Comparison of Nurse Anesthesia Student 12 Lead EKG Knowledge, Interpretation Skill, Satisfaction and Attitude: Traditional Instruction vs. Asynchronous Online Video Lecture

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Abstract

Online education has become increasingly popular for providing learning experiences in all disciplines. Despite continued evidence that online learning is at least equivalent to traditional methods, some educators are reluctant to embrace online educational offerings. This study evaluated whether an online class provided within an otherwise traditional face-to-face (F2F) nurse anesthesia curriculum would produce comparable learning outcomes and be accepted by students as an alternative learning format.

A F2F lecture format for teaching 12 lead EKG interpretation was compared with similar course materials provided in an asynchronous, self-paced, online narrated video format. A pretest/posttest design was used to evaluate concept knowledge change and an analytical skills examination (ASE) determined student ability to accurately interpret EKG readings. The variables of satisfaction, attitude toward online learning, and student time were also evaluated.

Knowledge and analytical skill acquisition were comparable in both groups and satisfaction was equally good with both delivery methods. The student's attitudes concerning online instruction improved after exposure to the online method of teaching.

These findings indicate that similar online activities can be successfully incorporated into a Nurse Anesthesia curriculum while maintaining learning outcomes and satisfaction.

Key Words: online learning, distance education, web-based learning, face to face, F2F, student satisfaction, attitude, efficiency, nurse anesthesia

Introduction

There has been substantial growth in online educational methodologies. The Sloan Consortium, considered a leader in online learning research, reported in 2010 that online enrollment rose 21% while total college enrollment grew just 1.2%. Their newest study reports that total enrollment fell slightly in 2011 but online enrollment as a percent of total enrollment rose to 32%, the highest in the 10 year study period (I E Allen & Seaman, 2013). With this explosion in technology-mediated instruction there are both assets and liabilities. Resistance to change and the belief that the traditional learning environment remains superior has led to reluctance by some institutions and educators to explore the potential for incorporating new strategies into existing curricula. Conversely, some online educational programs have grown so rapidly that concerns regarding quality of education have been raised (I E Allen & Seaman, 2013; Figlio, Rush, & Yin, 2010; Nissenbaum & Walker, 1998; Trinkle, 1999). The Sloan consortium reported in 2013 that faculty acceptance of online learning as legitimate and valuable remains about 30% overall, and has changed little over the last 10 years despite considerable growth in this medium. In their 2012 survey data, schools that offer both online courses and programs show the highest ratings, 38% as compared to schools that do not offer online options with 10% acceptance. This represents a slight decline in acceptance of online education by faculty between 2011 and 2012. The stagnant levels of faculty acceptance of online education is noted as concerning for academic leaders of educational institutions because they believe faculty acceptance is critical (I E Allen & Seaman, 2013).

The participants enrolled in this study were graduate nurse anesthesia students at a major university in Pittsburgh, PA. Data from the American Association of Nurse Anesthetists (AANA) Council on Accreditation (COA) of Nurse Anesthesia Educational Programs indicates that as of April 2014, there are 114 nurse anesthesia educational programs in the U.S. All programs accept only registered nurses with a bachelor's degree and a minimum of one year of critical care experience. Programs are currently required to be a minimum of 24 months, offer a minimum of a master's degree and ensure that students complete a rigorous clinical and didactic experience. These requirements are prescribed by national certification and accreditation bodies. Globally, the International Federation of Nurse Anesthetists Website notes that it currently represents 40 countries with a specific nurse anesthesia education.

This Nurse Anesthesia Program (NAP) is a 28 month Master's program admitting approximately 22 students twice each year into a traditional F2F curriculum. The University offers several online options in various schools, however may restrict enrollment in an online course to only those enrolled in an online program of study. The NAP is not offered as an online option, however most academic courses within the NAP curriculum are web-facilitated, using Blackboard as a course management system for posting of lecture materials, readings, class schedules and other pertinent information.

Brief Review of the Literature

As the internet has become a medium for providing alternatives to traditional education, a myriad of technologies have developed that make conducting and comparing research difficult. Researchers conducting meta-analysis of the studies in this field note the challenge created by the lack of agreed upon nomenclature (Shachar & Neumann, 2010). Originating from the early days of correspondence classes by postal mail, distance education developed as nomenclature for a general category referring to any modality where the student and instructor are not physically present together in a traditional classroom. However within this general framework, many strategies and technologies now exist without standardization of definitions of the many educational methods used. Within the general realm of distance education, some of the terms are used interchangeably, such as web-based and online. The evolution of web-enhanced or web-facilitated courses along with technology-mediated classrooms and flipped classrooms add another layer of confusion to the many terminologies used to describe online educational methods. Lack of consistent definitions leads to poorly designed research studies and inaccurate conclusions (M. Allen, Bourhis, Burrell, & Mabry, 2002; Bernard et al., 2004; Jang, Hwang, Park, Kim, & Kim, 2005).

Early uses of distance education were influenced by the availability of the internet and the proficiency of computer use by the learner (Gibson & Herrera, 1999) which is not usually encountered in the techno-savvy learner seen today in developed countries, but may remain a factor in emerging nations. Most F2F classes also use web-enhanced applications such as Blackboard (I.E. Allen & Seaman, 2011) and expect proficiency with internet search tools, especially in an evidence-based practice focused graduate healthcare curriculum.

For the purpose of this paper, traditional is defined as a F2F lecture delivered in a classroom on a single day by an instructor using PowerPoint slides with recording of the lecture not permitted. Online refers to the lecture provided in an asynchronous self-paced narrated video lecture format accessed on the Blackboard course site by the student at any time during a defined time interval.

Studies within healthcare

Nurse anesthesia programs in the U.S. are accredited by the AANA COA and the use of distance education requires specific approval for both courses and programs. The COA defines distance education in their Accreditation Policies and Procedures (2014) as separation of instructor and student by time or place and can include both synchronous and asynchronous methods. A course or program is considered distance education when >50% of required activities are offered at a distance. Using this criterion, the COA reports that 58% of programs are approved to offer distance education courses and 10% to offer a distance education program (Pecka, Kotcherlakota, & Berger, 2014), although approval does not mandate actual use. Within the realm of anesthesia education, little has been published that quantifies the use of online technology, evaluates the quality by comparison to traditional methods, or assesses student or faculty satisfaction with various teaching methods specifically in this nursing specialty. Some nurse anesthesia educators have been reluctant to forgo the traditional F2F classroom instruction, while others have incorporated online methods in varying amounts. Only one study of videoconferencing in the nurse anesthesia discipline was found. This study compared local-site students to distance-site students for 2 of 3 semesters using the mean score on the AANA Self Evaluation Examination as the outcome measure and reported no significant differences between the groups (Kerns et al., 2006). This study is now dated and very limited in scope. Pecka, et. al. (2014) published a theoretical model modified to specifically evaluate higher order thinking in nurse anesthesia courses and advocates this model to promote effective research within nurse anesthesia distance education courses.

In nursing education offered at the graduate level, a recent review of the literature by Horne & Sandmann (2012) concluded that there is a paucity of published systematic program evaluation research in the online realm despite substantial growth of online offerings over the past 20 years in the review period. There was concern that online courses have received less evaluation of quality, efficacy and cost compared to the traditional education formats in nursing education. They noted a wide variation in the approach to evaluation and utilization of the results.

A literature review of online learning in medical, dental and nursing education by Chumley-Jones, Dobbie, and Alford (2002) focused on evaluation of knowledge gains. The use of pretest/posttest scores was the most utilized evaluation method for knowledge gain, and as research design strengthened to include a control group to separate web-specific from content-specific learning gains, the results indicated that online learning is comparable but not superior to F2F instruction. This was supported by a more recent study by Tomlinson, et. al. (2013) that demonstrated comparable outcomes between F2F and online instruction in health professionals.

General findings of learning outcomes

The 2013 Sloan Consortium survey reports that the learning outcomes for online education are equivalent or better than F2F instruction, despite the continued resistance from educators to accept this learning modality. Online education is sometimes offered as "all or none" but more recent studies of "blended" curriculum outcomes indicate that shifting entire curriculums or programs of study to online format is not the most beneficial choice. In May 2009, the U.S. Department of Education (USDE) published a meta-analysis comparing F2F to online education. Among their findings was that on average, online learning students performed better than those receiving F2F instruction, and that blending online and F2F is even more effective, with much of the analysis generated from adult learners not school age children (Means, 2009).

A serious limitation in research comparing learning outcomes in online compared to F2F teaching methods is that it is virtually impossible to conduct randomized controlled trials in a setting where the student is the customer, purchasing the educational modality of their choice and self-enrollment is the norm (Gibson, 2011). Driscoll, Jicha, Hunt, Tichavsky, & Thompson (2012) report that because the nature of academic education almost exclusively uses self-enrollment in a course of study with the student selecting between online or F2F courses or programs, this is a major limitation to research study. A working paper by Figlio, Rush, and Yin (2010) notes that quasi-experimental studies represent a small number of the studies analyzed in the 2009 USDE study. The decision to enroll in a course or curriculum that is online, either completely or partially depends on multiple factors including geographic issues and the desire for flexibility by the student or perception of suitability to learning style (Carey & Gregory, 2002; Tutunea, Rus, & Toader, 2013).

Learning style has been hypothesized to impact selection of online vs. F2F instruction with online courses attracting students with self-discipline and comfort with the use of computer technology (Drennan, Kennedy, & Pisarski, 2005). This 'self-selection bias' has been thought to be a significant confounding variable in studies which compare the two methods. However, several studies have demonstrated no difference in outcomes for online or F2F regardless of learning style (Neuhauser, 2002; Nilsson et al., 2012). Other studies suggest that if learning opportunities are equivalent, the outcomes of online and F2F instruction are similar (Block & Udermann, 2008; Lapsley, Kulik, Moody, & Arbaugh, 2008; Shachar & Neumann, 2010).

While there are a vast number of references related to online courses, many articles are anecdotal accounts or descriptions of courses. Outcome studies of online offerings range from an entire program of study (Kerns et al., 2006) to an individual class (Jang et al., 2005), however many focus on a course in a curriculum (Jones & Long, 2013; Lu & Lemonde, 2013; Salyers, 2006; Shachar & Neumann, 2010). A recent literature review explored the factors that are associated with persistence in online study and associated attrition (Hart, 2012), but not comparative success of the two mediums. With the evolution to hybrid or blended curriculums, evaluation of this transition is a focus of current study. (Newhouse, Buckley, Grant, & Idzik, 2013)

Whether all cognitive domains from the lowest level of knowledge and comprehension through the more complex levels of analysis and synthesis are equivalent in measured outcomes in the online medium shows conflicting information. Ross and Bell (2007) summarized that online learners were at a disadvantage when expectations include higher level cognitive skill. This is not supported by other studies with higher level cognitive skill as an outcome, with academic aptitude of the student and educational level of the course cited as influential factors (Campbell, Gibson, Hall, Richards, & Callery, 2008; De Jong, Verstegen, Tan, & O'connor, 2013; Lu & Lemonde, 2013).

Student Satisfaction

Studies of F2F vs. online education have explored both achievement and satisfaction although the relationship is not predictable (Artino, 2009; Tesone & Ricci, 2008). Maki, Maki, Patterson, & Whittaker (2000) compared a psychology course offered online compared to a traditional lecture course and concluded that learning and course satisfaction were dissociated in the two course formats. As summarized by Picciano (2002), many factors can influence student performance, including whether the criterion used to measure outcome is objective such as test scores, or based on the students' perception of how well or how much they learned.

Several studies have shown that satisfaction is closely related to course structure and if course design provides equivalent learning experiences, little difference is noted (Ferguson & DeFelice, 2010). In a study in graduate nursing education, Debourgh (2003) demonstrated that the rating of the instructor had the strongest correlation with satisfaction. This would lead to the assumption that a quality instructor with organized course materials would be a guaranteed success in the online medium, but there is little literature to support that conclusion. However, failure of technology can be perceived as failure of the instructor (Debourgh, 2003), therefore IT support must be competent and available. PomalesGarcia (2006) noted that the quality of the design of the online materials plays a role in satisfaction as well – apparently appearance does matter.

Summary

Technology has become a mainstay of communication and learning in our current world, with the newest learners perhaps the most proficient. It is projected that traditional F2F instruction will be in the minority in K-12 education by 2014, with non-traditional instructional methodologies dominating (Nagel, 2009). As these individuals move toward their career goals, we as nurse anesthesia program faculty will be faced with the growing desire by our students for flexibility and creativity in our educational offerings.

Educational strategies are studied across every discipline and age group, therefore consideration must be given to evaluating the relevance to a focus area. The conclusions from some studies may apply to any educational domain however others may not be generalizable.

As the literature demonstrates, because the lack of faculty acceptance is not in proportion to the growth in online offerings, the considerable evidence that online education is effective does not predictably influence instructor choice. However, the literature does not equally represent all educational programs and types of learners. Specifically in advanced level clinically-based health care specialties, the effectiveness of online strategies to evaluate complex levels of educational taxonomy is weak.

This study was designed to determine within a competitive advanced clinical discipline with motivated students if learning outcomes of knowledge and analytical skill are comparable between traditional F2F lecture and online asynchronous narrated lecture. Additionally, how does student satisfaction between the teaching modalities compare and does exposure to an online module improve student attitude toward these types of learning activities? Since the time required to master a competency is important in an intense and demanding curriculum, determining which method was the most efficient use of student time was also explored. Without evidence to validate the effectiveness and student acceptance of online methods compared with traditional (F2F) instructional methods in the nurse anesthesia education realm, incorporation of online teaching strategies may be avoided.

Purpose and Aims of Research Study

The purpose of this study was to compare traditional F2F lecture with an online self-paced asynchronous narrated lecture to address the following questions.

1. To what extent are knowledge and application of EKG interpretation skills improved when utilizing an online instructional strategy?

2. To what extent does student satisfaction improve when utilizing an online instructional strategy?

3. To what extent does exposure to an online module improve attitude toward these types of learning activities?

4. To what extent are students' abilities to accurately interpret EKGs affected by utilizing an online instructional strategy?

12 lead EKG interpretation was selected for study because this subject is a required element of the curriculum and was taught by the investigator for many years as a traditional F2F class in the NAP. This subject area requires the acquisition of factual knowledge as a prerequisite to the development of the analytical skill necessary for a clinician to become proficient at the interpretation of critical abnormalities that impact the delivery of quality patient care. The interpretation of 12 lead EKGs is considered a primary skill that nurse anesthesia students should master as part of their educational program. This skill is also essential for other advance practice nurses, such as nurse practitioners, and also physician assistants and medical students worldwide. The aim of this study was to uncover the effects of non-F2F instructional strategies on NAP students' abilities to accurately interpret EKG reading, as well as their satisfaction with this teaching method to provide information for educators contemplating the use of online teaching methods in a highly clinical based discipline, but unsure if the change of teaching method would be effective and accepted.

Methods

A quasi-experimental research design was used to assess the knowledge, analytical skill, satisfaction and attitude comparing the currently used traditional F2F lecture method for teaching 12 lead EKG interpretation with the same lecture materials provided in an online video format. The research design is quasi-experimental because the cohorts are not randomized at a single point in time but grouped by year, based on curriculum design.

The study was submitted to the University of Pittsburgh Institutional Review Board (IRB) who determined that it met the criteria to be designated as "exempt" because it was a comparison of educational strategies. After receiving IRB approval, the study was conducted between September 2011 and October 2012. Each study cohort was comprised of 40-45 first year NAP students with clinical anesthesia experience of 9 or 12 months. The study compared outcomes for the traditional F2F instructional methods used for the Fall 2011 cohort as the control group with an online asynchronous video lecture method provided to the Fall 2012 cohort as the treatment group.

While participation in the class and mastery of the 12 lead EKG interpretation content is a required element of the curriculum, students were informed at the beginning of the course that they could withdraw from participation in the data analysis for the study without any effect on their course grade. Because the same instructor taught both cohorts, all data were collected in a manner that made identification of individuals impossible.

Students in the 2011 cohort were taught EKG interpretation in a 3 hour F2F lecture format using PowerPoint slides. The 2011 F2F lecture was videotaped and used by the instructor to create an online self-paced narrated video lecture using Adobe Captivate 5.5™ that was used to teach the same content to the 2012 cohort. The same PowerPoint material was incorporated into the module with minor modifications to accommodate for the asynchronous self-paced module. The online content was divided into 4 parts to facilitate ease of use. A table of contents with a tracking feature allowed students to follow their progress through the material. The calculated runtime of the online module was 135 minutes which was the same total instructional time (135 minutes) as the F2F class (an additional 45 minutes of non-instructional break time was added). The supplemental materials that were provided to both groups on the Blackboard course management system included learning objectives, references, and practice tracings.

Study Measures

Knowledge, analytical skill, satisfaction and attitude were measured using 3 instruments developed by the investigator. Knowledge was measured using pretest/posttest examination items and a 12 lead EKG analytical skill examination (ASE) was used to evaluate the ability to recognize abnormalities and interpret the findings. Satisfaction was measured using items adapted from the University of Pittsburgh Office of Measurement and Evaluation (OMET) course surveys. Attitude about factors associated with online instruction was measured using a 5-point Likert scale instrument.

Knowledge Tool Development: A 25 point pretest containing 21 short answer and 4 multiple choice questions was administered to both cohorts prior to the F2F class or availability of the online module. The purpose was to determine the homogeneity of the two groups and assess the preexisting level of knowledge of the concepts needed to interpret 12 lead EKG tracings. The test items were referenced to standard EKG textbooks (Kossick, 1999; Wagner & Strauss, 2013). Short answer questions were used to reduce the effect of guessing on multiple choice items. The test was scored by the investigator using a rubric of accepted answers. The same test was administered as a posttest at the conclusion of the class to quantify the amount learned and compare the effectiveness of the two educational methods to achieve mastery of the concepts needed to accurately interpret 12 lead EKGs.

EKG Analytical Skill Examination (ASE) Development: The second tool was a take home examination to evaluate student ability to analyze and interpret 12 lead EKGs. The ASE consisted of 15 EKGs requiring full interpretation for 3 points each and several tracings included for specific findings accounting for 15 points totaling 60 points for the examination. The examination was iteratively developed over a 5 year period with review by an Acute Care Nurse Practitioner Faculty (cardiac certification) with 25 years of experience in 12 lead EKG interpretation. The F2F group received a printed and electronic copy of the examination immediately after the lecture while the online group received paper and electronic versions of the examination after the course materials had been available for 2 weeks. Both groups had 2 weeks after receiving the examination to submit it for grading. All examinations were scored by the investigator in a blinded fashion using a grading rubric.

Satisfaction and Attitude Measurements: The final tool used in this study was an instructor-developed questionnaire to assess satisfaction and attitudes related to method of instruction. The class satisfaction section used a 5-point Likert scale with 1 as lowest and 5 as highest for 8 questions that could apply to both traditional and online instruction. Three of the questions (The instructor presented class content in

an organized manner, Rate the instructors overall teaching effectiveness, and Amount that you learned) were taken from the University OMET course evaluations. The remaining 5 items evaluated sequencing of materials, quality of slides, usefulness of supplemental information, format of the class, and attainment of objectives.

The attitude section of the questionnaire contained 5 items evaluated with a 5-point Likert scale with 1=not at all to 5=very much. Students were asked to rate factors associated with online learning, such as flexibility, motivation, learning style, stimulation of learning, and were asked if the nurse anesthesia program should incorporate more online learning methods. Both cohorts were asked to report the amount of time spent in this learning activity and the take home exam.

Statistical analysis was performed using the IBM® Statistical Package for the Social Sciences (SPSS) Version 20 for Windows. A paired samples t-test was used to evaluate within cohort pre-post knowledge gains for both 2011 and 2012. The knowledge gains in the respective cohorts were then compared with each other using the independent samples t-tests. ASE scores and time were compared using the independent t-test and a non-parametric Mann-Whitney U test used for the satisfaction and attitude survey Likert scale questions. Demographic characteristics obtained from de-identified admission data were used to compare baseline variables of students for both cohorts. This included admission GPA, Graduate Record Examination (verbal, quantitative, and analytical writing), years of ICU experience, age at admission, gender, and race. Continuous variables were compared using the independent t-test and Fisher exact test used for categorical values. Level of significance for all statistical tests was set as 0.05.

Results

A total of 86 nurse anesthesia students were enrolled in the study (F2F 2011: N = 41, online 2012: N = 45). Data from two students were excluded from the analysis for 2011 because one student was not able to attend the F2F class, and one student was not present to complete the post-class assessments. Demographic characteristics from admission data are shown in **Table 1** and indicate that there were no significant differences within and between the groups.

Knowledge Test: The pretest, posttest and change in scores were compared between the two groups and the findings are presented in **Table 2**. Knowledge levels improved significantly in both groups, from pre to post-instruction. The F2F group improved from 21% to 76% (55% mean change ±15.3%, p<0.0001) and the online group improved from 26% to 84% (58% mean change ±12.4%, p<0.0001). No significant difference in knowledge at baseline (p =0.064) or in knowledge improvement (p = 0.357) was detected between the cohorts indicating that they were comparable at baseline and that the online instructional strategy was similar in effectiveness to the F2F strategy used to teach EKG interpretation.

Analytical Skill Examination (ASE): ASE results between the two groups were compared as presented in **Table 2 (**F2F: 95.1% ±4.5%; online 95% ±7.3%) with no significant difference in analytical skill noted between groups (p =0.905). These high mean scores and lack of significance indicates that the effectiveness of the online instructional approach was as effective as the F2F approach for teaching EKG interpretation. Correlation of posttest scores with the ASE scores demonstrated a positive but weak correlation (Pearson Correlation Coefficient = 0.088, p=0.42).

Attitude and Satisfaction Survey: Satisfaction scores for the 8 items from the post class questionnaire for both groups are highlighted in **Table 3**. The Cronbach's alpha coefficient for internal consistency reliability was 0.91 for the summed scales which exhibited high reliability (Tavakol & Dennick, 2011). All students completed this item. Scores in the online group were higher for all 8 items however none of the items demonstrated statistical significance (p ≤ 0.05). The overall satisfaction means were 4.32 (F2F) and 4.42 (online) on a 5 point scale, indicating a high level of satisfaction with each instructional method.

Five additional attitude items were included on the post class questionnaire for both groups. **Table 4** summarizes the findings for attitudes. The Cronbach's alpha for these 5 items was 0.90, also demonstrating high reliability (Tavakol & Dennick, 2011). Mean scores were higher in the online group and statistical significance was determined for 2 of the 5 items using the Mann-Whitney U test, with Bonferroni adjustment of significance levels due to multiple comparisons.

Comparison of attitudes specific to the desire for more online learning activities in the NAP showed noticeable differences between the groups. The F2F group that had not been exposed to online

instructional strategies in the NAP demonstrated a bimodal distribution of scores with 42.5% scoring 1 and 2 (low interest) and 45% scoring 4 and 5 (high interest). In the group that was required to participate in the online module, only 9% scored 1 or 2, and 53% scored 4 or 5 with 44% scoring 5. The midpoint score of 3 was 12.5% in the F2F group and 38% in the online group.

The mean time reported by both cohorts of students for mastery of EKG interpretation in preparation for the examination showed a statistically significant decrease (p =0.018) of 2.97 hours in the online group (n=45, mean 8.67 ±5.27) compared with the F2F group (n=40, mean 11.64 ±6.06). No significant difference between the two groups (p = 0.734) was noted in time spent taking the ASE examination. (online: mean 7.08 ±10.56; F2F: mean 7.71 ±5.3).

Discussion

The decision to conduct this study using two cohorts over a one year period was made for several reasons. The ability to control sharing of materials offered in the online cohort with F2F students was problematic. The required course that contains the EKG content is offered yearly and these students are concurrently together in F2F classes and form study groups. Since the online module was created from the taped lecture content delivered the first year, the prior group materials provided nothing additional to the online cohort the following year. A similar study by Jang, et. al. (2005) that compared basic EKG instruction in undergraduate nursing students in Korea using online and F2F methods in the same class noted that sharing of materials was a serious limitation to determining the effect of the particular instructional method on the achievement of learning outcomes.

Using different teaching methods for the two cohorts improved the ability to evaluate outcomes and attitude in groups that did not have the option to self-select, a focus of this study. At the graduate level, the choice of teaching methods for a course, or content within a course is an option of the instructor, as evidenced by the IRB designation of "exempt". However, because this is a required element of a competitive curriculum, randomizing students and using two educational methods within the same class without evidence of equivalency was viewed by the investigator as unethical.

EKG interpretation competency for Registered Nurses is focused on the skill of reading a single monitoring lead to determine rate and rhythm disturbances (*HESI Comprehensive Review for the NCLEX-RN Examination*, 2014). Although critical care nurses are expected to be proficient in single lead monitoring, advanced EKG competency, commonly referred to as 12 lead EKG interpretation is a higher level skill required by physicians and many master's prepared advance practice nurses.

Both groups scored low on the pretest, indicating that the base line knowledge of concepts for 12 lead EKG interpretation was not present prior to the class. Because NAP students, although experienced in critical care, usually have not acquired the requisite skill for advanced EKG interpretation, this was an expected finding. Posttest scores improved significantly in both groups. However, there was no statistically significant difference between groups. The conclusion that knowledge acquisition was similar with both teaching modalities is supported. The ASE showed high scores in both groups and no statistical difference between the groups, indicating that the ability to utilize knowledge and resources to analyze a 12 lead EKG to diagnose abnormalities was similar with both teaching modalities. Limited studies evaluate the equivalency of learning outcomes when participation in an online teaching module is mandatory, a strength of this study. The relationship between knowledge as measured by the posttest did not correlate well to the ability to use this information in a take home analytical examination format. Since the posttest measured retention and recall of the concepts and the take home ASE allowed students to use reference materials, it is not surprising that a student can utilize available resources without committing concepts to memory. A similar study by Jang (2005) compared traditional and online methods teaching undergraduate nursing students basic EKG interpretation and showed knowledge to be lower in the online group, but analytical skill to be significantly better, supporting that the relationship between knowledge and application is not predictable.

Since both modalities proved to be equally effective, an instructor facing the decision to incorporate online modules may base the decision on student satisfaction. Comparative student satisfaction data was initially limited in the literature (Chumley-Jones et al., 2002; Ferguson & DeFelice, 2010; Woo & Kimmick, 2000), but in a recent large scale study by the Sloan Consortium (I.E. Allen & Seaman, 2011), academic leaders surveyed perceive that student overall satisfaction is similar with online and F2F. They noted that

online demonstrated an increase in satisfaction related to flexibility and F2F satisfaction increased in the realm of instructor communication. In this study, satisfaction scores on all eight survey items showed slightly higher scores in the online group but statistical significance was not demonstrated. Since this content was a required element of a course, both groups had equivalent motivation for success. A study by Artino (2009) regarding the satisfaction of military aviators compared to non-aviators in an online course reported that those that required the course for their professional role were less satisfied than their counterparts. Student motivation to be successful in a course or class influences the outcomes of any educational offering. Professional graduate program students have considerable time and money invested in their endeavor and significant incentive to succeed, therefore the educational medium becomes simply the vehicle.

In this study, matching of instructional content between the groups was implemented to improve internal validity, allowing the method of delivery to be evaluated. The highest satisfaction scores were in the online group in the area of organization and coordination of material. The attribute of self-regulation in the learner is essential in an autonomous learning environment (Artino, 2009). While this is a complex concept with many contributing factors including cognitive ability, motivation, and knowledge construction (Azevedo, 2005), the use of software that allowed the creation of a table of contents, navigational controls, tracking of progress and the ability to replay lecture components may have contributed to higher learner satisfaction.

Exposure to online instruction may change a student's perception of the value of this methodology. Arbaugh (2004) noted that indicators of online learning quality and effectiveness increase significantly as students take subsequent online courses and much of this increase occurs between the first and second course, therefore the first online course can be the determinant of whether a student prefers or chooses this modality in subsequent offerings. Classroom education in this NAP has employed the traditional F2F lecture approach and the 12 lead EKG component was the first organized content module in the curriculum required for the online group. The survey administered to both groups that evaluated their attitude toward online instruction generally support the conclusions of Arbaugh. All five questions concerning attitude toward web instruction scored higher in the online group compared to the F2F group that had not been exposed to this type of learning modality and after Bonferroni correction, the importance of flexibility of time and the stimulation of learning showed significance.

The question concerning whether independent learning modules were a fit for their learning style did not show significance between the two groups. This finding parallels a recent study among medical students by Nilsson et al. (2012) that investigated the characteristics that affect student's choice to use online learning materials. The study concluded that learning style did not influence the decision to use an addendum educational online learning program for 12 lead EKG interpretation. This is consistent with the finding that the reasons students choose online education over traditional methods has not been clearly identified in the literature (Horne & Sandmann, 2012).

The question "Should the Anesthesia program incorporate more online learning activities?" brings interesting information in the proportion of scores. The F2F group had a bi-modal distribution with an almost equal number of students indicating no interest in this modality as those that scored it very high. In contrast, the number of students that did not want more online activities was very low in the group that had experienced the self-paced online module. Although a limitation of the study was that each group was not surveyed about their attitude toward online instruction prior to the class for comparison within groups, the similarity of the cohorts may indicate a trend. Those that used the online module had noticeably less students that were not interested in further online activities and a high proportion who rated their interest as very high. The indications are that exposure to this online activity reduced resistance and increased acceptance, having a positive effect on changing the attitude toward this type of learning in this cohort of students. Perhaps simply asking students about the importance of online activities may yield disinterest and discourage an educator from using this modality. Once exposed to this learning activity, students may find it beneficial.

Studies and commentary from instructors support that courses taught in online format are more time consuming for faculty than their F2F counterparts (Cook, Levinson, & Garside, 2010; Jacobs, 2004), however there is little conclusive information as to whether online courses are similar to F2F instruction with respect to student efficiency. (Chumley-Jones et al., 2002; Cook et al., 2010) In this study, learning

outcomes and satisfaction scores were similar, however, students attitudes toward online instruction improved significantly after exposure. The time spent in the learning activity was approximately three hours less in the online group, however the reason for this decrease could be multifactorial. Possible explanations are that in traditional lecture, any content not well understood during the lecture must be mastered by the student independently, an activity which can be time consuming. The online group had the ability to self-pace, replay any lecture slide or component as often as needed, and progress at their own pace. In addition, the flexibility to study at a time and place most conducive to effective learning may promote this methodology as a more efficient way for students to learn and effect both satisfaction and attitude toward online activities. It is also for consideration that the online group, when compelled to learn by a method that differed from the usual traditional lecture, had more motivation for success. This study purposely evaluated only the effect of lecture delivery methods keeping the other elements of the module the same for both groups. The instructor who presented the F2F lecture and the online module was the same. Questions in the F2F group were minimal in both the classroom presentation and in subsequent electronic communication. The online cohort could submit questions to the instructor electronically but the questions were also minimal, with no more than 2 electronic questions received from each cohort. The time needed to attain mastery of a course or subject may be directly related to the quality of the materials and the proficiency of the student among many other variables.

Traditional F2F lecture has inherent time constraints, but incorporating online activities in courses does not, and could lead to additional workload for students. This study was designed to allow the online group an equivalent three hours of free time within the course content so that this module reflected substitution rather than expanded content.

Unlike a F2F lecture, an advantage to the creation of an online module is that it can be shared with other educators within a program of study or internationally if desired and acceptable at the institutional level. Permission has been granted to use this 12 lead EKG module in a newly developed nurse anesthesia education program in Belize City, Belize created by Health Volunteers Overseas in collaboration with the University of Belize and a local hospital. Additionally, another nurse anesthesia program currently being developed in Thimphu, Bhutan is planning to use this module in their curriculum design.

Limitations of the Study

Although the investigator was able to remove student self-selection bias, this was accomplished by using two cohorts of similar students with a one year interval between the study groups creating a potential for weakness in the comparative analysis.

Limitations for generalizability are that the study population was in a graduate level healthcare clinical practice program with students selected from a highly competitive applicant pool, the study size is small, and was conducted at a single institution with the same instructor. Generalization of the results to the population at large where there is a diversity of motivational factors and a wide range of scholastic aptitude of the students may be limited.

The use of a take home examination to assess analytical skill is a limitation to internal validity since many factors cannot be controlled, such as how much time was allowed and the ability to control communication between the students. In retrospect, repeating the study with the administration of an in class ASE may be valuable.

The tools used in this study were investigator developed and although scoring was blinded and used a rubric, the pre/post test and ASE grading was conducted solely by the investigator, also the instructor. Scoring by a second instructor may have strengthened the study. Finally, the study time estimates were self-recorded by the student with potential for inaccuracy.

Suggestions for Additional Research

Since the realm of education is so diverse with students of different competency levels, motivation, cultural backgrounds, and programs of study, additional studies in varied populations serves to enhance the overall perspective about online offerings. Perhaps faculty are more likely to embrace a strategy when data is available in their relevant population, and more information only serves to substantiate the findings overall.

Since faculty attitudes about online education have plateaued despite evidence of equivalency of

learning, further study should be focused on ways that change faculty beliefs to embrace the use of online strategies. Additional information needs to be obtained that quantifies the workload change when introducing an online offering, balanced by the perceived educational gains.

Since online educational studies include many types of teaching strategies, other related areas of study would be outcome data comparisons of online educational methods using non-video materials and video lecture compared to traditional F2F lecture. Additionally, the use of a hybrid "flipped" classroom strategy could be studied in this subject area by requiring the video lecture in advance of a classroom session where students could interact in an instructor guided analysis session. The outcomes could be compared with the F2F class and/or the completely online class.

Further study is needed to determine what aspects of online learning are beneficial to students and how students effectively use the online instructional offerings, especially when higher order taxonomy levels are the required outcome.

Lacking from the literature is the comparison between online and F2F instruction regarding the long term retention of material. Many educational programs by design do not have a mechanism to follow groups of students in a controlled study to evaluate the effect of an educational strategy on long term retention. This study was IRB approved to collect additional data to evaluate this question.

Conclusion

The explosion of technology in education is a reality, and educators within all disciplines worldwide not already utilizing online education may benefit from a calculated entry into this medium. In situations where an institution does not provide or permit online courses or programs of study, incorporating an online module within a F2F course, as done in this study, may be valuable to gain experience with this educational methodology. This study provides continued evidence that online education is at minimum comparable to F2F and is specific to a subject in an advanced clinical discipline as occurs in medicine or advance practice nursing.

Although within the cognitive domain, knowledge has received considerable study, the ability of online education to achieve comparable outcomes at the more complex levels of educational taxonomy is not as clear. Educators in related clinical disciplines, such as medicine and nursing for which critical thinking is key, can find support for using online modules by the findings in this study. Additionally, any discipline that requires mastery of concept knowledge with the subsequent application to variable circumstances requiring situational analysis and synthesis to provide an intervention or plan could relate to these findings.

The satisfaction of students is always a concern when deciding to change an educational strategy, and this study supports the general findings that online education does not compromise satisfaction. Additionally, required participation in an online activity is not viewed as a negative and in fact may help to change preconceived attitudes about online education toward the positive in both students and faculty.

Because selected subjects within a curriculum may more readily transition to an alternative approach from traditional F2F instruction, this may be a starting point to test the water while educators become more familiar with the best methods to use in this new medium.

References

Allen, I. E., & Seaman, J. (2010). *Class Differences: Online Education in the United States* Retrieved from http://sloanconsortium.org/publications/survey/class_differences

Allen, I. E., & Seaman, J. (2011). *Going the Distance: Online Education in the United States* Retrieved from http://sloanconsortium.org/publications/survey/going_distance_2011

Allen, I. E., & Seaman, J. (2013). *Changing Course: Ten Years of Tracking Online Education in the United States* Retrieved from http://onlinelearningconsortium.org/publications/survey/changing_course_2012

Allen, M., Bourhis, J., Burrell, N., & Mabry, E. (2002). Comparing Student Satisfaction with Distance Education to Traditional Classrooms in Higher Education: A Meta-Analysis. *American Journal of Distance Education, 16*(2), 83-97. doi: 10.1207/S15389286AJDE1602_3

American Association of Nurse Anesthetists Council on Accreditation of Nurse Anesthesia Educational Programs. (2014). from http://home.coa.us.com/accredited-programs/Pages/default.aspx

Arbaugh, J. B. (2004). Learning to learn online: A study of perceptual changes between multiple online course experiences. *Internet & Higher Education, 7*(3), 169-182.

Artino, A. R. (2009). Online learning: Are subjective perceptions of instructional context related to academic success? *Internet & Higher Education, 12*(3/4), 117-125. doi: 10.1016/j.iheduc.2009.07.003

Azevedo, R. (2005). Using Hypermedia as a Metacognitive Tool for Enhancing Student Learning? The Role of Self-Regulated Learning. *Educational Psychologist, 40*(4), 199-209. doi: 10.1207/s15326985ep4004_2

Bernard, R. M., Abrami, P. C., Yiping, L., Borokhovski, E., Wade, A., Wozney, L., . . . Binru, H. (2004). How Does Distance Education Compare With Classroom Instruction? A Meta-Analysis of the Empirical Literature. *Review of Educational Research, 74*(3), 379-439.

Block, A., & Udermann, B. (2008). Achievement and Satisfaction in an Online versus a Traditional Health and Wellness Course. *MERLOT Journal of Online Learning and Teaching, 4*(1).

Campbell, M., Gibson, W., Hall, A., Richards, D., & Callery, P. (2008). Online vs. face-to-face discussion in a Web-based research methods course for postgraduate nursing students: A quasi-experimental study. *International Journal of Nursing Studies, 45*(5), 750-759. doi: 10.1016/j.ijnurstu.2006.12.011

Carey, J. O., & Gregory, V. L. (2002). Students' Perceptions of Academic Motivation, Interactive Participation, and Selected Pedagogical and Structural Factors in Web-Based Distance Learning. *Journal of Education for Library and Information Science, 43*(1), 6-15.

Chumley-Jones, H. S., Dobbie, A., & Alford, C. L. (2002). Web-based learning: sound educational method or hype? A review of the evaluation literature. *Academic Medicine, 77*(10), S86-S93.

COA Accreditation Policies and Procedures Manual. (May 2014). Retrieved August 11, 2014, from http://home.coa.us.com/accreditation/Documents/Policies%20and%20Procedures%20Manual.pdf

Cook, D., Levinson, A., & Garside, S. (2010). Time and learning efficiency in Internet-based learning: a systematic review and meta-analysis. *Advances in Health Sciences Education, 15*(5), 755-770. doi: 10.1007/s10459-010-9231-x

De Jong, N., Verstegen, D., Tan, F., & O'connor, S. (2013). A comparison of classroom and online asynchronous problem-based learning for students undertaking statistics training as part of a Public Health Masters degree. *Advances in Health Sciences Education, 18*(2), 245-264. doi: 10.1007/s10459-012-9368-x

Debourgh, G. A. (2003). Predictors of student satisfaction in distance-delivered graduate nursing courses: what matters most? *Journal of Professional Nursing, 19*(3), 149-163. doi: S8755722303000723 [pii]

Drennan, J., Kennedy, J., & Pisarski, A. (2005). Factors Affecting Student Attitudes Toward Flexible Online Learning in Management Education. *The Journal of Educational Research, 98*(6), 331-338. doi: 10.3200/JOER.98.6.331-338

Ferguson, J. M., & DeFelice, A. E. (2010). Length of Online Course and Student Satisfaction, Perceived Learning, and Academic Performance. *International Review of Research in Open & Distance Learning, 11*(2).

Figlio, D. N., Rush, M., & Yin, L. (2010). Is it live or is it internet? Experimental estimates of the effects of online instruction on student learning. from http://www.nber.org/papers/w16089

Garcia, T. B., & Holtz, N. E. (2001). *12 Lead ECG: The Art of Interpretation*. Burlington, MA: Jones & Bartlett Learning.

Gibson, J. W. (2011). A comparison of student outcomes and student satisfaction in three MBA human resource management classes based on traditional vs. online learning. *Journal of College Teaching & Learning (TLC), 5*(8).

Gibson, J. W., & Herrera, J. M. (1999). How To Go from Classroom Based to Online Delivery in Eighteen Months or Less: A Case Study in Online Program Development. *The Journal, 26*(6), 57-60.

Hart, C. (2012). Factors Associated With Student Persistence in an Online Program of Study: A Review of the Literature. *Journal of Interactive Online Learning, 11*(1), 19-42

HESI Comprehensive Review for the NCLEX-RN Examination. (2014). (S. Upchurch, T. Henry, R. Pine & A. Rickles Eds. 4th ed.). St. Louis, Mo: Elsivier.

Horne, E. M., & Sandmann, L. R. (2012). Current Trends in Systematic Program Evaluation of Online Graduate Nursing Education: An Integrative Literature Review. *The Journal of nursing education, 51*(10), 570-576. doi: 10.3928/01484834-20120820-06

International Federation of Nurse Anesthetists. from http://ifna-int.org/ifna/page.php?16

Jacobs, J. (2004). Presidential Address: The Faculty Time Divide. *Sociological Forum, 19*(1), 3-27. doi: 10.1023/B:SOFO.0000019646.82538.cc

Jang, K. S., Hwang, S. Y., Park, S. J., Kim, Y. M., & Kim, M. J. (2005). Effects of a Web-based teaching method on undergraduate nursing students' learning of electrocardiography. *The Journal of nursing education, 44*(1), 35-39.

Jones, S. J., & Long, V. M. (2013). Learning Equity between Online and On-Site Mathematics Courses. *Journal of Online Learning & Teaching, 9*(1).

Kerns, A. S., McDonough, J. P., Groom, J. A., Kalynych, N. M., Hogan, G. T., Jr., Kerns, A. S., . . . Hogan, G. T., Jr. (2006). Televideo conferencing: is it as effective as "in person" lectures for nurse anesthesia education? *AANA Journal, 74*(1), 19-21.

Kossick, M. A. (1999). *EKG interpretation: simple, thorough, practical*: American Association of Nurse Anesthetists.

Lapsley, R., Kulik, B., Moody, R., & Arbaugh, J. (2008). Is identical really identical? An investigation of equivalency theory and online learning. *The Journal of Educators Online, 5*(1), 1-19.

Lu, F., & Lemonde, M. (2013). A comparison of online versus face-to-face teaching delivery in statistics instruction for undergraduate health science students. *Advances in Health Sciences Education, 18*(5), 963-973. doi: 10.1007/s10459-012-9435-3

Maki, R. H., Maki, W. S., Patterson, M., & Whittaker, P. D. (2000). Evaluation of a Web-based introductory psychology course: Learning and satisfaction in on-line versus lecture courses. *Behavior Research Methods, Instruments, & Computers, 32*(2), 230-239.

Means, B. (2009). *Evaluation of evidence-based practices in online learning a meta-analysis and review of online learning studies*. Washington, D.C.: U.S. Dept. of Education, Office of Planning, Evaluation and Policy Development, Policy and Program Studies Service Retrieved from http://purl.access.gpo.gov/GPO/LPS118480.

Nagel, D. (2009). 10.5 million preK-12 students will attend classes online by 2014. *The Journal*. http://thejournal.com/articles/2009/10/28/10.5-million-prek-12-students-will-attend-classes-online-by-2014.aspx

Neuhauser, C. (2002). Learning Style and Effectiveness of Online and Face-to-Face Instruction. *American Journal of Distance Education, 16*(2), 99.

Newhouse, R., Buckley, K. M., Grant, M., & Idzik, S. (2013). Reconceptualization of a doctoral EBP course from in-class to blended format: Lessons learned from a successful transition. *Journal of Professional Nursing, 29*(4), 225-232.

Nilsson, M., Ostergren, J., Fors, U., Rickenlund, A., Jorfeldt, L., Caidahl, K., & Bolinder, G. (2012). Does individual learning styles influence the choice to use a web-based ECG learning programme in a blended learning setting? *BMC Medical Education, 12*, 5. doi: 10.1186/1472-6920-12-5

Nissenbaum, H., & Walker, D. (1998). A grounded approach to social and ethical concerns about technology and education. *Journal of Educational Computing Research, 19*(4), 411-432.

Pecka, S. L., Kotcherlakota, S., & Berger, A. M. (2014). Community of Inquiry Model: Advancing Distance Learning in Nurse Anesthesia Education. *AANA Journal, 82*(3), 213.

Picciano, A. G. (2002). Beyond student perceptions: Issues of interaction, presence, and performance in an online course. *Journal of Asynchronous learning networks, 6*(1), 21-40.

PomalesGarcia, C., & Liu, Y. (2006). Web-based Distance Learning Technology: Effects of instructor video on information recall and aesthetic rating. *The American journal of distance education, 3*(3). doi: 10.1207/s15389286ajde2003_4

Ross, T. K., & Bell, P. D. (2007). No significant difference" only on the surface. *International Journal of Instructional Technology and Distance Learning, 4*(7), 3-13.

Salyers, V. L. (2006). Web-enhanced and face-to-face classroom instructional methods: Effects on course outcomes and student satisfaction. *International Journal of Nursing Education Scholarship, 2*(1), 1-13.

Shachar, M., & Neumann, Y. (2010). Twenty Years of Research on the Academic Performance Differences Between Traditional and Distance Learning: Summative Meta-Analysis and Trend Examination. *MERLOT Journal of Online Learning and Teaching, 6*(2), 318-334.

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International journal of medical education, 2*, 53-55. doi: 10.5116/ijme.4dfb.8dfd

Tesone, D. V., & Ricci, P. (2008). Student perceptions of web-based instruction: A comparative analysis. *MERLOT Journal of Online Learning and Teaching, 4*(3), 317-324.

Tomlinson, J., Shaw, T., Munro, A., Johnson, R., Madden, D. L., Phillips, R., & McGregor, D. (2013). How does tele-learning compare with other forms of education delivery? A systematic review of tele-learning educational outcomes for health professionals. *New South Wales Public Health Bulletin, 24*(2), 70-75. doi: http://dx.doi.org/10.1071/NB12076

Trinkle, D. A. (1999). Distance education: A means to an end, no more, no less. *The Chronicle of Higher Education, 45*(48), 1.

Tutunea, M., Rus, R., & Toader, V. (2013). Traditional Education vs. E-learning in the vision of Romanian business students. *Innovation, 2007*, 12.

Wagner, G. S., & Strauss, D. G. (2013). *Marriott's Practical Electrocardiography* (12th ed.). Philadelphia, PA: Lippincott, Williams & Wilkins.

Woo, M. A., & Kimmick, J. V. (2000). Comparison of Internet versus lecture instructional methods for teaching nursing research. *Journal of Professional Nursing, 16*(3), 132-139.

Appendix

Table 1

Comparison of Admission Demographics

	2011 F2F (n=41)	2012 Online (n=45)	P Value
	Mean score ± SD	Mean score ± SD	
GPA (0-4)	3.73 ±0.230	3.67 ±0.284	0.241
GRE Verbal (200-800)	486 ±75.693	478 ±76.675	0.940

GRE Quantitative (200-800)	592 ±95.103	581 ±78.648	0.566
GRE Analytical (0-6)	4.073 ±0.676	3.933 ±0.518	0.282
ICU Experience (years)	3.28 ±2.344	3.89 ±3.063	0.307
Age	28.95 ±5.878	29.58 ±6.174	0.632
	Frequency (percent)	Frequency (percent)	
Gender Female Male	33 (80%) 8 (20%)	30 (67%) 15 (33%)	0.222
Race White Non-White	35 (85%) 6 (15%)	41 (91%) 4 (9%)	0.508

Table 2

Knowledge and Skill Scores: (Shown as percent correct)

	2011 F2F (n=41) Mean score ± SD	2012 Online (n=45) Mean score ± SD	P Value
Pretest	21.4% ±11.8	26.2% ±12.2	0.064
Posttest	76.1% ±15.3	83.7% ±11.0	0.009*
Δ Pre-Post	54.7% ±15.4	57.5 ±12.4	0.357
ASE (Analytical Skill)	95.1% ±4.5	95% ±7.3	0.905

Table 3

Satisfaction Scores: Scale - 1 (lowest) to 5 (highest)

	2011 F2F (n=41) Mean score ± SD	2012 Online (n=45) Mean score ± SD	P Value
The instructor presented class content in an organized manner	4.32 ±0.756	4.53 ±0.757	0.114
The material was coordinated in a meaningful sequence	4.44 ±0.673	4.51 ±0.695	0.519
Quality of slides	4.39 ±0.737	4.49 ±0.626	0.634
Supplemental information provided was useful	4.32 ±0.820	4.44 ±0.659	0.598

Format of the class was conducive to learning	4.24 ±0.916	4.27 ±0.863	0.992
Rate the instructors overall teaching effectiveness	4.29 ±0.750	4.29 ±0.787	0.963
Amount that you learned	4.46 ±0.809	4.49 ±0.626	0.740
Confidence that you achieved the objectives in this class	4.12 ±0.927	4.31 ±0.793	0.373

Table 4

Attitude About Online Instruction Scores: Scale - 1 (not at all) to 5 (very much)

	2011 F2F (n=40) Mean score ± SD	2012 Online (n=45) Mean score ± SD	P Value
How important is flexibility of time for learning to you?	4.18 ±0.874	4.62 ±0.747	S*
Do you feel you are motivated to adequately learn using independent methods?	3.83 ±1.13	4.29 ±0.991	NS
Do you feel that independent learning modules fit your learning style	3.53 ±1.26	3.91 ±1.22	NS
Does it stimulate learning?	3.28 ±1.32	4.04 ±1.02	S*
Should the Anesthesia program incorporate more online learning activities?	3.00 ±.1.63	3.82 ±1.23	NS

*with Bonferroni correction for adjustment of significance levels