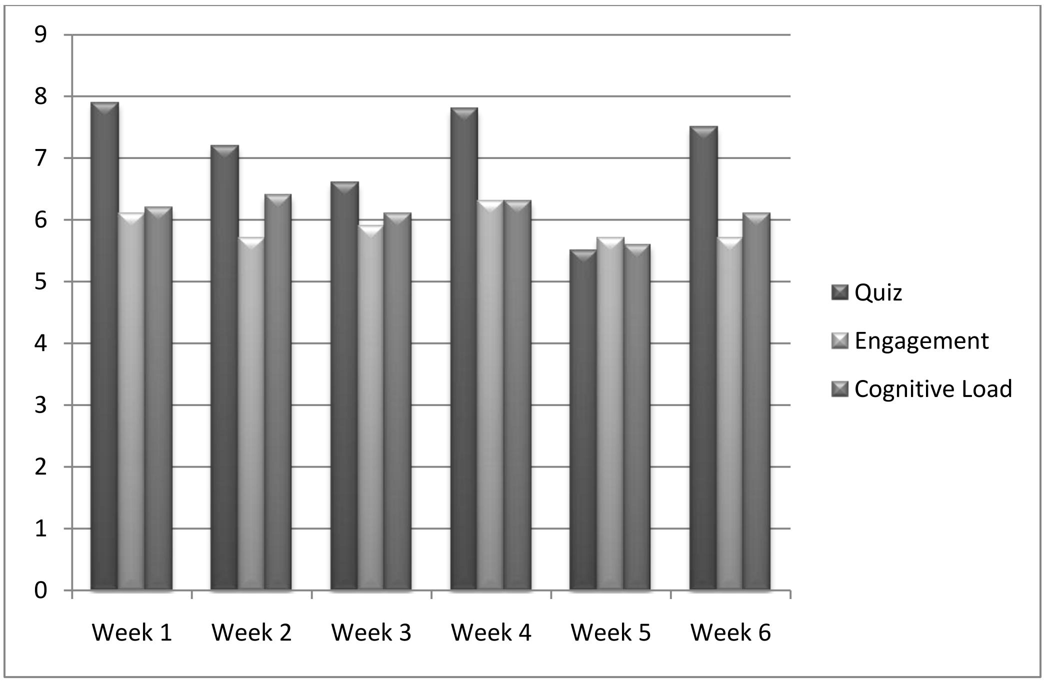

Figure 4. Average of Quiz, Engagement and Cognitive Load Scores by Week.

A *rather high mental effort* was both an anticipated and desirable finding. If many elements simutaneously interact in working memory, the material has high element interactivity. If there are few interacting elements in working memory, the material has low element interactivity (Paas, Renkl, et al., 2003). Intrinsic cognitive load, as determined by relative element interactivity, is impacted by learner expertise (Kalyuga, et al., 2003; Kalyuga, et al., 2001). The more the learner is familiar with the material, the lower the element interactivity in working memory as schema already exist and working memory is freed (Ayres, 2006; Paas & Kester, 2006).

Rather high mental effort is also a desirable outcome of instuction. According to Gobet et al., (2001), learning occurs by comparing information to preexisting schema. If a complete schema exists, no learning occurs. If no schema exist, then information is processed by working memory. A third, and more likely possibility, is that partially developed schema exist in long term memory. A stimulus facilitates schema transfer into working memory and new information is added to an existing schema. When content was presented in each FHN class session, the faculty members intentionally built links between existing schema and new information. Subjects reported overall *rather high mental effort,* which supports Gobet's (2001) findings.

Statistical analysis of the effects of the pause procedure on cognitive load did not produce any significant findings. The mean cognitive load score for non-pause days was 6.21 and the mean cognitive load score for the pause days was 6.33. The difference between the non-pause and the pause days was 0.12, a comparatively small difference. The mean mental effort for all of the FHN class sessions was 6.1, indicating consistently *rather high mental effort*. This mean mental effort finding supported the thought that the participants were experiencing rather high element interactivity; this finding stands to reason as the content presented in the FHN classes included elements from many domains of education.

To produce a statistically significant change, participants would have had to consistently report *very high mental effort* to *very very high mental effort* or *very low mental effort* to *very very low mental effort*; mental effort correlates with increasing learning difficulty (Paas & van Merrienboer, 1994). While Rikers, et al. (2004), reported learner motivation is improved with challenging instructional design, if instruction consistently demands *very high mental effort* to *very very high mental effort*, it stands to reason that learner motivation would decline over time. The finding of no significant effect of the pause procedure on cognitive load, given the level of instruction in this study and the reported mental effort, is not disconcerting.

The lack of significant change in mental effort supports DeLeeuw and Mayer's research (2008). They reported, Paas' Mental Effort Tool demonstrated validity in measuring intrinsic load, but did not address the remaining germane and extraneous loads. In an effort to study the effects of the pause procedure, this researcher intentionally set out to control for as many classroom-related variables as possible. The mean cognitive load for the non-pause days was 6.21, the mean cognitive load score for the pause days was 6.33, and the standard deviation was nearly the same at 1.37 fir the non-pause days and 1.31 for the pause days. The difference between the mean of the non-pause and the pause days was 0.12, a comparatively small difference. As there was no significant difference, this result implies intrinsic processing load was steady throughout the study. The research corroborates the findings of DeLeeuw and Mayer (2008).

Limitations

The limitations section of this study indicated that females tend to undestimate their self-perceptions (Beyer, 1998b; Maccoby & Jacklin, 1974). Demographic data obtained indicated that 77.8% of the study subjects were female. If the females in this study did indeed underestimate their perception of their cognitive load, and the mean cognitive load was 6.1, the females who participated in this study may actually have had *very high mental effort* to *very very high mental effort.* If there is any possibility that this is an accurate statement; faculty members need to be mindful of this potential when planning instruction.

Negative recall bias is thought to influence a gender difference in self-preception (Beyer, 1998b). This is one of the foundational reasons for females underestimating themselves. If this is possible, then negative recall may have the inverse effect on reporting mental effort. Females in this study may then have indicated a higher than actual mental effort rating score. This finding has implications for instructional design.

The Mental Effort Rating Scale is a uni-dimensional measure (Paas, 1992). The tool has been well validated in the literature (Paas, 1992; Paas, Renkl, et al., 2003; Paas & van Merrienboer, 1994). The intent of this study was to design instruction to effect germane load, while maintaining intrinsic load and limiting extraneous load. The lack of significance difference of the pause procedure may be limited to implications of the tool only measureing intrinsic load, which is congruent with the findings of DeLeeuw and Mayer (2008).

Pause Effect on Near-term Learning

Discussion

Research question three: Will the introduction of the pause procedure during the lecture/discussion portion of upper level nursing classes at a small, private, liberal arts university have any effect on near-term learning outcomes? The third research question attempted to examine the effect of the pause procedure on near-term learning, as evidenced by performance on ten-question quizzes at the conclusion of the lecture/discussion portion of a class session. This research question was fashioned after the multiple studies which implemented the pause procedure (Howe, 1970; Rowe, 1976, 1980; Rowe, 1983; Ruhl, 1996; Ruhl, et al., 1990; Ruhl, et al., 1987; Ruhl & Suritsky, 1995; Ryan, 1995). Improved recall in a laboratory setting was identified (Howe, 1970) when a pause with discussion was interjected into note-taking sessions. The study of the pause procedure was then taken out of the laboratory and implemented in the classroom (Rowe, 1976, 1980; Rowe, 1983). Despite the lack of empirical evidence, the reported findings of these studies were both improved learning and improved exam performance. Improved performance on objective testing and improved long term recall has been empirically reported (Ruhl, 1996; Ruhl, et al., 1990; Ruhl, et al., 1987; Ruhl & Suritsky, 1995). The collective findings of these aforementioned studies serve as the foundation for improved conceptual learning.

The statistical analysis conducted for this question did not yield any significant effect of the pause procedure on near-term learning. This finding is in stark contrast to the findings that have been previously reported (Barrera, 1997; Howe, 1970; Rowe, 1976, 1980; Rowe, 1983; Ruhl, 1996; Ruhl, et al., 1990; Ruhl, et al., 1987). The mean score on the ten-question quiz for the non-pause days was 6.91 and the mean quiz score on the pause days was 7.21. While the score did improve on the pause days by 0.3, the improvement was not enough to make a statistically significant difference.

The results of this study also differed from Webster and Ahuja's findings of improved socred with higher levels of engagement (2006). They note a positive correlation between engagemeny and correct answers on a post-experiment questionnaire (β=.35). Whereas, the findings of this study did not demonstrate any significant change in quiz scores.

Many of the same factors identified in the lack of relationship between overall engagement and near-term learning are likely responsible for the lack of statistical significance of the effect of the pause procedure on near-term learning. To briefly iterate, those factors were an exam in a subsequent nursing class, a lack of student reading the assigned materials before class, and an absence of content presentation during the lecture/discussion portion of the class session. Both student and faculty-related factors may have led to the outcome of this study.

An interesting finding was the students' performance in FHN when there was an exam in a subsequent nursing class, or the *exam factor*. To this researcher's knowledge, this factor has not been reported on in the literature. To thoroughly examine this factor, this study would need to be conducted over a longer period of time. A brief review of the data indicates the mean quiz score for weeks four and six was 7.8 and 7.5, respectively. The mean quiz score for pause week three, the class before a subsequent nursing exam, was 6.6. There is not enough data to examine the pause days before a subsequent nursing class with and without an exam.

Another factor that may have led to the non-significant finding of the effect of the pause procedure on near-term learning was when during the class session the ten-question quizzes were administered. The FHN class met once a week for three continuous hours. The ten-question quiz was administered during the last 30 minutes of each class session. Students were consistantly offered a break between the first and second hour of class. However, related to the amount of content and the intermittent questioning with

LiveClassTech (LCT), no break was offered between the second and third hour of class. Therefore, fatigue may have been a contributing factor of student quiz performance.

One of the characteristics of the Net Gen is they are confident (Howe & Strauss, 2000). A report by Twenge and Campbell (2008) indicated that today's learners have higher levels of self-confidence; this report supports the assertions of Howe and Strauss. Perhaps another factor leading to the statistical findings for question three relates to the confidence level of the Net Gen. Meaning, to achieve their desired level of success they are confident in their ability to glean all of the necessary information during a class session; therefore, they believe that to be successful in class they do not need to pre-read the assignments.

The magnitude effect may be a factor when considering the number of weekly quiz questions and the lack of statistical significance of the pause procedure on near-term learning. Ten quiz questions each week may not offer the necessary level of discrimination needed to produce an effect. More quiz questions may have offered more data to produce a significant result. However, one must consider the class time required to administer more quiz questions.

The ceiling effect may have influenced the findings of this study. In that, the pause procedure may have been too rudimentary for senior level students, as they are considered advanced learners. Deliberate instructional design includes developing educational materials with an awareness of the learner's educational needs. To avoid the expertise reversal effect, instructional designers must know their learners (Kalyuga, 2006; Kalyuga, et al., 2001; Paas, Renkl, et al., 2003; Renkl, 1997; Rikers, et al., 2004). And, as learners cognitively mature, their needs change (Paas & Kester, 2006). Instructional design that was once useful for the inexperienced learners has decreased effectiveness with experienced learners (Kalyuga, et al., 2003). In review of the demographic data, 37% of the subjects had either an Associate's or Bachelor's degree in a non-nursing field. Admission and progression requirements for the program used in the study were rigorous. Once a student advances to the senior level, attrition is low, and graduation within four semesters is nearly guaranteed. It is conceivable that the pause intervention was too basic for this level of student; this could be yet another factor contributing to lack of statistical evidence to support an effect of the pause procedure on near-term learning.

The participants noted on the mid-term evaluation that they liked the pausing in class. The findings for pausing and near-term learning did not yeild a statstically significant result. Conceptual learning my have been influenced by the pause procedure; however, the tools selected did not yeild a statistically significant change. This disparity leads the investigator to think that the tools selected for the study did not necessiarly measure the participant's preference for the pause procedure.

Limitations

The convenience sample of senior nursing students at a small, private, liberal arts university may not share the same characteristics with those students who attend larger, public universities. This factor limits the ability to generalize the engagement findings of this study.

Significance of the Study

The purpose of this study was to attempt to provide empirical evidence to support the need for engagement of the Net Generation in the college classroom. The sole engagement indicator correlated positively to near-term learning. While this result was encouraging, no other statistically significant findings were identified. Overall, this study did not provide a strong empirical link to fill the gap in the literature which could have connected engagement to the Net Generation. However, this study is meritorious on other levels. It provides a beginning place to study the pause procedure in other student populations. The positive feedback received on the mid-term course evaluation indicated the students liked the pause procedure, and in the pause is the inherent ability to discuss the content that was presented and assure a complete set of notes. The tools selected for the study did not measure preference or enjoyment. If these variables had been studied, the findings may have been different.

Recommendations for Future Study

More research is needed to study engagement in the Net Gen. Empirical findings are necessary to support the assertions made in the literature that the Net Gen is enraged if they are not engaged in the classroom setting (Prensky, 2005). The pause procedure may be an effective instructional strategy for lower level nursing students. One way to engage the Net Gen is to incorporate instructional technology in the classroom (Atkinson, 2004; Milne, 2007; Oblinger & Oblinger, 2006; Tapscott, 2008; Wilson, 2004). The use of LCT in the classroom is one way to bring educational technology in the classroom. The unique instructional features of this technology needs to be evaluated for both engagement and educational effectiveness. This study is a catalyst for future research.

The pre-nursing and nursing classrooms are an excellent venue to conduct engagement research on the Net Gen. Since senior level nursing students are advanced learners, and the pause procedure may be too rudimentary for this population; studies on lower level or Associate degree seeking students may be considered. Nursing students are generally an academically homogenious population; thereby, eliminating some of the variables that may confound a study. A study of the relationship of engagement and near-term learning of pre-nursing students compared to beginning level nursing students may help identify the category discrimination as noted on Webster's engagement tool (Webster & Ho, 1997).

Senior level nursing students are highly motivated learners. Howe and Strauss noted that achievement is a characteristic of the Net Gen (Howe & Strauss, 2000). Senior nursing students have demonstrated their ability to be successful in lower level nursing classes, and are focused on performing well on exams. This observation was noted by the lower FHN quiz scores observed on weeks three and five (Figure 4). Students reported they did not prepare for FHN class, as they were preparing for an exam in a subsequent nursing class. Additional research is needed to validate if this is an influencing variable or an aberrant phenomena germane to this study.

The six week duration of the study yeilded a significant change in the sole engagement factor. Conducting the same study over a one or two semester time frame may produce results that demonstrate a statistical significance in other study factors.

Gender may influence accuracy in self-reporting (Beyer, 1998b; Maccoby & Jacklin, 1974). Since nursing is a predominantly female profession, a study of cognitive load by gender may offer additional insight into nursing education. Faculty members may design instruction considering these findings.

The informal findings of the mid-term questionnaire indicated students liked pausing in class, and the sole category of engagement related to near-term learning was statistically significant. Combining engagement and instructional preference may produce note-worthy results which may then influence instructional design.

Cognitive load remains an intriguing topic of study. This study attempted to control for factors that influence extraneous load. The converse may have occurred; extraneous load may have increased related to the new and unfamiliar instructional strategies employed for this study. A longer study may have helped the students overcome some of the unfamiliarity of the instructional strategies. Additionally, a future research question might examine the relationship between engagement and cognitive load. A positive correlation may validate the claim to design instruction with the learner in mind (Sweller, 1994; Sweller, et al., 1998), and the engagement effect may emerge.

The audience response system used for this study was relatively new to the market. No research has been conducted comparing learning outcomes using LiveClassTech to more traditional, hand-held, ARS transmitters. Additionally, studies of this unique student input feature may lend empirical evidence linking engagement to the Net Gen.

Summary

The research cited in this study claimed students of the Net Gen need to be engaged in the classroom. However, there is a lack of emprical evidence to support to these claims. The purpose of this study was to provide empirical support to these assertions. Principles of engagement, active learning, peer instruction, note-taking, the pause procedure, gender-based and generational issues, as well as cognitive load were presented. A study was carried out to incorporate these principles into an instructional design meant to engage students of the Net Gen. Engagement, cognitive load and near-term learning were measured. The sole category of engagement related to near-term learning was identified as statistically significant. This finding was congruent with many of the previously cited studies regarding active learning, peer instruction and audience response systems. The remaining variables studied demonstrated no significant change when the instructional design was implemented. While this may be a seeming disparity, the subjects selected for the study were advanced learners which ultimately may have influenced the outcomes of this study. Other implications that led to the findings were identified, additionally limitations of the study were noted. Limited empirical evidence to fill the gap in the literature was produced from this study, future research is indicated to further evaluate the efficacy of the pause procedure in the nursing classroom.

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APPENDICES

Appendix A

Demographic Survey

Number ___________________________

1. My current age is:
    a. 27 or younger
    b. 28-32
    c. 33-45
    d. 46 or older

2. What is your sex?
    a. Female
    b. Male

3. Are you:
    a. Single and never married
    b. Married
    c. Widowed
    d. Divorced
    e. Other

4. How would you describe yourself?
    a. American Indian or Alaska Native
    b. Asian or Asian American
    c. African or African American
    d. Non-Hispanic White
    e. Other

5. If you did not select “other” on the previous question, select D. If you answered “other” to the previous question, would you describe yourself as:
    a. Hispanic or Latino
    b. Hawaiian or Pacific Islander
    c. Other
    d. Not apply

6. Which of the following best describes your permanent place of residence?
    a. The Oklahoma City area is my permanent place of residence
    b. Oklahoma is my permanent place of residence
    c. My permanent place of residence is a state that borders Oklahoma
    d. My permanent place of residence is inside the United States
    e. My permanent place of residence is outside the United States

7. Which statement best describes your educational background?
    a. I am currently working on my first degree
    b. I currently hold an associate's degree
    c. I currently hold a bachelor's degree
    d. I currently hold a master's degree
    e. I currently hold more than one degree

Appendix B

IRB Approval Oklahoma City University

OKLAHOMA CITY UNIVERSITY

Petree College of Arts and Sciences • Office of the Dean
2501 N. Blackwelder • Oklahoma City, Oklahoma 73106-1493 • (405) 521-5446 • Fax (405) 521-5447

April 9, 2009

Lynn Korvick
Kramer School of Nursing
Oklahoma City University

Dear Professor Korvick:

Your research proposal, *The Effects of the Pause Procedure on Germane Load* meets the criteria for expedited review and has been approved in accordance with the Code of Federal Regulations governing human subjects research (Title 45, Part 6, *Protection of Human Subjects*) and Oklahoma City University Institutional Review Board policies and procedures.

This approval expires April 9, 2010. On or before that date please submit either a Periodic Progress Report (PPR) if the project will continue, or a final PPR if the project has ended. Please note that if it becomes necessary to modify the protocol or consent form you have described in your proposal, an amending request must be submitted to the IRB chairperson for review and approval before implementing any such changes.

Sincerely yours,

Terry R. Conley, Ph.D.
IRB Chairperson

C: Dr. Marvel Williamson, Dean of KSN

Celebrating a Century of United Methodist Scholarship and Service

Appendix C

IRB Approval Oklahoma State University

Oklahoma State University Institutional Review Board

Date:	Thursday, July 16, 2009
IRB Application No	ED0993
Proposal Title:	The Effect of the Pause Procedure on Classroom Engagement
Reviewed and Processed as:	Exempt

Status Recommended by Reviewer(s): Approved Protocol Expires: 7/15/2010

Principal Investigator(s):

Lynda M. Korvick	John Curry
12504 Maple Ridge Rd.	209 Willard
Okla. City, OK 73120	Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

☒ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Beth McTernan in 219 Cordell North (phone: 405-744-5700, beth.mcternan@okstate.edu).

Sincerely,

Shelia Kennison, Chair
Institutional Review Board

Appendix D

Webster's Engagement Tool

Measured on a seven point Likert scale from strongly disagree to strongly agree.

Engagement:

Attention focus:

This (presentation medium) keeps me totally absorbed in the presentation.
This (presentation medium) holds my attention.

Curiosity:

This (presentation medium) excites my curiosity.
This (presentation medium) arouses my imagination.

Intrinsic interest:

This (presentation medium) is fun.
This (presentation medium) is intrinsically interesting.

Overall:

This (presentation medium) is engaging.

Appendix E

Permission to use Webster's Tool

Lynn: Thanks for your message – and of course you can use the measure, Jane

From: Korvick, Lynn [mailto:lynn.korvick@okstate.edu]
Sent: January 20, 2009 1:18 PM
To: jwebster@business.queensu.ca
Cc: Curry, John
Subject: Permission to use engagement tool

Dr Webster-

Allow me to introduce myself; I am a PhD student at Oklahoma State University. I am working towards the dissertation phase of my studies. I am interested in measuring engagement in the college classroom and I would like to use the tool to measure student engagement as described in the article *Audience Engagement in Multimedia Presentations* (The DATA BASE for Advances in Information Systems, 1997). My plan is to introduce the *Pause Procedure,* intermittent 2 minute breaks at 20-30 minute intervals for student dyads to discuss and review notes, during the lecture/discussion portion of some the class periods of senior level nursing students. I would like to measure student engagement at the end of the each lecture/discussion, with and without the pause procedure. After reading about the tool in the aforementioned article, I believe it measures what I am attempting to evaluate in my study.
I look forward to your reply and consent to implement your tool to measure student engagement.

Respectfully,
Lynn Korvick, MS, RN, CNE
Ph D student Oklahoma State University
Assistant Professor, Oklahoma City University

Appendix F

Paas' Tool of Mental Effort Rating Scale 2

In solving or studying the preceding problem I invested

1. very, very low mental effort

2. very low mental effort

3. low mental effort

4. rather low mental effort

5. neither low nor high mental effort

6. rather high mental effort

7. high mental effort

8. very high mental effort

9. very, very high mental effort

Appendix G

Permission to use Paas' Tool

Dear Lynn,

Yes sure you can use the attached instrument. I only ask you to refer to my work as mentioned in the attachment (see references).

Good luck and of course I am interested in hearing about your results.
Please send my regards to Pasha.

Fred

-----Oorspronkelijk bericht-----
Van: Korvick, Lynn [mailto:lynn.korvick@okstate.edu]
Verzonden: za 24-1-2009 20:58
Aan: Paas, Fred
CC: Antonenko, Pasha; Curry, John
Onderwerp: Permission to use CL self-report tool

Dr Paas-

Allow me to introduce myself. I am a PhD student at Oklahoma State University in the Educational Technology program. I am in the beginning stages of the dissertation phase of my program. I am proposing to measure cognitive load in a senior level nursing class. With your permission, I would like to use the Short Self-report Subjective Instrument as described in your article, Cognitive load measurement as a means to advance cognitive load theory (2003). I appreciate your time in this regard.

Respectfully,

Lynn Korvick, MS, RN, CNE
PhD Student, Oklahoma State University
Assistant Professor of Nursing, Oklahoma City University

Appendix H

Item Evaluation Tool

Content Expert 1 2 3
(circle one)

	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
1. Quiz item matches content	1	2	3	4	5
2. Quiz item matches content	1	2	3	4	5
3. Quiz item matches content	1	2	3	4	5
4. Quiz item matches content	1	2	3	4	5
5. Quiz item matches content	1	2	3	4	5
6. Quiz item matches content	1	2	3	4	5
7. Quiz item matches content	1	2	3	4	5
8. Quiz item matches content	1	2	3	4	5
9. Quiz item matches content	1	2	3	4	5
10. Quiz item matches content	1	2	3	4	5
11. Quiz item matches content	1	2	3	4	5
12. Quiz item matches content	1	2	3	4	5
13. Quiz item matches content	1	2	3	4	5
14. Quiz item matches content	1	2	3	4	5
15. Quiz item matches content	1	2	3	4	5

Appendix I

Recruiting Letter

Dear student,

Allow me to introduce myself; I am a doctoral student at OSU and I am working on my dissertation project. I have received permission from the Institutional Review Boards of both Oklahoma City University and Oklahoma State University to ask you to participate in a study planned for the first seven weeks of Family Health Nursing (FHN) class. I have done some research on a teaching technique that will be implemented during some of the first seven FHN classes. FHN class is scheduled to meet on Mondays from 1:00-3:50. Each three hour FHN class will be divided into 2 sections, a lecture discussion section and an activity section. After the lecture/discussion session, if you elect to participate in the study, you will be asked to complete an eight question Internet-based survey. You will be given class time to complete the survey; you must bring your laptop to class and have an Internet connection to complete the survey.

The results of the survey are completely confidential and your name will never appear with any of the data entered for the study. The data from the study may be used in publications or presentations. But again, your anonymity is completely protected as your name will never be entered with any of the data for the study. Participation in the study is completely voluntary and you can opt-out at any time.

There are 1000 total points for the FHN class. Of those points there are 100 "alternative assignment" points noted in the syllabus. To recognize your participation in the study you will receive 50 points that will count towards alternative assignment points, **after you achieve a passing exam average.** The only way to receive the 50 points is to participate in all six of the surveys. No partial points can be earned for completing fewer than all six surveys. If you choose not to participate, there are options for you to earn the 50 points.

I am asking you to consider participating in the study. I will be in FHN class on the first day to further explain the study, answer any questions regarding the study, and distribute a consent form acknowledging your participation in the study. I appreciate your time in this regard.

Respectfully,

Lynn Korvick, PhD C, RN, CNE

Appendix J

Consent

OKLAHOMA CITY UNIVERSITY

KRAMER SCHOOL OF NURSING

2501 N. Blackwelder

Oklahoma City, OK, 73106

405-208-5906

lkorvick@okcu.edu

The Effects of the Pause Procedure on Classroom Engagement

Lynn Korvick, MS, RN, CNE

Assistant Professor, Oklahoma City University

John Curry, PhD

Assistant Professor, Oklahoma State University

INFORMED CONSENT STATEMENT

1. Invitation to Participate and Description of the Project. You are being asked to participate in a study of the effects of the pause procedure on classroom engagement. This topic is being investigated in order to further the understanding of instructional techniques that may help students better remember information. Your participation in the research study is voluntary. Before agreeing to be part of this study, please read and/or listen to the following information carefully. Do not hesitate to ask questions if you do not understand something.

2. Description of Procedure. If you participate in this study, you will be asked to complete a survey of your engagement and mental effort in while in class. This survey will be electronicall distributed at the end of the lecture/discussion portion of class.

3. Risks and Inconveniences. There are no risks to you if you choose to participate in this study. A survey will be administered at the end of six class sessions. Class time will be dedicated to completing the survey. Your grade in this course will not be impacted in any way if you elect or decline to participate in this study.

4. Benefits. This study was designed with students in mind. The hope is to learn new information on how students can get the most out of a lecture/discussion style classes by implementing a teaching technique that may help you better remember information taught to you during class. In addition, information from the study may help faculty members understand how to teach more effectively.

5. Financial (or other) considerations: There is no compensation available to you for participating in this study.

6. Confidentiality. Any and all information obtained from you during the study will be confidential. Your privacy will be protected at all times. You will not be identified individually in any way as a result of your participation in this research. When the data is collected and stored for use in this study, your name will not appear with the data. However, the data collected may be used as part of publications and papers related to the pause procedure.

7. Voluntary Participation. Your participation in this study is entirely voluntary. You may refuse to participate in this research. Such refusal will not have any negative consequences for you. If you begin to participate in the research, you may at any time, for any reason, discontinue your participation without any negative consequences.

8. Other considerations and questions. Please feel free to ask any questions about anything that seems unclear to you and to consider this research and consent form carefully before you sign.

Authorization: I have read or listened to the above information and I have decided that I will participate in the project described above. The researcher has explained the study to me and answered my questions. I know what will be asked of me. I understand that the purpose of the study is study instructional techniques that may help me remember information presented in class. If I don't participate, there will be no penalty or loss of rights. I can stop participating at any time, even after I have started.

I agree to participate in the study. My signature below also indicates that I have received a copy of this consent form.

Participant's signature____ Date ________

Name (please print)____

If you have further questions about this research project, please contact the principal investigator, Lynn Korvick, at (405)208-5906,e-mail:lkorvick@okcu.edu,or my dissertation advisor, Dr. John Curry, email:john.curry@okstate.edu. If you have questions about your rights as a research volunteer, you may contact Dr. Shelia Kennison, IRB Chair, 219 Cordell North, Stillwater, OK 74078, 405.744.1676 or irb@okstate.edu . The participant will be given one copy of this consent form. One copy of this form is to be kept by the investigator for at least five years.

Appendix K

Script

Students spend a lot of time listening to lectures and taking notes and are expected to take it all in and remember it. As we listen and/or take notes we have to not only keep up with what is being said, we also have to decide the most important information.

Why is this difficult to do sometimes (e.g. "too much too fast")? We can only take in so much before we fall behind in taking this information we can get further behind. We get overwhelmed.

What we want to do is to try a method of altering the typical lecture format to help students keep up with information presented and identify the important points being presented. This procedure is called the pause procedure and that is exactly what we will be doing during the lectures, pausing or stopping periodically for 2 minutes. What is important is what is done during the pause.

During the pause, you and 2 other partners will discuss the content portion of the lecture just presented. You will discuss main ideas and important details about them. You can update your notes or check their accuracy based on your conversation during the pause. The lecturer does not get involved (e.g., answer questions). (Ruhl, et al., 1990, pp. 59-60)

VITA

Lynda M. Korvick

Candidate for the Degree of

Doctor of Philosophy

Thesis: THE EFFECTS OF THE PAUSE PROCEDURE ON CLASSROOM ENGAGEMENT

Major Field: Education

Biographical:

Education:

- Bachelor's of Science degree in Nursing from Ball State University, Muncie, Indiana in May, 1981;
- Master's of Science Degree in Nursing from The University of Oklahoma Health Sciences Center, Oklahoma City, Oklahoma in December, 1996
- Completed the requirements for the Doctor of Philosophy in Education with an emphasis in Professional Education Studies at Oklahoma State University, Stillwater, Oklahoma in May, 2010.

Experience:

- Registered nurse for 29 years
- Nurse educator for 16 years
- Cardio-thoracic nurse at The University of Rochester (U of R), 1981.
- Women's health and maternity care, U of R, 1983-1991.
- Claims Investigator and Legal Consultant U of R, 1991-1992
- Regional Manager for MedValu, a precertification company, 1992-1994.
- Full-time nursing faculty, Rose State College, MWC, OK, 1994-1999
- Director of Nursing, Rose State College, MWC, 1999-2002
- Adjunct faculty, various colleges and universities in OK, 2003-2004
- Full-time nursing faculty, Southern Nazarene University, 2004- 2005
- Full-time Clinical Instructor at Oklahoma City University, 2005-2007
- Assistant Professor, Oklahoma City University, 2007-present.

Professional Memberships: Phi Kappa Phi, Golden Key, Sigma Theta Tau, AWHONN, ANA, ONA, and NLN

Name: Lynda M. Korvick Date of Degree: May, 2010

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: THE EFFECTS OF THE PAUSE PROCEDURE ON CLASSROOM ENGAGEMENT

Pages in Study: 135 Candidate for the Degree of Doctor of Philosophy

Major Field: Education

Scope and Method of Study:

The purpose of this study was to examine an instructional strategy intended to enhance engagement in the college classroom. The effects of the pause procedure on classroom engagement and cognitive load were studied. The relationships between levels of classroom engagement and near-term learning outcomes, as well as engagement and cognitive load were investigated in the Net Generation (Net Gen) students. The goal of this study was to empirically link the Net Gen to classroom engagement and cognitive load through the use of the pause procedure.

The study was implemented in a baccalaureate nursing program located at a small, private, liberal arts college in the Midwest. Pausing was introduced in three of six senior-level three hour weekly nursing class sessions. Near-term conceptual learning, engagement and mental effort, indicating cognitive load, were measured each class session. Statistical differences in engagement, conceptual learning and mental effort were measured between pause and non-pause class sessions.

Findings and Conclusions:

There was no significant difference in mental effort in any of the six class sessions indicating cognitive load remained stable throughout the study. A positive correlation was noted between the sole engagement factor and near-term learning. Other factors related to engagement remained unchanged with the implementation of the pausing in class. The pause procedure did not yield a statistically significant difference in near-term learning. The results of a mid-semester questionnaire indicated the vast majority of the students reported they preferred pausing in class. Senior level nursing students are considered advanced learners and the introduction of the pause procedure needs to be studied in lower level nursing classes.

ADVISER'S APPROVAL: Dr. John Curry