

**A Comparison of Teaching Methods Based on Kolb Learning Styles in a  
Nurse Anesthesia Program**

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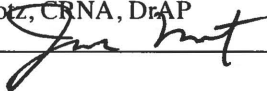
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### Abstract

**Purpose:** In 2010, the Carnegie Foundation for the Advancement of Teaching published a call for the radical transformation of nursing education. A challenge was made to nursing educators to shift from a focus on decontextualized knowledge to an emphasis on teaching for a sense of salience, situated cognition and action in particular situations, as well as the development of life-long learners. Team-based learning (TBL), a type of active learning, has been used in many health science programs to address these needs. The purpose of this capstone project was twofold: first, to evaluate student satisfaction, accountability and preference for team-based learning, and secondly to determine if a correlation exists between student satisfaction, accountability and preference for team-based learning and learning style as defined by Kolb.

**Methods:** Team-based learning was used during the first semester of a nurse anesthesia program to teach 4 sessions in the module entitled 'Anesthesia for Specific Populations and Procedures'. A traditional lecture format was used to teach the remaining 5 topics in that module. Students were given a Kolb Learning Style Inventory (LSI) as well as a Team-Based Learning Student Assessment questionnaire (TBLSA) at the conclusion of the course. The LSI categorized the students into one of four learning types: converging, accommodating, diverging or assimilating and examined each student for their preference of learning method in Kolb's learning spiral. The TBLSA evaluated the students' perception of accountability (defined as student preparation before class and contribution to the team), preference for lecture or TBL, student satisfaction with the TBL method and overall experience with TBL.

**Results:** Sixty percent of nurse anesthesia students in this study had a positive experience with team-based learning when used in a foundational nurse anesthesia class. There were significant differences between accountability ( $t(19) = 9.82, p < .001$ ), satisfaction ( $t(18) = 3.18, p = .005$ ), overall experience ( $t(18) = 4.77, p < .001$ ) and the neutral scores within each category, indicating that the experience with TBL was generally well received by the students. A correlation between the three subscales of TBL (accountability, satisfaction and preference) and learning styles could not be determined due to the limited number of students, however Pearson's correlation demonstrated a positive correlation between the use of concrete experimentation to grasp knowledge and student satisfaction ( $r(17) = .56, p = .012$ ), overall experience with TBL ( $r(17) = .50, p = .029$ ). A negative correlation was identified between the use of reflective observation and accountability ( $r(18) = -.52, p = .019$ ), preference for TBL ( $r(18) = -.58, p = .008$ ), student satisfaction ( $r(17) = -.51, p = .026$ ) and overall experience ( $r(18) = -.60, p = .007$ ).

**Conclusions:** Students in this study were generally satisfied with TBL. They were more accountable for their education as a result of the implementation of the TBL method. They felt satisfied with team-based learning, but were neutral regarding preference for TBL over lecture. Students who had a preference for learning by applying knowledge to practical applications (concrete experimentation) felt more accountable and were more satisfied with TBL than those with a preference for reflective observation, active experimentation or abstract conceptualization. Students with a preference for reflective observation as a mode of learning were not satisfied with TBL and felt it negatively affected their accountability. This study adds to the literature examining the use of TBL in the health science professions and suggests that those with a

preference for learning by concrete experimentation may better accept TBL, than those with a preference for learning with reflective observation.

**Data sources:** PubMed, TRIP, ERIC, CINAHL and Google search

**Key words:** Team-based learning, nursing education, medical education, active learning, nurse anesthesia education, Kolb learning style.

## INTRODUCTION

In 2010, the Carnegie Foundation for the Advancement of Teaching published a call for the radical transformation of nursing education. During their observations of nursing education, it was found that while nursing does an effective job in some areas, work needs to be done to ensure that educators improve their teaching so that graduates are safe clinicians and lifelong learners who develop clinical knowledge.<sup>1</sup> The teaching they observed in classrooms was in sharp contrast to that seen in the clinical area. For the most part, educators presented material about physiology, disease categorizations and interventions as taxonomies *to be memorized*, instead of engaging the student in how such knowledge can be applied to actual patient care. A challenge was made to nursing educators to shift from this type of teaching to an emphasis on teaching for a sense of salience, situated cognition and action in particular circumstances and the development of life-long learners. The Council on Accreditation for Nurse Anesthesia Educational Programs has responded to the Carnegie report by supporting doctoral education for entry into nurse anesthesia practice by 2025.

During training, student registered nurse anesthetists (SRNAs) are expected to synthesize a tremendous amount of material in order to be prepared for their introduction to the clinical environment. Even as beginners, SRNAs are expected to demonstrate some level of competence, and make deliberate choices from a repertoire of learned behaviors to manage a variety of situations in the clinical arena. Team-based learning (TBL), an active teaching strategy, has been used in health professions over the past decade to address these needs.

Traditionally, lecture is one of the most well-known and most frequently used techniques in education.<sup>2</sup> However, knowledge acquisition by lecture may be limited due to the passive

approach of this technique. Lecture is seen as a one-way transmission of information and does not mandate student engagement.<sup>3</sup> Team-based learning uses student engagement as a critical component of the method. Larry Michaelsen originally introduced team-based learning in the late 1970s in response to his dissatisfaction with the lecture style of teaching. During his first experiences with TBL, he noticed that students were learning how to *apply* concepts, rather than simply learning *about* the concepts.<sup>4</sup>

Within healthcare, team-based learning has been most actively employed in medical schools, and to a lesser extent in pharmacy and nursing education. Educators have found TBL to result in greater content comprehension when compared to passive lectures. Team-based learning students are also found to have improved personal communication and teamwork skills, better clinical application of knowledge, and a higher level of engagement.<sup>5</sup>

The acceptance of TBL by students is partially dependent upon their endorsement of group work. It is commonly recognized that students learn in different ways. Understanding the ways in which students learn can assist educators in designing activities that facilitate learning. In 1984, David Kolb identified four learning styles based on experiential learning theory: accommodating, diverging, assimilating and converging.<sup>6</sup> These learning styles define the way individuals grasp and transform experiences to create knowledge.<sup>7</sup> Learners that possess the diverging or accommodating learning style prefer to work in groups, while those that fall into the assimilating learning style prefer lectures and studying alone.<sup>9</sup> No studies could be found that correlated learning style to success or satisfaction with team-based learning.

The purpose of this capstone project was twofold: first, to evaluate student satisfaction, accountability and preference for team-based learning in comparison to traditional lecture

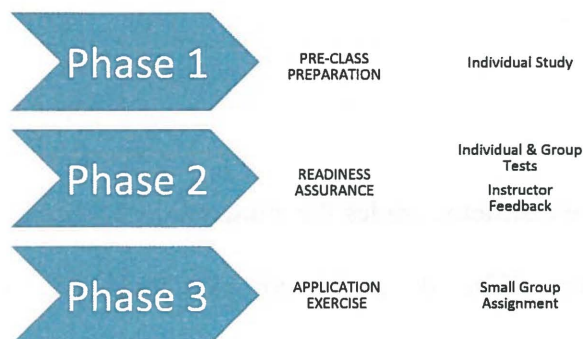
format, and secondly to determine if a correlation exists between student satisfaction, accountability or preference for team-based learning and learning style as defined by Kolb.

## REVIEW OF LITERATURE

### Team-Based Learning

Team-based learning (TBL) is an evidence-based, active teaching strategy that was developed by Dr. Larry Michaelsen in the 1970s. It is a learner-centered, instructor-directed strategy that provides students the opportunity to apply conceptual knowledge to real-life problems. Using the “flipped classroom approach,” the instructional content is provided to students before the class period, leaving time in class to be spent applying the concepts to scenarios likely to be experienced by the students. Team-based learning sessions are designed as units of instruction that are taught as a three-step cycle: pre-class preparation, readiness assurance testing (RAT) and application-focused exercises (see Figure 1).<sup>9</sup>

**Figure 1:** Team-Based Learning Phases



Pre-class preparation includes reading assignments, narrated PowerPoint lectures or pertinent educational videos. The readiness assurance process assesses the adequacy of students' preparation. At the beginning of class, students take an individual readiness assurance test



(iRAT). After completion of the iRAT, students gather in groups to take the *same* readiness assurance test as a team (tRAT). An immediate feedback self-scoring sheet (IF-AT) is used for the tRAT. Within the IF-AT, a star lies under a scratchable surface denoting the correct answer (see figure 2). Teams are given immediate feedback by scratching off the surface that corresponds to the letter they perceive to be the correct answer. If the scratching does not reveal a star, the team must continue discussing the questions until they arrive at the correct answer.

**Figure 2:** Immediate Feedback-Assessment Tool<sup>11</sup>

IMMEDIATE FEEDBACK ASSESSMENT TECHNIQUE (IF AT)

Name Team # 3 Test # 1

Subject \_\_\_\_\_ Total 23

SCRATCH OFF COVERING TO EXPOSE ANSWER

|    | A        | B        | C        | D        | Score |
|----|----------|----------|----------|----------|-------|
| 1  | [Yellow] | [Yellow] | [Yellow] | [Yellow] | 4     |
| 2  | [Yellow] | [Yellow] | [Yellow] | [Yellow] | 2     |
| 3  | [Yellow] | [Yellow] | [Yellow] | [Yellow] | 4     |
| 4  | [Yellow] | [Yellow] | [Yellow] | [Yellow] | 1     |
| 5  | [Yellow] | [Yellow] | [Yellow] | [Yellow] | 4     |
| 6  | [Yellow] | [Yellow] | [Yellow] | [Yellow] | 4     |
| 7  | [Yellow] | [Yellow] | [Yellow] | [Yellow] | 0     |
| 8  | [Yellow] | [Yellow] | [Yellow] | [Yellow] | 4     |
| 9  | [Yellow] | [Yellow] | [Yellow] | [Yellow] |       |
| 10 | [Yellow] | [Yellow] | [Yellow] | [Yellow] |       |

While students are taking the tRAT, the instructor grades the students' iRATs and determines areas that require further clarification. When the groups complete the tRAT, the instructor provides additional feedback by a 'clarification lecture' that covers the misunderstood concepts as determined from the iRAT. Students are given the opportunity to appeal responses on the readiness assurance tests, thus allowing them to do a focused restudy of the assigned readings, thereby reinforcing their learning. The remainder of class time is spent with the teams completing a decision-based application assignment.<sup>12</sup>

### **Principles and Practices of Team-Based Learning**

There are four key principles of TBL:

- (1) Groups must be properly formed and managed.
- (2) Students must be accountable for the quality of their individual *and* group work.
- (3) Students must have frequent and timely feedback.
- (4) Team assignments must promote both learning *and* team development.<sup>9</sup>

The incorporation of these key elements will allow student groups to naturally evolve into cohesive learning teams.

*Group formation and management.* Three important variables must be managed when forming groups for TBL: the distribution of member resources, allowing adequate time for team cohesiveness to develop, and minimizing barriers to group cohesiveness.<sup>9</sup> Groups that are fairly large and diverse allow each team access to high-performing students with the potential to make significant contributions to the highly challenging, intellectual tasks in the application exercises. However, groups that are too large are not able to develop the cohesiveness needed for effective group work.<sup>10</sup> Forming teams with 5-7 members provides a sufficiently rich talent pool for each team while also promoting group cohesiveness.<sup>13</sup> Developing these groups should be the responsibility of the instructor as students tend to align with similar personalities and do not possess the information to wisely form groups.<sup>4</sup>

Ideally, students should stay in the same group for the duration of the course. In the beginning stages of a course, groups tend to rely on the contributions of one or two team members. As time progresses, team communication becomes more open and conducive to learning. Members become more willing to challenge one another as they begin to understand how the effectiveness of the groups influences their personal grades. Quieter members feel more comfortable voicing their opinions and group cohesiveness develops.<sup>10</sup>

Previous relationships among members or the presence of a cohesive *subgroup* are the biggest threats to group cohesiveness. These relationships can take the form of previously established relationships (i.e. boyfriend/girlfriend) or subgroups based on nationality or culture. In these circumstances, an “insider/outsider” tension develops, ultimately leading to destruction of the cohesion and effectiveness of the learning team.<sup>10</sup> Thus, the instructor should be responsible for forming groups with a randomization method that would minimize these previous relationships. In this way, the group is forced to build themselves into teams “from the ground up.”<sup>12</sup>

***Student accountability.*** During a traditional lecture course, students are accountable to themselves and the instructor, with grades as the means to measure this accountability. In TBL however, students must not only be accountable to themselves and their instructor, they must also be accountable for their contribution to the team. Accountability includes individually preparing for group work, dedicating effort to complete group assignments, and interacting with fellow group members in a productive and professional manner.<sup>4</sup>

The success of team-based application exercises is dependent on students coming to class with foundational knowledge. If students fail to complete pre-class assignments, they will be unable to contribute to the endeavors of the team. Teams are far less likely to be successful and will be less cohesive if individual members are not prepared. The readiness assurance process, consisting of individual and team testing of assigned materials, is designed to ensure an understanding of core concepts.<sup>9</sup>

Peer reviews, occurring at the halfway point and at the completion of a TBL course, not only assure that students are coming prepared with the requisite knowledge, but that they are also contributing to the success of their team. Students that come to class unprepared may create



resentment among the prepared students. Not only is peer evaluation a mechanism to induce accountability, it is also useful for developing interpersonal skills, fostering insight and promoting professional behavior.<sup>9,10</sup> Students in the health professions will benefit from learning these skills as they can be applied throughout their careers, when giving and receiving constructive feedback from their peers.<sup>14</sup>

***Timely feedback.*** As students are taking the tRATs in their groups, it is the responsibility of the instructor to grade the individual readiness assurance tests. This allows the instructor to identify the areas of weakness in core concepts. The instructor is then able to present a short “clarifying” lecture to assure that all students have a base understanding of the core concepts before advancing on to more complex application assignments.<sup>4</sup>

Feedback from the readiness assurance tests also aids in the process of developing cohesive teams. Immediate feedback from the IF-AT makes students aware of situations where the group failed to recognize the knowledge of one or more of their members. Groups quickly learn the importance of considering everyone’s opinions in the decision-making process.<sup>4</sup> Retaking the identical test as a group reinforces correctly answered questions, and corrects any misinterpretation of incorrect answers. As students explain the rationale for their correct answers chosen, learning is once again reinforced.<sup>13</sup>

### **TBL Utilization in Health Education**

Team-based learning is being used with increased frequency in health education programs throughout the country. It was first used in medical education at Baylor College of Medicine in 2001. Professors at Baylor trialed TBL at a resident noontime forum and found increased resident engagement, favorable changes in attitude about usefulness of content in daily medical practice, and a high degree of interaction among participants.<sup>11</sup> Following this trial, a

three-year grant from the Fund for the Improvement of Post-Secondary Education (FIPSE) allowed TBL to be introduced into ten medical institutions. Improved academic performances, high student and faculty satisfaction scores, and increased student engagement were reported after initial introductions.<sup>12</sup> It was also discovered that fewer faculty members were required to effectively teach a large group of students when compared to other active learning strategies such as problem-based learning which requires one facilitator for each student team.<sup>12-14</sup>

Currently, TBL use has been documented in over 60 institutions dedicated to educating future health professionals in the fields of nursing, medicine, dentistry, veterinary medicine and allied health professions at the undergraduate and postgraduate level in the United States and abroad.<sup>15</sup> It has also been used as a teaching strategy in continuing medical education, hospital-based education, resident education, and the National Academies of Practice to develop health care policy.<sup>16-23</sup> Application of TBL has been documented in nursing programs, however literature related to or regarding the use of TBL in nurse anesthesia education was not found by this author.

Research related to TBL shows increased knowledge acquisition and retention, increased student satisfaction and engagement, and a greater appreciation of teams reported by students.<sup>27-29</sup> Although most studies found that students were satisfied with the use of TBL as a learning strategy, a few have shown a preference for the traditional lecture format.<sup>28</sup>

### **Knowledge Acquisition and Retention with TBL**

Instructors of the health professions disciplines are faced with three challenges when educating students. First, the amount of information that students must learn is enormous, and keeps growing at an exponential pace. Secondly, it is not enough for students to possess the

knowledge; they must be able to apply the information in the clinical context. Finally, students must have effective communication skills and experience working with people in teams.<sup>13</sup>

Team-based learning has been found to be very effective in the acquisition of large amounts of material. Improved course and final examination scores were demonstrated in multiple studies.<sup>24-36</sup> In most of these studies TBL was used as a primary teaching strategy, however TBL has also been used as a supplement to lectures where it also improved examination scores.<sup>27,28,32</sup>

Standardized exams are ubiquitous in health professions programs. The existence and longevity of a program may be dependent upon the success of students on these standardized exams. In some cases, TBL increased standardized exam scores, such as the National Board of Medical Examinees (NBME) exams for medical students.<sup>31,34,36-38</sup> A recent study showed improvement of NBME scores in an individual content area when TBL was implemented. This information adds to the pool of literature supporting the use of TBL to improve performance on high-stakes examinations.<sup>39</sup> Students must develop an ability to retain information in order to be successful on standardized and certifying exams. Team-based learning may stimulate higher-order thinking skills, allowing students an improved long-term ability to recall information.<sup>34,38,40</sup>

Team-based learning was used over eight semesters in a psychiatric mental health (PMH) nursing course and was found to significantly increase PMH exit examination scores during that period. Self-reported studying time significantly increased as students had the expectation of active participation in a team. Despite the improved standardized exam scores, university-generated course evaluations did not reflect an increase in perception of course effectiveness after the TBL method was introduced.<sup>41</sup>

Although using team-based learning resulted in increased examination scores for *all* students, academically weak students exhibit the greatest improvement.<sup>29,34,42</sup> In Korea, TBL was used for the remediation of at-risk medical students, resulting in a 100% pass rate on the Korean Medical License Examination.<sup>43</sup> Interestingly, despite the increased examination scores, students in the lower quartiles of academic performance reported lower satisfaction scores than the higher performing students.

### **Student and Faculty Perceptions of TBL**

Students are generally satisfied with the format of team-based learning.<sup>14,26,27,30,44-49</sup> In one study, high-performing students were significantly more satisfied with TBL when compared to low-achieving students.<sup>49</sup> When TBL was used in a gross anatomy class, students were content with their ability to cover a vast amount of material in a short time.<sup>34</sup> Another set of students in a clinical neurology class felt that peer discussions allowed for self-reflection and resulted in further self-directed learning, leading to an ability to reinforce and retain knowledge. Fifty-seven percent of these students felt that TBL helped with their understanding of difficult neuroscience material and assisted in their focus on core information.<sup>40</sup>

Team-based learning was used during a pediatric clerkship at the University of Michigan Medical School in 2009-2010. Standardized test scores improved and a greater appreciation of teams was demonstrated, however student satisfaction scores were low.<sup>36</sup> Satisfaction scores improved after the first year of implementation, possibly demonstrating an increased comfort level by the faculty and students with the teaching strategy. Students acknowledged the improvement in test scores and the increase in participation, but did not enjoy the method and had no desire to use TBL in any future courses.<sup>36</sup> This negative satisfaction was reiterated in a

few other studies which revealed student comments such as, “The teachers are PAID to teach, not to watch us learn,” and “I pay for the teachers to teach me.”<sup>50</sup>

This mixed reaction to the implementation of TBL has been found in various studies.<sup>44,51,52</sup> It may be due to the stress of the additional workload placed on students to prepare for a TBL session.<sup>28</sup> One researcher attributed the lower satisfaction scores to anxiety associated with the preclass readings.<sup>52</sup> Michaelsen believes a lifetime of lectures has not prepared students for the process of the organization and summation of required readings and may be responsible for this anxiety.<sup>10</sup> A mixed response was also garnered when students were directly asked if they would like to see TBL incorporated into other courses, some in agreement<sup>18,40,57-59</sup> and some not (see Table 1).<sup>36,52,53</sup>

**Table 1:** Student Satisfaction and Preference for TBL<sup>36,45,47,49,52-58</sup>

| Study                                      | Satisfied with TBL | Not satisfied with TBL | Preference | Would prefer more courses with TBL |
|--|--------------------|------------------------|------------|------------------------------------|
| Carbo <sup>47</sup>                        | X                  |                        |            |                                    |
| Corbridge <sup>44</sup>                    | X                  |                        | N          |                                    |
| Letassy <sup>62</sup>                      | X                  |                        | L          |                                    |
| Mennega <sup>50</sup>                      | X                  |                        | N          |                                    |
| Mody <sup>63</sup>                         | X                  |                        |            |                                    |
| Ravindrath <sup>58</sup>                   | X                  |                        | T          | X                                  |
| Vasan <sup>54</sup>                        | X                  |                        |            |                                    |
| Clark <sup>52</sup>                        |                    | X                      | L          |                                    |
| Della-Ratta <sup>37</sup>                  |                    | X                      |            |                                    |
| Warrier <sup>36</sup>                      |                    | X                      |            |                                    |
| Atlinas <sup>54</sup>                      |                    |                        |            | X                                  |
| <i>Legend: T=TBL, L=lecture, N=Neutral</i> |                    |                        |            |                                    |

The transition from lecture-based teaching to team-based learning can be difficult for students and faculty. Many students are accustomed to lectures and find the transition to TBL difficult.<sup>36,52,53</sup> Medical students often prefer lectures, as accomplished speakers simplify complex concepts and provide students with a sense of security that information needed to pass examinations has been provided.<sup>29</sup> The transition to collaborative learning after a lifetime of competitive learning also presents a problem for medical students. This is problematic when

introducing TBL into a curriculum, as the historically competitive atmosphere may result in a reluctance of students to share information.<sup>59</sup>

Faculty deciding to adopt team-based learning may also find the transition difficult. The usual role of 'sage on the stage' undergoes a transformation to that of 'guide on the side.'<sup>65</sup> The initiation of TBL can increase faculty workload in the early stages as lectures are replaced with application exercises. Transition of pharmacy lectures to TBL sessions in the UK, resulted in faculty reports of increased workload related to the development of effective application exercises.<sup>66</sup> However, these challenges were balanced by enhanced student engagement, peer learning and increased satisfaction with teaching experienced by the faculty.

Student engagement in course content and with peers has been shown to increase performance levels and satisfaction.<sup>10</sup> Many studies report an increase in student engagement when team-based learning is implemented,<sup>18,25,29,33,50,66-68 14,22,24,28,45,60-62</sup> although one study<sup>24</sup> points out this is an expected outcome due to the active engagement inherent in the TBL strategy. Most faculty members appreciated increased student engagement,<sup>44</sup> as well as the increase in class attendance, when TBL was implemented.<sup>31,52,53</sup>

One goal of all educational programs is to develop lifelong learners. TBL has been credited with improving student effort and self-regulated learning.<sup>12,28,40,54,60,61,63-65</sup> In an experimental study done with a hybrid baccalaureate nursing class, it was found that students in the TBL group utilized online resources to prepare for classes more frequently than those in the traditional lecture group.<sup>65</sup> It was hypothesized that TBL provided the motivation for students to increase self-regulated learning behaviors.

### **Teamwork Development in TBL**

Once considered an optional skill, the ability to work effectively in a team is now considered essential for most jobs. Health professionals, in particular, need to develop their teamwork skills to function on a daily basis. Supporting the development of high performance learning teams is stated as one of two goals of team-based learning.<sup>12</sup> For these reasons, team performance and the students' perceptions of the value of teams is an often-studied outcome in TBL research.

One way in which team performance can be compared to individual performance is via the readiness assurance tests. Not surprisingly, multiple studies found that the team readiness assurance test (tRAT) scores were higher than the individual scores (iRAT).<sup>38-40,45,53,66,70,72-74</sup> An increase in respectful discussion practices was noted after the implementation of TBL and led to a favorable perception of the group learning experience in one study.<sup>66</sup>

Students in many studies reported a greater appreciation of teams.<sup>18,34,41,42,58,67,73,74</sup> In these studies, the students recognized the combined brainpower of peers in the teams as a useful educational resource.<sup>29</sup> Peer-to-peer teaching is a valuable educational resource, not only for the peer seeking understanding, but also for the more knowledgeable peer, as teaching is a mechanism to reinforce learning.

When TBL was used as a teaching strategy in third and fourth year medical students in Beirut where it was found to be more effective at developing teams in the junior class compared to the senior class.<sup>67</sup> The developers of the team-based learning strategy recommend that teams remain permanent over the course of a semester. The belief is that *only* when students work together over time are they able to become high-functioning groups capable of self-management, leading to effective learning.<sup>10</sup> In a study of physiology students, the quality and performance of



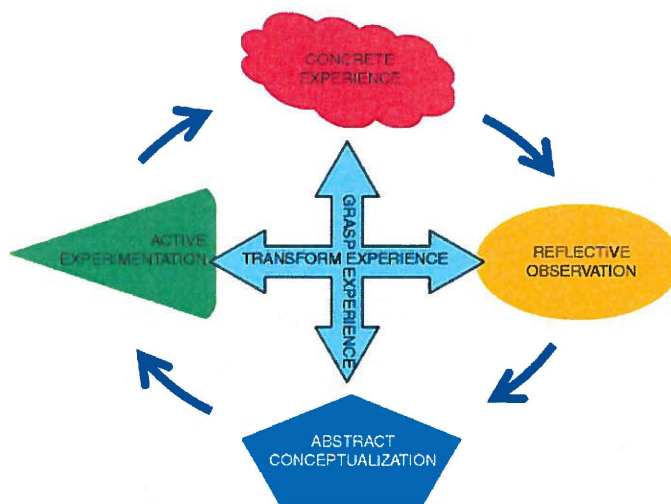
the team was instrumental in overcoming the educational disadvantages of lower functioning students.<sup>75</sup>

### TBL and Learning Styles

The experiential learning theory (ELT), developed by David Kolb, examines how information is processed to define learning. It is based on the premise that learning occurs through experiences. Learning, as defined by the experiential learning theory, is “the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experiences.”<sup>68</sup>

The process of learning, according to the ELT, is viewed as a continually revolving spiral of four stages: experiencing (concrete experimentation-CE), reflecting (reflective observation-RO), thinking (abstract conceptualization-AC) and acting (active experimentation-AE). Learning is thought to occur in a spiral as each trip through the cycle brings new insight gained from reflection, thought and action. As a concrete experience is reflected upon, given meaning by thought, and reconstructed by action, the new experience is broader, deeper and more meaningful. Learning occurs with progression through this spiral (see figure 3).<sup>77</sup>

**Figure 3. Experiential Learning Spiral<sup>69</sup>**



Learning styles describe the way an individual spirals through these stages. Four learning styles have been identified according to the learner's preference for absorbing new information—diverging, assimilating, converging and accommodating.<sup>69</sup> A person with a diverging learning style prefers concrete experimentation (experiencing) and reflective observation (reflecting) as their primary learning method. These individuals excel in situations that call for brainstorming. They like to gather information, are imaginative and prefer to work in groups.<sup>70</sup>

An individual with an assimilating style learns best by thinking (AC) and reflecting (RO). Assimilators excel at understanding a large amount of information and putting it into a concise, logical form. In a formal learning environment, they prefer lectures and exploring analytical models to group work. Convergents, on the other hand, prefer to learn by thinking (AC) and acting (AE). These individuals are good at making decisions and problem solving. Their preference is simulations, laboratory assignments and practical applications of knowledge.<sup>8</sup>

Learners with an accommodating style learn by acting (AE) and experiencing (CE). “Hands-on” assignments appeal to this type of learner. In contrast to convergers who act by logically analyzing situations, accommodators tend to act on “gut” feelings. These individuals rely on others for information gathering; they prefer action to thinking. They enjoy working in groups, so that others may research the ideas, leaving them free to act (table 4).<sup>7</sup>

**Table 4:** Learning Styles and Formal Learning Situations<sup>78</sup>

| <u>Learning Style</u> | <u>Preference for learning in formal learning situations</u>                         |
|-----------------------|--|
| DIVERGING             | Prefer to work in groups. Listens with an open mind to different points of view.     |
| ASSIMILATING          | Prefer readings, lectures, analytical models and having time to think things through |
| CONVERGING            | Prefer simulations, laboratory assignments and practical applications.               |
| ACCOMODATING          | Prefer to work with others. Tests out different approaches to completing a project.  |

Learning styles are not thought to play a role in TBL satisfaction because students with many different learning styles form teams.<sup>71</sup> In fact, a tenet of team-based learning is that the use of heterogeneous groups leads to higher functioning learning teams.<sup>44</sup> A group of researchers in Greece studied use of learning styles as method of forming heterogeneous groups. Greater group creativity and a higher appreciation for teams were found when the groups were diverse in regard to learning style.<sup>72</sup>

The application exercise in TBL involves working in groups and solving ambiguous practical problems.<sup>4</sup> As seen in Table 4, students with diverging and accommodating style prefer to work with others, while assimilators are most comfortable working alone. Convergents prefer practical applications but may be uncomfortable in ambiguous situations.<sup>69</sup> This author was unable to locate a study that examined the correlation between learning styles and satisfaction with team-based learning.

### **METHODOLOGY AND STUDY DESIGN**

To evaluate student registered nurse anesthetists' (SRNAs) experience with TBL, a descriptive study design was utilized. Permission to collect data was obtained from University of Michigan-Flint Institutional Review Board. The target population for this project was nurse anesthesia students. The accessible population and sample for this study consisted of first semester nurse anesthesia students enrolled in the Oakland University-Beaumont Graduate Program of Nurse Anesthesia. Permission to collect data was obtained from the director of the Oakland University-Beaumont Graduate Program of Nurse Anesthesia.

### **Formation of Teams**

Students were introduced to the team-based learning method with a video presentation explaining the team-based learning concept and a short lecture given by the author of this project at the beginning of the semester. Oakland University's nurse anesthesia program has one main campus and two didactic distance sites located throughout the state. A real-time video conferencing system was used to conduct classroom sessions to include all students.

Communication occurs among the three sites. The author formed teams in the following manner with the goal of establishing heterogeneity:

1. Fifteen students at the main campus were divided according to their intensive care unit (ICU) experience.
2. The students were aligned with those that most recently worked in a surgical ICU first, followed by those in a general ICU, medical ICU, neurologic ICU and finally those that most recently worked in other types of ICUs.
3. Students were asked to count off from 1-3 while in their lines. All students that counted "1" formed a team, those that counted "2" formed a team, and those that counted "3" formed a team.
4. The 5 students located at distance sites formed one team for the sake of practicality. The ICU background mix of the distant students was similar to the other groups in that it consisted of a combination of medical, surgical and cardiac intensive care experience.

### **Course description**

Team-based learning was introduced as a method to teach NRS 607 Introduction to Nurse Anesthesia Practice at Oakland University. This 3-credit course consists of 5 learning units

covering 30 topics. The units and topics covered are described in Appendix A: NRS 607 Introduction to Nurse Anesthesia Practice Content.

Team-based learning was used for a portion of the course in the fifth module that covers anesthesia for specific populations and procedures. Five topics were covered by a traditional lecture format: Anesthesia for the obese population and bariatric surgery, anesthesia for orthopedic surgeries, anesthesia for electroconvulsive therapy, anesthesia for genitourinary surgery, and non-operating room anesthesia. Team-based learning was used to cover the following four topics: Anesthesia for the geriatric population, anesthesia for ophthalmological surgeries, anesthesia for gastrointestinal surgeries and anesthesia for gynecological surgeries. The author of this project conducted the TBL sessions. Five content experts presented the traditional lectures in this module.

In order to ensure success in this project, TBL principles were closely followed. Pre-class preparation included reading assignments and narrated PowerPoint presentations. Individual readiness assurance tests were given at the beginning of each TBL session, followed by team readiness assurance tests and clarifying lectures. These tests were graded in accordance with the TBL principle of establishing accountability. Peer assessments were completed after the second TBL session to determine team contributions and provide peer feedback.

### **Collection of Data**

Permission was granted to use the Team-Based Learning Student Assessment Instrument (TBLSA) and the Kolb learning style inventory (LSI), version 3.1.<sup>73</sup> The TBLSA assesses three subscales: student accountability, preference for lecture or TBL and student satisfaction. Accountability is defined as student preparation in advance of class and/or contribution to other members of the team. Student satisfaction includes “positive feelings

toward either the team-based learning activities or traditional lecture.”<sup>73</sup> This instrument contains 39 questions and obtained a Cronbach  $\alpha$  of .941. Cronbach  $\alpha$  scores for the accountability, preference and student satisfaction subsets were .782, .893 and .942, respectively.<sup>73</sup> Results were analyzed using Pearson correlations.

The Kolb LSI<sup>78</sup> is a 12-item, rank-order questionnaire that measures an individual’s learning style preference. Each of the 12 items begins with a statement regarding how the individual prefers to learn, with a choice of four endings. The individual taking the test ranks the answers in their order of preference. The LSI is then scored to determine the individual’s preference for each stage of Kolb’s learning spiral: concrete experience, reflective observation, abstract conceptualization and active experimentation. These scores are then plotted on a graph to assign a specific learning style: accommodating, diverging, assimilating and converging. The LSI is reported to have good internal consistency reliability, with an average Cronbach alpha of 0.70.<sup>78</sup>

## RESULTS

A total of 20 participants were included in the study sample; 11 of the participants were women (55%), and 9 were men (45%). The most common ICU experience was in the surgical ICU (35%), however experience in general, neurologic, medical, cardiac and trauma ICUs were also represented (see table 5).



**Table 5. Demographics of ICU Experience by Learning Team**

|                       | Type of ICU |         |       |         |         |              |
|-----------------------|-------------|---------|-------|---------|---------|--------------|
|                       | Surgical    | General | Neuro | Medical | Cardiac | Trauma/Burns |
| <b>Group #1 (n=5)</b> | 2           |         | 1     | 1       |         | 1            |
| <b>Group #2 (n=5)</b> | 2           | 1       | 1     | 1       |         |              |
| <b>Group #3 (n=4)</b> | 1           | 1       | 1     | 1       |         |              |
| <b>Group #4 (n=6)</b> | 2           | 2       |       | 1       | 1       |              |

Data was analyzed using SPSS Statistical Software 22.0 (IBM, 2016). Descriptive statistics were conducted, including summing of the Learning Style Inventory, and the subscale and total score for the Team-Based Learning Student Assessment Instrument. The descriptives for the learning style inventory and team-based learning overall measures are depicted in Table 6. Scores in each of these learning modes range from a minimum of 4 to a maximum of 48. Students utilized active experimentation by the greatest degree, with a mean of 38.25 ( $SD=5.35$ ), followed by abstract conceptualization (mean=33.30,  $SD=5.16$ ), reflective observation (mean=26.05,  $SD=5.80$ ) and concrete experience (mean=22.45,  $SD=5.86$ ).

**Table 6. Descriptive Statistics for Learning Mode (n=20)**

| Measures                   | Min | Max | Mean  | SD   |
|----------------------------|-----|-----|-------|------|
| Concrete Experience        | 14  | 41  | 22.45 | 5.86 |
| Reflective Observation     | 16  | 36  | 26.05 | 5.80 |
| Abstract Conceptualization | 23  | 45  | 33.30 | 5.16 |
| Active Experimentation     | 23  | 47  | 38.25 | 5.35 |

All four learning styles were identified (see figure 4). The predominant learning style identified in this sample was converging (60%) which emphasizes abstract conceptualization and active experimentation. The accommodating and assimilating learning styles were the next most frequently occurring styles, with 3 students in each of these categories (15% each). The accommodating style emphasizes concrete experience and active experimentation, while the assimilating style emphasizes reflective observation and abstract conceptualization. The diverging learning style occurred least frequently with 2 students (10%) in this category. The diverging style emphasizes concrete experience and reflective observation.

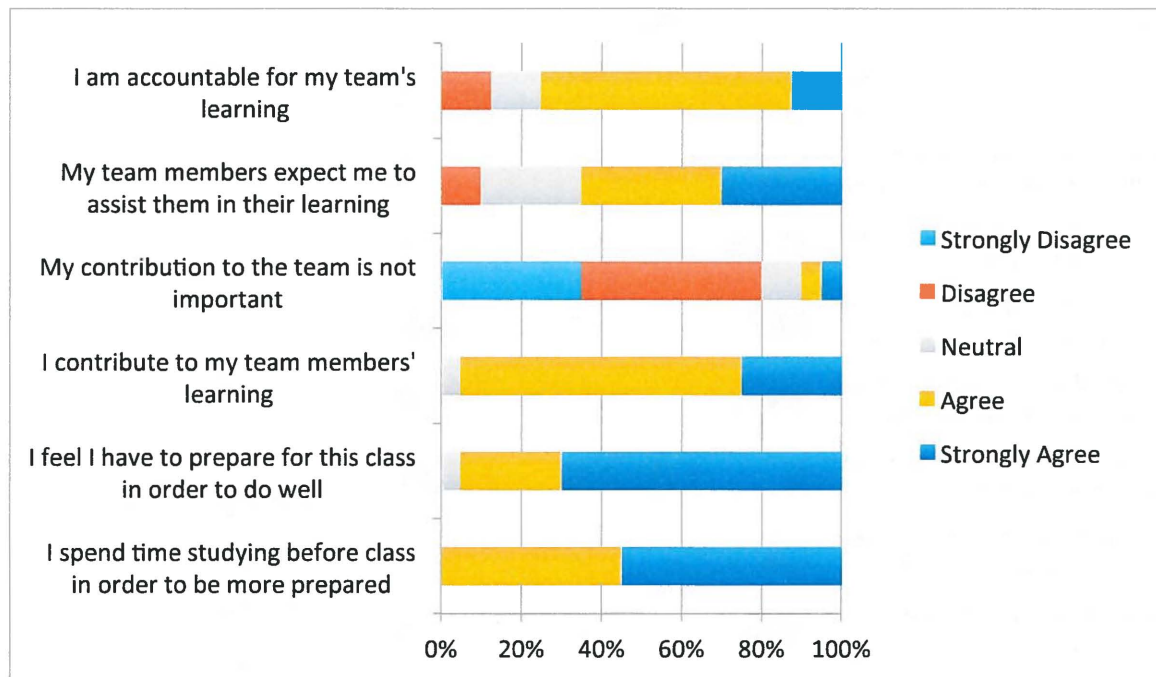
**Figure 4. Learning Styles**



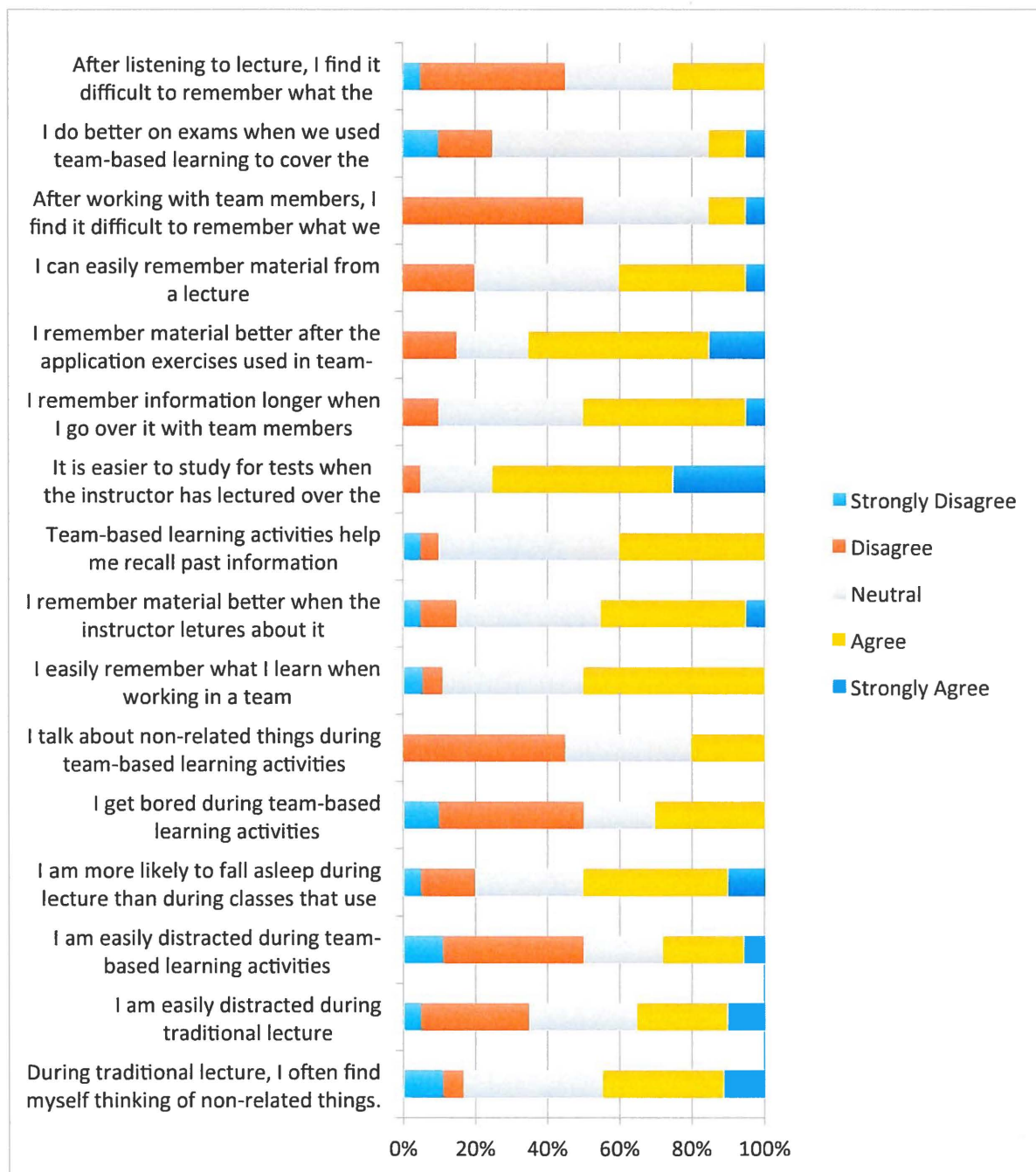
The 39- item TBLSA instrument uses 5-point Likert scales with possible responses of strongly disagree, disagree, neutral, agree and strongly agree. It consists of three subscales: accountability, preference for lecture or TBL and student satisfaction. Descriptive data for the TBLSA follows in figures 5-7. Results for each subscale will be discussed below.



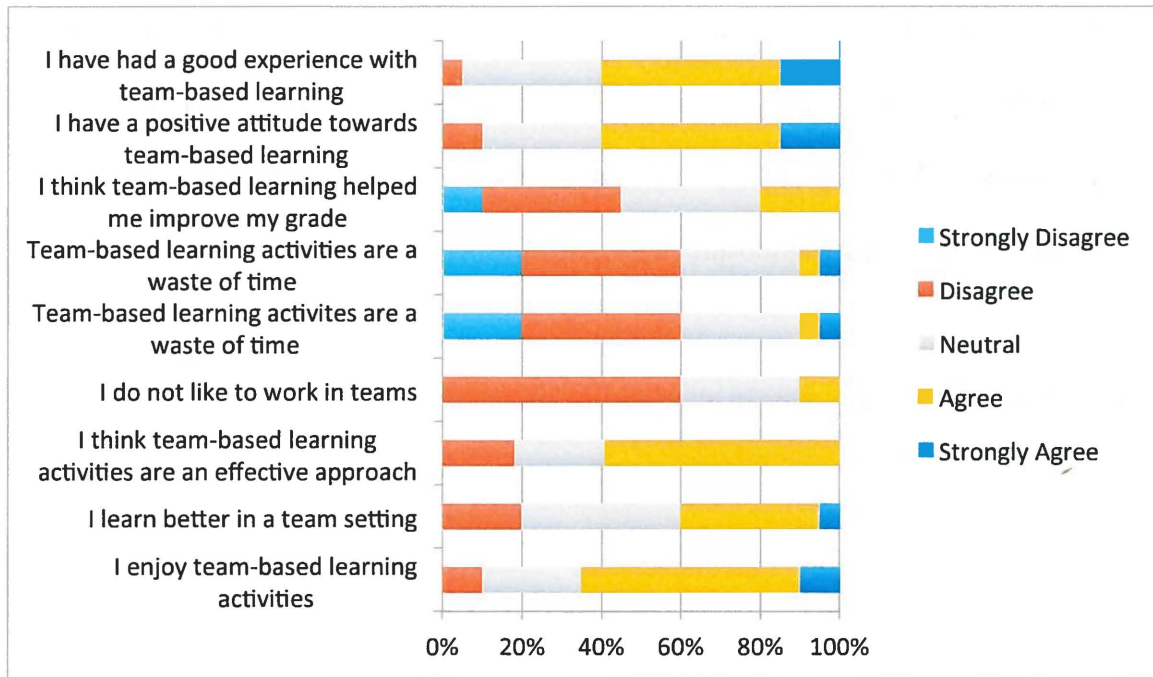
**Figure 5. Student Responses to Team-Based Learning Questions Regarding Accountability (percentages) (n=20)**



**Figure 6. Student Responses to Team-Based Learning Questions Regarding Preference for TBL (percentages) (n=20)**



**Figure 7. Student Responses to Team-Based Learning Questions Regarding Satisfaction with TBL (frequencies/percentages) (n=20)**



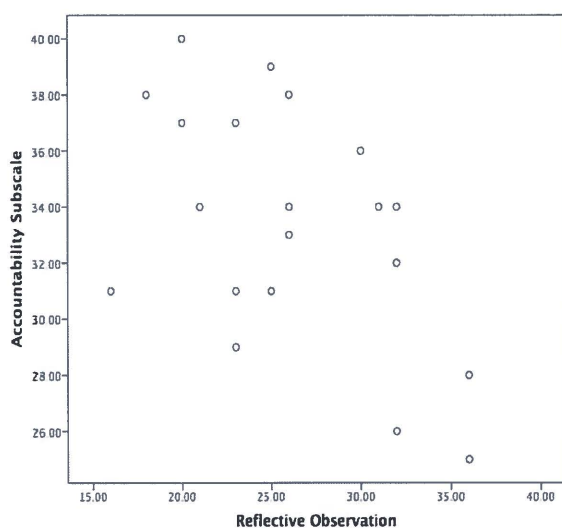
**Accountability**

It was of interest to explore students’ perception of accountability when the TBL method was used and to determine a correlation with Kolb learning styles. Data was collected on the overall experience with the TBL method using the Team-Based Learning Student Assessment Instrument.<sup>73</sup> Accountability scores range from 8-40, with a higher score indicating a higher level of accountability. The subscale scores ranged from 25-40, with a mean of 33.50 (*SD*=4.26). A score of 24 is considered neutral. Students in this study had a high level of accountability with TBL. One-sample t-tests were used to assess whether or not group subscale means differed from the neutral values. For the accountability subscale, a significant difference

was found between average accountability ( $M = 33.5$ ,  $SD=4.26$ ) and the neutral score which was 24,  $t(19) = 9.82$ ,  $p < .001$ .

The results indicate that there is a significant (negative) correlation between reflective observation and accountability,  $r(18) = -.52$ ,  $p = .019$ . Thus as reflective observation increases, accountability decreases. The other three learning stages were not significantly correlated with accountability (all  $p > .05$ ). This relationship is depicted in figure 8.

**Figure 8.** Scatterplot of Reflective Observation and Accountability ( $r = -.52$ )



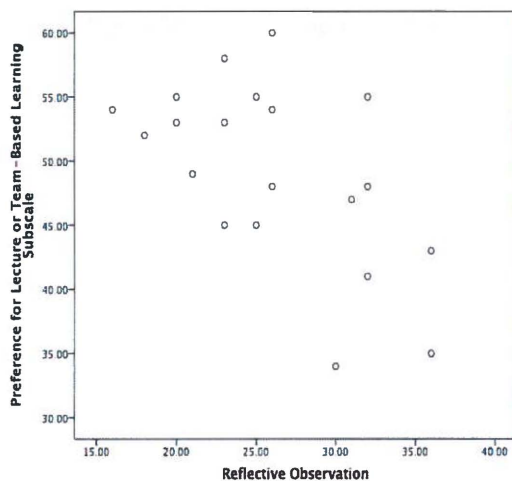
### Preference for TBL

Students' preference for TBL or lecture was also measured. On this subscale, possible scores ranged from 16 to 80, with a higher score indicating a preference for TBL. Participant's subscale scores ranged from 34 to 60, with a mean of 49.2 ( $SD = 7.11$ ). As a score of 48 is considered neutral, participants in this study were almost neutral in their preference for TBL or lecture. For the preference subscale, the difference between average preference ( $M = 49.2$ ,

$SD=7.11$ ) and a neutral score (48) was non-significant,  $t(19) = .75, p = .459$ .

The correlation between preference for TBL or lecture and the students' learning style was also examined. Results indicate a significant (negative) correlation between reflective observation and preference,  $r(18) = -.58, p = .008$ . Thus as reflective observation increases, preference for TBL decreases. The other three learning stages were not significantly correlated with preference (figure 9, all measures  $p > .05$ ).

**Figure 9.** Scatterplot of reflective observation and preference ( $r = -.58$ )



### Student satisfaction

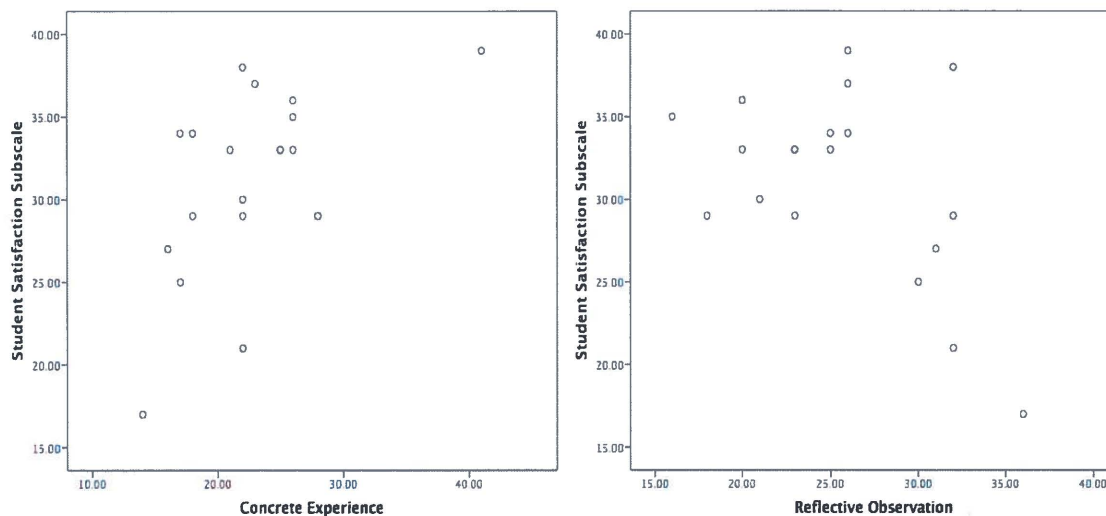
The degree to which students were satisfied with the TBL method was also measured. On the student satisfaction subscale, possible scores ranged from 9 to 45, with a higher score indicating a higher level of satisfaction with TBL. Scores in the subset ranged from 17 to 39, with a mean of 31.16, ( $SD=5.7$ ). Considering that a score of 27 is considered neutral, these results showed that participants were satisfied with TBL when compared to lecture. For the



satisfaction subscale, the difference between average satisfaction ( $M = 31.16$ ) and a neutral score (27) was significant,  $t(18) = 3.18$ ,  $p = .005$ .

There was a significant positive correlation between concrete experience and student satisfaction,  $r(17) = .56$ ,  $p = .012$ . This indicates that as concrete experience increases, student satisfaction increases. Also, there was a significant (negative) correlation between reflective observation and student satisfaction,  $r(17) = -.51$ ,  $p = .026$ , indicating that as reflective observation increases, student satisfaction decreases (figure 10).

**Figure 10. Scatterplots of Student Satisfaction with Concrete Experience ( $r = .56$ ) and Reflective Observation ( $r = -.51$ )**

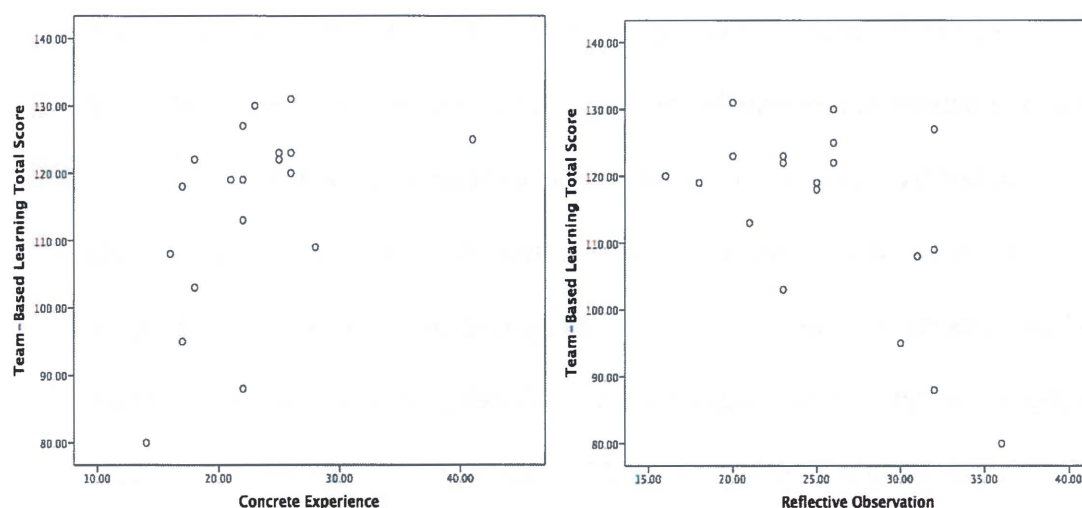


### Overall Experience with TBL

A total instrument score was calculated to measure the overall impression of TBL. Possible scores range from 34 to 170, with 99 being a neutral score. The difference between the average team-based learning total score ( $M = 114.47$ ) and a neutral score (99) was significant,  $t(18) = 4.77$ ,  $p < .001$ . Scores ranged from 80 to 131 with a mean of 114.47 ( $SD=14.14$ ),

indicating participants had a generally favorable experience with TBL. A correlation was done between the TBL total score and the Kolb learning stages. Concrete experience was positively correlated with total scores,  $r(17) = .50$ ,  $p = .029$ , and reflective observation was negatively correlated with total scores,  $r(18) = -.60$ ,  $p = .007$  (figure 11).

**Figure 11. Scatterplots of Team-Based Learning Total Score with Reflective Observation ( $r = -.60$ ) and Concrete Experience ( $r = .50$ )**



## DISCUSSION

Sixty percent of nurse anesthesia students had a positive experience with team-based learning when used in a foundational nurse anesthesia class. There were significant differences between participant scores and neutral scores in regard to accountability, satisfaction and overall experience, indicating that the experience with TBL was generally well received by the students.

It was of interest to correlate Kolb learning style types with the subscales of the Team-Based Learning Student Assessment (accountability, preference for TBL or lecture, and satisfaction with TBL), but given the limited sample size, this was not possible. Correlations

could be completed comparing the subscales of the TBLSA and each of the learning stages as defined by Kolb's experiential learning theory (concrete experience, abstract conceptualization, reflective observation and active experimentation). As individuals placed a stronger emphasis on reflective observation, they were less likely to enjoy team-based learning or prefer to use TBL in future classes. However, those individuals that preferred using concrete experience to grasp information demonstrated higher satisfaction and overall experience scores.

Kolb's experiential theory defines knowledge as the grasping and transforming of experiences.<sup>68</sup> Concrete experience is a method by which an individual grasps experience by emerging in actual situations before transforming it by reflecting and observing. Individuals with a preference for concrete experience choose action and practical applications to learn something new, while those with a preference for reflective observation would select thinking and understanding.<sup>6</sup> Laschinger<sup>74</sup> discovered that nursing students with concrete learning styles were found to prefer concrete learning methods, such as small groups and 'hands on' practical applications. This is consistent with the results in this study; concrete experience positively correlated with student satisfaction and the overall team based learning score. It may be speculated that the application exercises appealed to those with a preference for concrete experience because participants were able to actively apply them to clinical situations instead of just reading and listening to a lecture.

### **Accountability**

The accountability subscales measured the students' preparation before attending class and/or the students' contribution to the team. Based on a neutral score of 24, students in this study demonstrated a high level of accountability (mean=33.35). Studies among BSN students,<sup>45</sup> nurse practitioner students,<sup>44</sup> and physical therapy students<sup>75</sup> found similar results. The readiness



assurance process is often credited for the increased accountability experienced by students.<sup>25,70</sup>

In this study, 100% of the students either agreed or strongly agreed to the statement “I spend time studying before class in order to be more prepared,” thus reinforcing the findings from the above studies. Student-to-student mentoring may also be an explanation for the increased sense of accountability. Ninety-five percent of students in this study felt that they made an important contribution to their teammate’s education, but only 60% agreed with the statement that they were accountable for the team’s learning.

### **Satisfaction**

Students in this study were generally satisfied and had a positive overall experience with team-based learning. This finding is consistent with many studies in the TBL literature.<sup>34,47,55-58,76</sup>

Students who prefer to learn by applying concepts in a concrete application predictably experienced greater satisfaction. The application exercises use the concept of applying knowledge to practical situations almost exclusively, which is very appealing to those that prefer to learn by concrete experimentation. Student satisfaction with educational experiences has been shown to increase student retention in programs<sup>77</sup> and to result in higher learning, increased productivity and lower stress.<sup>86</sup>

What is it about TBL that makes satisfied students? It is well accepted that there is a direct relationship between student engagement, positive learning outcomes and satisfaction.<sup>77</sup> Student engagement is inherent in the concept of TBL. Studies in the TBL literature have attributed the use of TBL to aiding in comprehension of difficult concepts,<sup>32</sup> while other studies credit TBL for changing how students learn.<sup>19</sup> Students reported higher satisfaction because the use of TBL allowed for a large amount of content to be covered in a short period of time.<sup>49</sup> There were, however, a few student comments to the contrary. An anecdotal student comment noted

the inability to “cover as much material with TBL compared with traditional lecture in the same time parameters.” Another student noted TBL to be “a nice change of pace” when compared to lectures, but stated retention of materials was not improved with TBL.

There is abundant research regarding the effect of generational differences on learning preferences. The percentage of millennial students (those born between the 1980 and 2000) in nurse anesthesia programs grows each year. Studies have shown that millennials prefer collaborative, learner-centered experiences with real-life applications.<sup>78</sup> Creating a learning environment that appeals to the current generation can lead to increased satisfaction. Students from the millennial generation are very comfortable with technology and expect learning to be fun and interactive. Team-based learning offers collaborative work regarding clinically applicable problems with enough rigor and content coverage to satisfy both the students and the faculty.

Students are not the only ones who are more satisfied; when educators begin to use TBL, they often feel reinvigorated about teaching.<sup>11</sup> Some educators believe that the interaction that occurs between a professor and the students during a TBL session feels more “natural” than traditional lectures.<sup>22</sup> Team-based learning undoubtedly involves an increased workload for seasoned lecturers. PowerPoint presentations must be narrated or eliminated altogether, and readiness assurance tests must be developed. The application exercises were found to be the most time-consuming, challenging part of this study for the author. However, studies have shown despite the extra workload, most faculty reported an increased satisfaction with TBL, less student apathy, higher attendance, and the development of personally rewarding relationships that come from the changing role of teacher to educational partner.<sup>13</sup>

**Preference for TBL**

Participants in this study showed a very slight preference for TBL versus lectures. This finding is consistent with many other studies.<sup>36,44,45,75,79</sup> A typical graduate student will have very little exposure to active learning strategies during their education. Medical education, in particular, has emphasized the value and legitimacy of traditional lectures.<sup>79</sup> While some professors have developed the skill to give finely honed lectures, many use the PowerPoints as a crutch rather than a tool. In a study done in Great Britain, 59% of students reported that lectures were boring, and PowerPoint was reported to be the dulllest presentation method.<sup>80</sup> The least boring teaching methods were group discussions, seminars and practical applications. However, this and other studies,<sup>50,51</sup> have found students to be the biggest opponents of the transition to active learning.

Why are students resistant to the change to active learning? Team-based learning, as well as any other flipped classroom approach, forces the student to be committed to studying. There is a shift in the responsibility of learning from the teacher to the student, which may cause students to venture out of their comfort zone.<sup>12</sup> While some students may appreciate the deadline pressure to assist their commitment to study, others resent it because they thrive on last minute studying.

Some think that millennials are a natural fit for TBL, while others believe this generation will require much support when introducing TBL or any active learning strategy into the curriculum. In general, millennials want to know exactly what to do in order to get good grades and may have a difficult time adjusting to the ambiguous nature of the application exercises.<sup>41</sup> They may be uncomfortable with application exercises that have multiple correct answers. Unlike previous generations, this generation needs to have the purpose and meaning of activities

explained to them, and will not follow directions without asking for a rationale.<sup>90</sup> Educators understanding these differences can use this opportunity to inform students on learning theory, and gain support their support.

### CONCLUSION

The findings in this study were very similar to the studies in the literature that also used the Team-Based Learning Student Assessment instrument. Students were more accountable for their education and felt satisfied with team-based learning, but were neutral on their preference for TBL over lecture. The author and TBL instructor of this study found the new teaching style to be comfortable as it was similar to the type of teaching used in the clinical area. However, as with any new technique, not everything was smooth and some lessons were learned that would be applied in future classes.

Although an introduction was given to the students before the TBL sessions began, the students still did not have an understanding of the necessity of studying before the TBL session in order to be prepared for the readiness assurance tests. In the future, a sample TBL session will be used to acclimate students to the process. Additionally, the students will be provided with specific objectives for the readiness assurance tests to allow more success. Technologic glitches also played a part. Some students had difficulty viewing the narrated PowerPoint lectures which affected their grades. A reliable method of viewing narrated PowerPoint lectures will be implemented for future TBL sessions. Some authors<sup>35</sup> recommend a difficulty level of 30-70% for the RATs, however it was this author's experience that quizzes that were too difficult led to dissatisfaction and apathy during the application exercises. Although the majority of the principles of TBL were followed in this study, application exercises were not graded. Unfortunately, this led to unrelated conversations during the application exercises. Future

classes will incorporate the suggestions to assign a grade to the application exercise in order to increase accountability and decrease extraneous conversations.

Some studies note that a mindset change that must occur in faculty when implementing TBL or any type of flipped classroom. Lubeck<sup>55</sup> notes “instructors had to let go of the perception that if it was not discussed in class, it was not covered.” In this study, a TBL session was scheduled for two hours, with 30 minutes being devoted to the readiness assurance process and clarifying lecture. Although application exercises comprehensively covered a portion of the content, it was not possible to cover all the required content despite best efforts. Students had to be accountable for learning material not covered in the application exercises. Future TBL session will have two sets of objectives and readings: one pre-session set and a more inclusive post-session set. It is reassuring to note the studies in which satisfaction scores increased the second time TBL was implemented. This has been attributed to faculty comfort with the technique.<sup>36,63</sup>

Limitations of this study include the small sample size at one nurse anesthesia program. This limits generalizability and the ability to make a correlation between learning style and each subset of the TBLSA. The author of this study observed the use of TBL in a medical school to learn how to facilitate the use of TBL in this study. Although helpful in familiarizing the author with the general format and the general content of application exercises, this style of teaching was new to the author. Experience with developing iRATs, tRATS and application exercises could lead to higher satisfaction in future endeavors as has been demonstrated in other studies.<sup>36,81</sup>

This study contributes to the body of research regarding the use of TBL in the field of nursing and suggests that those with a preference for learning by concrete observation may better

accept TBL than those with a preference for learning with reflective observation. With faculty commitment to fine-tuning the use of TBL, this teaching method may be used to answer the call for radical transformation in the nursing field by integrating clinical application into the classroom and developing life-long learners.

**Appendix A: NRS 607 Introduction to Nurse Anesthesia Practice Content**

- Unit 1: Preoperative Preparation
  - Preoperative Assessment and Medications
  - Basic Monitoring
  - Aseptic Technique
  - Environmental Hazards in the Operative Room
- Unit 2: Intraoperative Management
  - General Anesthesia
  - Airway Assessment and Management
  - Oxygen Therapy and Ventilation Strategies
  - Fluid Therapy and Management
  - Thermoregulation in the Operating Room
  - Intraoperative Positioning
  - Monitored Anesthesia Care
  - Regional Anesthesia
- Unit 3: Anesthesia Equipment & Technology
  - The Anesthesia Gas Machine
  - Compressed Gases and Vaporizers
  - Capnography
  - Electrical safety
- Unit 4: Postoperative Care and Anesthetic Complications
  - Postoperative Care and Complications
  - The Allergic Response and Anaphylaxis
  - Hemorrhage and Transfusion Therapy
  - Awareness Under Anesthesia
  - Malignant Hyperthermia
- Unit 5: Anesthesia for Specific Populations and Procedures
  - Anesthesia for the Obese Population and Bariatric Surgery
  - **Anesthesia for the Elderly Population**
  - Anesthesia for Orthopedic Surgeries
  - Anesthesia for Electroconvulsive Therapy
  - **Anesthesia for Ophthalmological Surgeries**
  - **Anesthesia for Gastrointestinal Surgeries**
  - Anesthesia for Genitourinary Surgeries
  - **Anesthesia for Gynecological Surgeries**
  - Non-operating Room Anesthesia

Legend: **Bolded topics** are those covered in TBL format

**Appendix B: Team-Based Student Learning Assessment Instrument**

**Team-Based Learning Student Assessment Instrument (TBL-SAI)  
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This instrument asks you about your experience with team-based learning. There are no right or wrong answers. Please be honest and report your true reaction to each question by circling the number for the response that best describes your answer.



**Accountability Subscale**

This subscale assesses student preparation for class and contribution to the team.

The scale for the items is as follows:

- 1= Strongly Disagree
- 2= Disagree
- 3= Neither Disagree or Agree (Neutral)
- 4= Agree
- 5= Strongly Agree

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 1. I spend time studying before class in order to be more prepared. | 1 | 2 | 3 | 4 | 5 |
| 2. I feel I have to prepare for this class in order to do well.     | 1 | 2 | 3 | 4 | 5 |
| 3. I contribute to my team members' learning.                       | 1 | 2 | 3 | 4 | 5 |
| 4. My contribution to the team is not important.                    | 1 | 2 | 3 | 4 | 5 |
| 5. My team members expect me to assist them in their learning.      | 1 | 2 | 3 | 4 | 5 |
| 6. I am accountable for my team's learning.                         | 1 | 2 | 3 | 4 | 5 |
| 7. I am proud of my ability to assist my team in their learning.    | 1 | 2 | 3 | 4 | 5 |
| 8. I need to contribute to the team's learning.                     | 1 | 2 | 3 | 4 | 5 |

**PLEASE GO TO NEXT PAGE**

**Preference for Lecture or Team-Based Learning Subscale**

This subscale assesses student ability to recall material and student attention level in lecture and team-based learning.

The scale for the items is as follows:

- 1= Strongly Disagree
- 2= Disagree
- 3= Neither Disagree or Agree (Neutral)
- 4= Agree
- 5= Strongly Agree

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 9. During traditional lecture, I often find myself thinking of non-related things.                                  | 1 | 2 | 3 | 4 | 5 |
| 10. I am easily distracted during traditional lecture.  | 1 | 2 | 3 | 4 | 5 |
| 11. I am easily distracted during team-based learning activities.   | 1 | 2 | 3 | 4 | 5 |
| 12. I am more likely to fall asleep during lecture than during classes that use team-based learning activities.     | 1 | 2 | 3 | 4 | 5 |
| 13. I get bored during team-based learning activities.  | 1 | 2 | 3 | 4 | 5 |
| 14. I talk about non-related things during team-based learning activities.  | 1 | 2 | 3 | 4 | 5 |
| 15. I easily remember what I learn when working in a team.  | 1 | 2 | 3 | 4 | 5 |
| 16. I remember material better when the instructor lectures about it.   | 1 | 2 | 3 | 4 | 5 |
| 17. Team-based learning activities help me recall past information.   | 1 | 2 | 3 | 4 | 5 |
| 18. It is easier to study for tests when the instructor has lectured over the material.                             | 1 | 2 | 3 | 4 | 5 |
| 19. I remember information longer when I go over it with team members during the GRATS used in team-based learning. | 1 | 2 | 3 | 4 | 5 |

**PLEASE GO TO NEXT PAGE**

|  |   |   |   |   |   |
|--|---|---|---|---|---|
| 20. I remember material better after the application exercises used in team-based learning.                    | 1 | 2 | 3 | 4 | 5 |
| 21. I can easily remember material from lecture.   | 1 | 2 | 3 | 4 | 5 |
| 22. After working with my team members, I find it difficult to remember what we talked about during class.     | 1 | 2 | 3 | 4 | 5 |
| 23. I do better on exams when we used team-based learning to cover the material.                               | 1 | 2 | 3 | 4 | 5 |
| 24. After listening to lecture, I find it difficult to remember what the instructor talked about during class. | 1 | 2 | 3 | 4 | 5 |

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**Student Satisfaction Subscale**

This subscale assesses student satisfaction with team-based learning.

The scale for the items is as follows:

- 1= Strongly Disagree
- 2= Disagree
- 3= Neither Disagree or Agree (Neutral)
- 4= Agree
- 5= Strongly Agree

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 25. I enjoy team-based learning activities.                                       | 1 | 2 | 3 | 4 | 5 |
| 26. I learn better in a team setting.   | 1 | 2 | 3 | 4 | 5 |
| 27. I think team-based learning activities are an effective approach to learning. | 1 | 2 | 3 | 4 | 5 |
| 28. I do not like to work in teams.   | 1 | 2 | 3 | 4 | 5 |
| 29. Team-based learning activities are fun.                                       | 1 | 2 | 3 | 4 | 5 |
| 30. Team-based learning activities are a waste of time.                           | 1 | 2 | 3 | 4 | 5 |
| 31. I think team-based learning helped me improve my grade.                       | 1 | 2 | 3 | 4 | 5 |
| 32. I have a positive attitude towards team-based learning activities.            | 1 | 2 | 3 | 4 | 5 |
| 33. I have had a good experience with team-based learning.                        | 1 | 2 | 3 | 4 | 5 |

**Please add any comments you may have about your experience with team-based learning.**

**Appendix C: Permission to use Team-Based Learning Student Assessment Instrument**

Hi Linda,

I am happy to provide you permission to use the instrument and have attached it for you. Please credit the instrument and myself in any resulting publication/presentation. Please let me know if you have any questions or if I can be of any further assistance. Best of luck with your study and your degree!

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**Appendix D: Raw Data for TBLSA****Student Responses to Team-Based Learning Questions Regarding Accountability  
(frequencies/percentages) (n=20)**

| <b>QUESTION</b>   | <b>Strongly<br/>Disagree</b> | <b>Disagree</b> | <b>Neutral</b> | <b>Agree</b> | <b>Strongly<br/>Agree</b> |
|---|------------------------------|-----------------|----------------|--------------|---------------------------|
| I spend time studying before class in order to be more prepared | 0                            | 0               | 0              | 9(45)        | 11(55)                    |
| I feel I have to prepare for this class in order to do well     | 0                            | 0               | 1(5)           | 5(25)        | 14(70)                    |
| I contribute to my team members' learning                       | 0                            | 0               | 1(5)           | 14(70)       | 5(25)                     |
| My contribution to the team is not important                    | 7(35)                        | 9(45)           | 2(10)          | 1(5)         | 1(5)                      |
| My team members expect me to assist them in their learning      | 0                            | 2(10)           | 5(25)          | 7(35)        | 6(30)                     |
| I am accountable for my team's learning                         | 0                            | 1(5)            | 7(35)          | 5(25)        | 7(35)                     |
| I am proud of my ability to assist my team in their learning    | 0                            | 0               | 2(10)          | 11(55)       | 7(35)                     |
| I need to contribute to the team's learning                     | 0                            | 1(5)            | 4(20)          | 10(50)       | 5(25)                     |



**Student Responses to Team-Based Learning Questions Regarding Preference for TBL (frequencies/percentages) (n=20)**

| QUESTION   | Strongly Disagree | Disagree | Neutral | Agree  | Strongly Agree |
|--|-------------------|----------|---------|--------|----------------|
| During traditional lecture, I often find myself thinking of non-related things                                 | 2(10)             | 3(15)    | 7(35)   | 6(30)  | 2(10)          |
| I am easily distracted during traditional lecture  | 1(5)              | 6(30)    | 6(30)   | 5(25)  | 2(10)          |
| I am easily distracted during team-based learning activities   | 2(10)             | 7(35)    | 4(20)   | 6(30)  | 1(5)           |
| I am more likely to fall asleep during lecture than during classes that use team-based learning activities     | 1(5)              | 3(15)    | 6(30)   | 8(40)  | 2(10)          |
| I get bored during team-based learning activities  | 2(10)             | 8(40)    | 4(20)   | 6(30)  | 0              |
| I talk about non-related things during team-based learning activities  | 0                 | 9(45)    | 7(35)   | 4(20)  | 0              |
| I easily remember what I learn when working in a team  | 1(5)              | 3(15)    | 7(35)   | 9(45)  | 0              |
| I remember material better when the instructor lectures about it   | 1(5)              | 2(10)    | 8(40)   | 8(40)  | 1(5)           |
| Team-based learning activities help me recall past information   | 1(5)              | 1(5)     | 10(50)  | 8(40)  | 0              |
| It is easier to study for tests when the instructor has lectured over the material                             | 0                 | 1(5)     | 4(20)   | 10(50) | 5(25)          |
| I remember information longer when I go over it with team members during the GRATS used in team-based learning | 0                 | 2(10)    | 8(40)   | 9(45)  | 1(5)           |
| I remember material better after the application exercises used in team-based learning                         | 0                 | 3(15)    | 4(20)   | 10(50) | 3(15)          |
| I can easily remember material from lecture  | 0                 | 4(20)    | 8(40)   | 7(35)  | 1(5)           |
| After working with my team members, I find it difficult to remember what we talked about during class          | 0                 | 10(50)   | 7(35)   | 2(10)  | 1(5)           |
| I do better on exams when we used team-based learning to cover the material                                    | 2(10)             | 3(15)    | 12(60)  | 2(10)  | 1(5)           |
| After listening to lecture, I find it difficult to remember what the instructor talked about during class      | 1(5)              | 8(40)    | 6(30)   | 5(25)  | 0              |

**Student Responses to Team-Based Learning Questions Regarding Satisfaction with TBL (frequencies/percentages) (n=20)**

| <b>QUESTION</b>  | <b>Strongly Disagree</b> | <b>Disagree</b> | <b>Neutral</b> | <b>Agree</b> | <b>Strongly Agree</b> |
|--|--------------------------|-----------------|----------------|--------------|-----------------------|
| I enjoy team-based learning activities                                       | 0                        | 2(10)           | 5(25)          | 11(55)       | 2(10)                 |
| I learn better in a team setting   | 0                        | 4(20)           | 8(40)          | 7(35)        | 1(5)                  |
| I think team-based learning activities are an effective approach to learning | 0                        | 2(10)           | 5(25)          | 13(65)       | 0                     |
| I do not like to work in teams   | 0                        | 12(60)          | 6(30)          | 2(10)        | 0                     |
| Team-based learning activities are fun                                       | 0                        | 2(10)           | 8(40)          | 9(45)        | 0                     |
| Team-based learning activities are a waste of time                           | 4(20)                    | 8(40)           | 6(30)          | 1(5)         | 1(5)                  |
| I think team-based learning helped me improve my grade                       | 2(10)                    | 7(35)           | 7(35)          | 4(20)        | 0                     |
| I have a positive attitude towards team-based learning activities            | 0                        | 2(10)           | 6(30)          | 9(45)        | 3(15)                 |
| I have had a good experience with team-based learning                        | 0                        | 1(5)            | 7(35)          | 9(45)        | 3(15)                 |

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