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Retention across pedagogies

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Retention across Pedagogies

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Abstract

When teaching, many professors try to increase their students' retention of the information that is taught. Instructors can incorporate active learning, repeated testing, collaborative testing, and/or corrective feedback into traditional forms of teaching (e.g., lecture), or they can combine all of these components and transform their entire course, such as with Team-Based Learning (TBL). The current study compares retention of course material in TBL, lecture, reading, and control conditions in a lab setting. In the first session, students received one teaching method and learned about an article on whether having pets led to lowered blood pressure. During the second session, students came back to the lab to take a test on what had been taught a week before. The results indicated no difference in test scores between TBL and lecture conditions, but TBL led to higher retention of material than reading and control conditions. Lack of difference between TBL and lecture conditions may have been due to the information being conveyed in multiple forms (e.g., audio, visual). The limited amount of time spent in the lab also may have impacted the effectiveness of TBL because it takes multiple meetings to form a team. Further research may add supplementary learning sessions within a lab setting or compare lecture and TBL within a classroom setting where students are exposed to four components that may increase retention during every class meeting.

Introduction

When studying how students learn, many instructors and researchers ask themselves whether students retain the material. Researchers have defined retention as acquiring knowledge in order to use it in a future setting (e.g., Larson, Butler, & Roediger, 2013), meaning previously learned information can be applied at a later date. When studying retention, most researchers measure it through the use of exam scores (e.g., Larson et al., 2013; McInerney & Fink, 2003; Saville, Zinn, & Elliot, 2005; Woody, Woody, & Bromley, 2008) and interpret high exam scores as indicating higher retention of material. One of the main concerns many instructors have when it comes to students' retention of class material is how to improve it. A variety of teaching techniques have been used to study retention in a college setting, including active learning, repeated testing, collaborative testing, and corrective feedback. Team-based learning, a teaching method that restructures how a course is traditionally taught (e.g., lecture, reading), incorporates all four of these teaching techniques, each of which has been shown to improve retention.

Team-Based Learning

Team-based learning (TBL) is a form of active learning that involves working in a team, peer teaching, problem solving, and receiving regular feedback during each class period (Michaelsen, Knight, & Fink, 2004; Thomas, 2009). Students learn the primary course content individually outside of the classroom and receive feedback throughout the learning process so that they are prepared to discuss the content with their team in the classroom.

During the first class period of each chapter or unit, students go through the Readiness Assurance Process (RAP). First, students individually study the assigned materials (e.g., readings, videos, recorded lectures, etc.) outside of the classroom. Then, before being exposed to

the material in the classroom, students take a Readiness Assurance Tests (RAT), which is a short multiple-choice test that covers the content of the assigned materials. Students first take this test individually (iRAT) and then take the same test again shortly afterwards with their assigned teams (tRAT). The questions on the RATs directly relate to the learning objectives of the chapter being covered (i.e., all questions should be mapped to learning objectives). If any team believes that a question on the RAT is unfair or poorly worded, or the content from the assigned materials was unclear, the team members are allowed to submit a written appeal to the instructor (Michaelsen et al., 2004). These appeals must be completed as a team and require the team to provide evidence from the assigned reading for why they believe the question is unfair. After appeals, the instructors will then give a "muddiest points" lecture clarifying any concepts that the students struggled to understand. During the RAP, students receive feedback from their teammates, from the immediate feedback on the tRAT (e.g., immediate feedback assessment technique [IF-AT] forms), and from the lecture provided by the instructor.

Following the RAP, teams complete application activities, which are designed to increase higher-level learning and are based on the learning objectives of the material being covered. The key features of the application activity involve having all teams working on the same problem, making a simple decision (i.e., teams are presented with a limited number of answer choices for the problem, all of which are correct), and presenting their chosen answer at the same time. Each team initially completes the application activity individually, providing reasoning for why they chose each answer. Once each team has completed the activity, they simultaneously share their answers. Because each team works on the same problem and must decide on a simple choice, not every team may pick the same answer. When each team reveals their answer simultaneously, they defend why they chose the answer they did (Michaelsen et al., 2004). When this occurs, it

allows each team to see the other teams' perspectives on the question and teaches the students other ways to approach the problem.

Through the RAP and the application activity, TBL restructures nearly every aspect of a traditionally taught course. Restructuring incorporates four methods of teaching that have been shown to increase retention: active learning, repeated testing, collaborative testing, and corrective feedback. These four techniques can be used in any combination throughout a traditionally taught course (e.g., lecture). What sets TBL apart from traditionally taught courses that may only use one or two techniques is that a TBL course seamlessly integrates all four techniques in nearly every class meeting throughout the entirety of the course.

Active Learning

The first way that a TBL course may increase retention is through the use of active learning. Active learning has been an interest for many instructors as it has been thought to improve student learning and involvement in the classroom (e.g., Chickering & Gamson, 1987; Prince 2004). For the purpose of my paper, I will use Thomas' (2009) definition of active learning, which is "an educational approach in which teachers ask students to apply classroom content during instructional activities and to reflect on the actions they have taken" (p. 13). Using any form of active learning often includes four components: problem solving, working in a team, providing feedback, or peer-teaching in order to utilize new content (Thomas, 2009).

There are numerous forms of active learning that instructors can implement in their classrooms, from short activities, such as clicker questions (Lantz & Stawiski, 2014), to restructuring the course, such as interteaching (Boyce & Hineline, 2002), problem-based learning (Barrows, 1996), and team-based learning (Michaelsen, Knight, & Fink, 2004). Throughout a

TBL course, each component of active learning is incorporated into every class meeting. The first component, problem solving, is integrated when students work on the application activity, during which students must use evidence to back up the answer they selected. The second component, working in a team, is carried out throughout the entire TBL course. The students complete every RAP (with the exception of the iRAT) and application activity with the help of their team. Providing feedback, the third component of active learning, is also assimilated into a TBL course when students complete the tRAT and application activity. In order to successfully complete the tRAT and application activity, the students have to give their opinions and back those opinions up with facts from the class materials. The final component of active learning, peer-teaching in order to utilize new content, goes hand-in-hand with providing feedback. Students who comprehensively understand the information taught will have the opportunity to teach those in their team who are struggling with the information. The four components of active learning can be integrated into any type of classroom. Within a lecture, any combination of problem solving, working in a team, providing feedback, and peer-teaching can be successfully used throughout the course. The presence of any components of active learning while teaching may increase retention, but what sets TBL courses apart is that it incorporates all four components on a daily basis.

The effectiveness of active learning has been tested in classroom settings (e.g., McInery & Fink, 2003; Nicoll-Senft, 2009; Persky & Pollack, 2011) and laboratory settings (e.g., Butler & Roediger, 2007; Kang, McDermott, & Roediger, 2007; Lantz & Stawiski, 2014; Saville et al., 2005). Researchers typically compare active learning to traditional lecture and other pedagogies in order to measure retention changes (e.g., Saville et al., 2005; Persky & Pollack, 2011; McInery & Fink, 2004; Lucas et. al., 2013; Kelly et. al., 2005). When comparing the different

methods of teaching, researchers have found that active learning produces higher retention than traditional courses that do not include active learning (e.g., Kelly et al., 2005; Lucas, et al., 2013; McInery & Fink, 2003; Moye, Metzger, & Matesic, 2012; Persky & Pollack, 2011; Saville et al., 2005;). Active learning has been used both on its own and in combination with the other three teaching methods (e.g., repeated testing, collaborative testing, and corrective feedback) to increase retention within a course (e.g., Larson, et al., 2013; Moye, et al., 2012).

Repeated Testing

The second way that a TBL course may increase retention is through repeated testing, which is an important topic in the world of teaching. Through repeated testing, an instructor can assess students' knowledge of material throughout the entirety of a course rather than through one comprehensive final at the end of the course. Researchers have found that repeated testing either immediately after an initial test (Wiklund-Hornqvist, Jonnson, & Nyberg, 2014), like how it is during the RAP, a month after an initial test (e.g., Butler & Roediger, 2007; McDaniel, Roediger & McDermott, 2007), or six months after an initial test (Larsen, Butler, & Roediger, 2013) improves retention of information for later tests. Repeated testing not only exposes students to the same questions about class material more frequently, but it also allows students to receive feedback on which concepts they understand and which they do not.

Repeated testing occurs throughout the entirety of both TBL and lecture courses. Students are exposed to material multiple times within each RAP through the iRAT and tRAT. During this time, they are exposed to the same material twice within one class period. In each unit of the course, the students will complete the RAP. Throughout the course, students also take exams that cover multiple units. Lectures can use repeated testing to assess retention throughout

a course (Wilkund-hornqvist et al., 2014). Students in a lecture may not take the same test repeatedly, but they will still be exposed to multiple tests where they can receive feedback. The number of tests may vary depending on the course, but students are frequently exposed to tests. Repeated testing throughout TBL and lecture courses allow for students to increase their retention of materials taught.

Collaborative Testing

The third way that a TBL course may increase retention is through collaborative testing, or team testing, which has also started to appear within classrooms as a component of active learning. Studies have shown that collaborative tests yield higher scores compared to individual test scores (e.g., Cortright et al., 2003; Moye et al., 2012; Nicoll-Senft, 2009; Shellenberger, Seale, Harris, Johnson, Dodrill, & Velaquez, 2009). Within a TBL course, where collaborative testing is used during every RAP, students consistently score higher on the tRAT compared to the iRAT (e.g., Moye et al., 2012; Nicoll-Senft, 2009; Shellenberger et al., 2009). When multiple students take a test together, it makes sense that test scores would increase because they can pool their knowledge. At the start of a TBL course, teams are structured so that they are heterogeneous, based on factors that may be critical for a particular course (e.g., major, previous experience with course content, grades in previous classes, anxiety about course content; Michaelson, et al., 2004). The assignment of teams allows each team to be equal and should allow for each team member to contribute to the RAP.

In a study by Moye et al. (2012), researchers specifically looked at retention within a course that had traditional lecture modules and a modified TBL module (i.e., the application activities did not meet the standard TBL structure). During the TBL module, the researchers found that

students' tRAT scores were significantly higher when compared to iRAT scores; this is consistent with previous findings (e.g., Chung, Rhee, Baik, & A, 2009; Neider et.al., 2005; Nicoll-Senft, 2009; Persky & Pollack, 2011; Shellenburger et.al., 2009). In addition, retention of materials on individual exams was higher for the TBL module compared to the lecture modules (Moye et al., 2012). Because TBL incorporates collaborative testing in the RAP, it should result in increased retention of the material.

Corrective Feedback

The final way that TBL may increase retention is through its use of corrective feedback. In TBL, feedback is given immediately during the RAP as well as after individual exams taken later during the course (Michaelsen et al., 2004). Feedback is also given throughout the course by both instructors and students (Michaelsen et al., 2004). Researchers have shown that feedback after a test, both immediate and delayed, is beneficial when it comes to retaining information when compared to receiving no feedback at all (e.g., Butler & Roediger, 2008; Butler, Karpicke, & Roediger, 2007; Kang et al., 2007; Wojcikowski & Kirk, 2013). Many courses use corrective feedback to help students better understand the information, but because repeated testing and feedback are such important components of TBL, the amount of testing and feedback that takes place during a TBL course should improve retention when tested later on materials later on. Studies have found that students have higher academic performance in TBL classrooms compared to traditionally taught classes (e.g., Carmichael, 2009; Koles, Stofli, Borges, Nelson, & Parmalee, 2010; Levine et. al, 2004; Neider et. al. 2005).

Purpose and Hypotheses

Researchers have studied retention of information both in classroom and laboratory settings. They have found that active learning, repeated testing, collaborative testing, and corrective feedback all improved retention when participants were tested on material on a later date. This study was a lab-based study in which students were assigned to learn the same information in different learning conditions: TBL, traditional lecture, reading only, and control. I predicted that because students in the TBL condition will have participated in active learning, repeated testing, collaborative testing, and corrective feedback, they will demonstrate higher levels of retention compared to participants in the other conditions, who will not be exposed to these elements.

Methods

Participants

Participants were recruited via the Department of Psychology participant pool, which counted as class credit for students enrolled in GPSYC classes. The participants consisted of 107 college students (29 men, 78 women) who were put into four conditions. The average age of the participants was 18.9 years. The 16 Students who indicated that they were familiar with the information presented in the study were excluded from data analysis. The 23 students who did not provide GPA or did allow GPA to be verified were excluded from data analysis. Only the 70 students who provided their GPA and allowed their GPA to be verified were included for analyses.

Materials

Article. Participants in the TBL and reading conditions read an article about the influence of pet ownership on blood pressure (Allen, 2003).

Test materials. Participants in all conditions completed a 10-item multiple-choice test to assess their retention of the material (See Appendix A). Questions were based on the Allen (2003) article.

RAT. Participants in the TBL condition completed a three-item multiple choice test (See Appendix B). The participants first completed this test individually on a scantron and then again immediately afterwards as a team on an IF-AT form.

Application activity. Participants in the TBL condition completed a three-question application activity based on the Allen (2003) article (See Appendix C).

Demographics. Participants in all conditions completed a demographic questionnaire (See Appendix D). Participants answered questions about their academic year, GPA, and familiarity with the material.

Procedure

This study took place in a lab setting in which participants were assigned to one of four conditions: team-based learning, lecture, reading, and control.

Team-based learning. For the team-based learning condition, the students (*n*=19) were randomly put into teams of four to six when they entered the lab. During the first 15 min of the session, students read the article, which was distributed at the beginning of the session; the article was collected after students finished reading. Then the students took a three-question multiple-choice test on a scantron form individually (iRAT), immediately followed by the same test on an IF-AT form as a team (tRAT). The students did not submit any appeals. The instructor lectured on any unclear material. The RAP took about 7 min to complete. The instructor then handed out an application activity to the teams. During the application activity, the teams had to apply the information from the article to answer questions that required critical thinking. After discussing the question on the application activity, the teams had to choose an answer from a set of multiple-choice options. Next, each team presented their answer choice with cards that display the letter that corresponded to their answer choice. The teams then had a chance to debate their answer choices with each other. The application took about 25 min to complete. The TBL session took about 45 min total.

Lecture. In the lecture condition, the participants (*n*=12) came into the lab. Then the instructor lectured for about 40 min using a PowerPoint that summarized the article. The

participants were allowed to take notes during the lecture, but the instructor collected the notes after the lecture was over.

Reading. In the reading condition, the participants (*n*=19) came into the lab, individually read the article and took notes on the article for about 40 min. The instructor collected the notes after the session is over.

Control. The control group participants (*n*=20) came into the lab and completed difficult anagrams for about 40 min.

All participants came back to the lab 1 week after the first session to take a 10-item multiple-choice test in order to test retention of the material and complete the demographics form, which took about 20 min to complete.

Results

The hypothesis of this study stated that students in the TBL condition would demonstrate higher levels of retention compared to participants in the other conditions. Retention was measured with the 10-item multiple-choice test during the second session of the study. A preliminary analysis evaluating the differences between verified GPA (M= 30.952, SD=19.30) and non-verified GPA (M=51.11, SD=17.45) showed significant differences, $t(100)=1.994$, $p=.049$. A preliminary analysis evaluating the difference between participants who were not familiar with the information (M=59, SD=19.32) and those who were familiar (M=64.67, SD=16.42) revealed no significant differences, $t(103)= 1.072$, $p=.286$. Participants who indicated they were familiar with the information were included for further analysis. A one-way ANCOVA was conducted to determine whether teaching condition (TBL, lecture, reading, control) had an impact on retention, while controlling for GPA and semester. A preliminary analysis evaluating the homogeneity-of-regression assumption indicated that the relationship between the covariate GPA and retention did not differ significantly as a function of teaching condition, $F(3,66) = 1.286$, $p=.287$. A preliminary analysis evaluating the homogeneity-of-regression assumption indicated that the relationship between the covariate semester and retention did not differ significantly as a function of teaching condition, $F(3,66) = 0.832$, $p = .364$. The ANCOVA revealed a significant effect of teaching condition on retention after controlling for GPA and semester, $F(3,66) = 30.231$, $p < .001$, $\eta_p^2 = 0.583$. A LSD post hoc analysis revealed that participants in TBL (M = 70.952, SD = 15.13) answered the same percentage of questions correctly as the participants in the lecture (M= 72.50, SD= 11.64), $p=.540$, d= .1146. A LSD post hoc analysis revealed that participants in TBL correctly answered a significantly greater

percentage of questions than participants in the reading group (M = 63.62, SD = 12.12), p=.021, d=0.535 and control group (M = 37.62, SD = 14.80), p< .001, d=2.227.

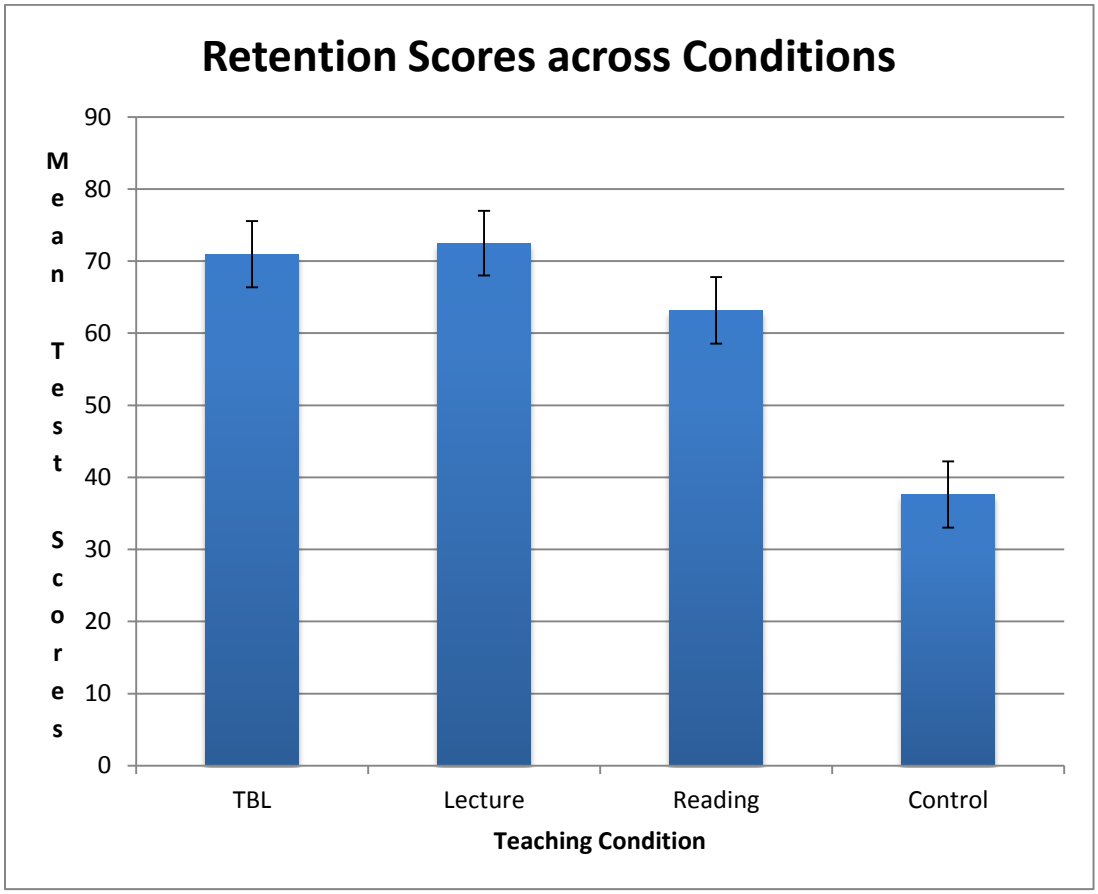

Figure 1. Average test scores of each condition with standard error bars.

Discussion

I predicted that TBL would yield higher retention scores when compared to other groups (i.e., lecture, reading, and control) one week after being exposed to material taught in a lab setting. The results showed that TBL and lecture retention scores did not differ. The straightforward nature of the test questions may have also contributed to the lack of difference in retention scores between TBL and lecture. The answers to the test came directly from the article. The test was also multiple-choice, which allowed for some degree of guessing. The control group performed above chance (25%), which indicates that the questions may have been easy. Research has shown that tests that use short answer or recall style tests improve retention over long periods of time (e.g., 1 month) compared to multiple choice tests (Butler & Roediger, 2007; Kang, McDermott, & Roediger, 2007). Short answer tests allow students to apply the information that they have learned which is what students in the TBL section did during the application activity. The TBL group may have received higher retention scores compared to the lecture group if there were more application based questions on the test.

Another explanation for the lack of difference in retention scores between the TBL and lecture conditions is that the participants in the TBL condition met for 45 min and the lecture condition met for 40. This extra time may have impacted the retention scores of the two groups. Also, previous research shows that students who are familiar with each other tend to perform better in class (Azmitia & Montgomery, 1993; Crawford, Krajcik, & Marx, 1998), and 40 min is not sufficient time to become familiar with an entire team. The effectiveness of TBL is contingent on the use of teams and it takes longer than one class meeting to form a team (Michaelson et al., 2004). When TBL is used in a classroom, the class often meets for three 50

min sessions rather than one 45 min session also. Spreading the components of TBL over the course of a week allows students to spend more time with the material as well.

Just as the 40 min session may not have allowed sufficient time for teams to form, it also may not have allowed the four components that increase retention (e.g., active learning, repeated testing, collaborative testing, and corrective feedback) to be effective. Students in the TBL group were exposed to active learning because they worked in a team, problem solved, provided feedback, and peer taught (Thomas, 2009). The TBL group was also exposed to repeated testing through the RAP, but in a typical TBL course students complete the RAP multiple times along with more comprehensive exams at the end of a unit. Previous research shows that when tests are administered frequently (e.g., every class meeting) students retain more of the material (Leeming, 2002; McDaniel, Anderson, Derbish, & Morrisette, 2007). Collaborative testing has also been shown to increase retention compared to individual testing; however, it may only increase immediate short-term (e.g., with the RAP) retention rather than long-term retention (Woody, Woody, & Bromley, 2008). Finally, students in the TBL group received corrective feedback immediately after completing the RAP. Research indicates that both immediate and delayed feedback may be effective when increasing retention (e.g., Butler & Roediger, 2008). Students in the TBL group only received immediate feedback and may have missed out on some benefits of receiving delayed feedback about their work on the application activity or test in the second session. When TBL students are exposed to the four components during each class period, I expect that they would show increased retention compared to when they are exposed to each component once in a lab setting.

One reason there may not be a difference between TBL and lecture is that students were exposed to the material in multiple formats (e.g., Nugent, 1982; Rivard & Straw, 2000). TBL

students initially read the article and then actively engaged with the content on the RAP and in the application activity, discussing the information throughout the entire session. Lecture students listened to the information from the article and they also saw the main points of the article on a PowerPoint. Both conditions were exposed to both audio and visual methods of teaching, which may allow retention to increase compared to students who are only exposed to the material in one form (i.e., just reading). The results also indicated that students in the TBL group had higher scores than the students in the reading group. The difference between TBL and reading could also be explained by the amount of exposure to the information. TBL was exposed to the material in multiple forms while the reading group was only exposed to the material in written form, which may have impacted how much of the information was retained. Finally, the results showed that students in the TBL group had higher scores than the students in the control group. The control group was not exposed to any of the material that the other groups were exposed to, which may explain why the control group had the lowest retention score.

Implications

There are multiple ways to effectively increase retention while teaching, including active learning, repeated testing, collaborative testing, and corrective feedback (e.g., Butler & Roediger, 2007; Butler, Karpicke, & Roediger, 2007; Cortright et al., 2003; Kelly et al., 2005). In a TBL course, students are exposed to the four components during every class meeting and have an entire semester to reap the benefits of active learning, repeated testing, collaborative testing, and corrective feedback. During each RAP, students are actively learning, repeatedly taking tests, collaboratively testing, and receiving corrective feedback. The application activities also include active learning and corrective feedback. Students in a TBL course experience the four components that may increase retention during each class meeting, which may increase their

chances of retaining the material taught. Within this study, the TBL group received significantly higher retention scores compared to the reading and control groups, which did not have any of the four components that may increase retention. Although the lecture group also did not receive any of the four components, the lack of differences between TBL and lecture retention scores may have been due to the students being exposed to the information in multiple formats (e.g, audio, visual), as previously mentioned. These findings line up with previous research that suggests that the four components may increase retention (Butler, Karpicke, & Roediger, 2007; McDaniel, Roediger & McDermott, 2007; McInery & Fink, 2003; Nicoll-Senft, 2009). The four components used in TBL can also be used in any combination throughout a lecture to increase retention.

Retention is an important issue when it comes to teaching. What the results show is that TBL effectively increases retention compared to only reading and no exposure to class materials. According to the results of my study, multiple teaching methods (i.e., TBL and lecture) can be effective to help students retain information. Additionally, there are many reasons for why an instructor would choose to have a TBL class. Within a TBL course students get to socialize with each other. Instructors and students have also rated TBL being more enjoyable compared to traditionally taught courses (e.g., Clark, Nguyen, Bray, & Levine, 2008; Conway, Johnson, & Ripley, 2010; Reinig, Horowitz & Whittenburg, 2001; Vasan, DeFouw, & Compton, 2009). Both TBL and lecture have their benefits and result in equal rates of retention according to my study. It is up to instructor preferences as to how they want to structure their course.

When studying pedagogy, both lab and classroom settings allow researchers to explore the effectiveness of teaching. Even though both lab and classroom studies offer unique settings for research to take place, they also have their limitations for future applications (Daniel, 2012).

The present study was completed in a lab setting, which allows for control of extraneous variables but also has some limitations compared to classroom-based settings. As mentioned previously, time constraints within a lab also limit the formation of teams and the effectiveness of active learning, repeated testing, collaborative testing, and corrective feedback. Future studies could add additional sessions within the lab setting in order to test if more time spent learning in each condition would increase retention across conditions.

Classroom studies are not without their limitations (e.g., lack of control), but a classroom study may allow for some of the limitations of a lab-based study to be eliminated (Daniel, 2012). Even though a classroom does not offer as much control as a laboratory setting, a classroom study would allow teams to form effectively as well as allow the four components that increase retention to be effective because the four components (i.e., active learning, repeated testing, collaborative testing, corrective feedback) would be present in every class meeting. If a classroom study were completed over the course of a semester, I would expect to see higher retention scores in a TBL course compared to a lecture without the four components that may increase retention. If differences were found between the groups, further research could be done to determine which component of retention impacts retention the most.

Appendix A

Instructions: Please answer the following 10 questions to the best of your ability.

1. What common "fact" seems to be appearing on television shows and even in publicity for nursing homes and hospitals?
   a. Pets improve your memory.
   b. Pets lower your blood pressure.
   c. Pets increase fat loss.
   d. Pets have a positive influence on anxiety.
   e. Pets reduce worry.

2. Today in the United States, there are approximately ____ pet dogs and approximately ____ pet cats.
   a. 68,000; 75,000
   b. 6.8 million; 7.5 million
   c. 680,000; 750,000
   d. 68 million; 75 million
   e. 680 million; 750 million

3. Approximately how much money do Americans spend on their pets each year?
   a. $30 million
   b. $750 million
   c. $1 billion
   d. $10 billion
   e. $30 billion

4. Approximately what percentage of Americans describe their pets as "important family members?"
   a. 25%
   b. 33%
   c. 50%
   d. 75%
   e. 90%

5. Which of the following is NOT true regarding the health benefits of pet ownership?
   a. Pet owners who suffer heart attacks are more likely to live at least 1 year after the heart attack.
   b. Pet owners tend to have fewer stressful events than people who do not own pets.
   c. Elderly people who own pets typically make fewer visits to the doctor.
   d. People with AIDS who own pets suffer less from depression than those who do not own pets.

e. Children who read in the presence of pets have lower blood pressure than children who do not read in the presence of pets.

6. In most studies examining the effects of pets on blood pressure, how are the pets obtained?
   a. They typically belong to the researchers, who purchase them from breeders for the purpose of using them in studies.
   b. They belong to the participants because it is best to study how participants respond to their own pets.
   c. They are adopted by the researchers from humane societies so the pets can be saved and used in psychological research.
   d. They are owned by the universities where the researchers work and can be used by anyone wanting to study pet-human bonding.
   e. They are owned by the researchers, so they can verify how the pets will behave during the studies.

7. In one study, female participants who performed mental arithmetic in the presence of their pets had ____ blood pressure compared to when they completed the same task in the presence of their friends.
   a. lower
   b. higher
   c. the same
   d. all of the above
   e. It depended on the participant.

8. What is one of the problems with previous pet studies that may make it difficult to determine exactly whether pets have positive effects on health?
   a. The people in these studies often didn't have many close friends
   b. The people in these studies typically didn't own pets prior to the study
   c. The people in these studies may have been healthier to begin with.
   d. The people in these studies often didn't like pets.
   e. The people in these studies still experienced high levels of stress but were more likely to report that they felt fine.

9. Which of the following most accurately describes the results of a study in which stockbrokers either (a) took blood pressure medication, or (b) took blood pressure medication and owned a pet, and then experienced a stressful situation?
   a. Stockbrokers who took the medication experienced a greater decrease in blood pressure than stockbrokers who took the medication and owned a pet.
   b. Both stockbrokers who took the medication and stockbrokers who took the medication and owned a pet experienced a significant decrease in blood pressure.
   c. Stockbrokers who took the medication and owned a pet experienced a greater decrease in blood pressure than stockbrokers who only took the medication.

d. Both groups of stockbrokers experienced a significant increase in blood pressure while under stress.
e. Although both groups experienced an increase in blood pressure under stress, stockbrokers who took the medication and owned a pet experienced significantly smaller increases in blood pressure than stockbrokers who simply took the medication.

10. Why did the researchers who studied the stockbrokers (from Question 9) use randomized pet adoption in their study?
    a. So they could be sure that everyone got a good pet.
    b. So they could be sure that the participants were completely healthy before pet adoption.
    c. So they could be sure that the pet owners and non-pet owners were similar before the study started.
    d. So they could be sure that the pets were similar before the study started.
    e. So they could be confident that the researchers were completely unbiased.

Appendix B

Quiz

Instructions: Please answer the following 3 questions to the best of your ability, and mark the correct answers on the scantron (be sure to include your ID number on the scantron).

1. The main purpose of the article was
    a. To describe how pet ownership decreases depression
    b. To explore how social interaction lowers blood pressure and stress responses
    c. To test whether pet ownership increases likelihood of heart disease
    d. To determine whether pet ownership lowers blood pressure and stress responses

2. The majority of participants in the reviewed literature…
    a. Had never owned pets throughout their lives
    b. Were given pets that were adopted from animal shelters by the researchers
    c. Went to public places (e.g., a dog park) where they could easily interact with pets and their owners
    d. Already owned pets when the studies were conducted

3. Which sample of participants was randomly assigned pet ownership?
    a. Stockbrokers
    b. Women
    c. People with AIDS
    d. People who have had heart attacks

Appendix C

Application activity questions

For each question, your team must come to a consensus from the options provided. There are no right or wrong answers, rather, your team will need to provide a rationale for why you made the decision you made.

1. Which of the following facts from the article does your team think the general public would be most shocked by (p. 236)? Provide 2 reasons.
    a. There are more than 68 million pet dogs and at least 75 million pet cats in the U.S.
    b. Americans spend about $30 billion on their pets.
    c. About 90% of pet owners describe their pets as cherished family members.

2. Although the article presents existing research that demonstrates a supportive role for pets, there are several limitations. Of the limitations below, which one is the greatest limitation? Provide 2 reasons.
    a. Although research shows that pets can reduce blood pressure responses among people with normal and high blood pressure, it has not yet been determined if such responses contribute to survival among individuals who have heart attaches, or if they could be factors that help prevent heart attacks (p. 238).
    b. The existing research addresses only positive physiological responses to having a pet, but experiments haven't been designed to examine how the presence of pets may add stress to the lives of some people (p. 238).
    c. Media reports of the ability of pets to lower blood pressure are often inflated and misrepresent research (p, 239).
    d. Previous pet studies have made it difficult to determine whether pets have a positive effect on health because it is possible that people in the studies may have been healthier to begin with (p. 238).

3. The article presents several research findings about the impact of pets on health (p. 236-237). Which finding should be shared with the general public? Provide 2 reasons.
    a. High social support and pet ownership are associated with better survival after hearth attack (Friedmann et al., 1980, 1995).
    b. Elderly people with pets appear to be buffered from the impact of stressful life events and make fewer visits to physicians (Siegel, 1990).
    c. Among people with AIDs, pet owners have a lower incidence of depression that do people without pets (Siegel et al., 1999).
    d. Children who read in the presence of pets have lower blood pressure than children who read in the absence of pets (Friedmann et al., 1983).
    e. When women performed mental arithmetic in the presence of their pets, they had lower blood pressure than when they completed the same task in the presence of their friends (Allen et al., 1991).
    f. Stockbrokers who took medication and owned a pet had smaller increases in blood pressure under stressful situations than stockbrokers who only took medication (Allen et al., 2001).

Appendix D

Demographics

1. Please indicate your gender:

__Male

__Female

__Other

2. Please indicate your major(s): _____

3. Please indicate your minor(s): _____

4. Please indicate your age: _____

5. Please indicate your year at JMU:

__Freshman

__Sophomore

__Junior

__Senior

__ Post-baccalaureate

6. Were you familiar with the information presented in the article?

__Yes

__No

__ Does not apply

7. Please report your cumulative GPA _____

8. Do you give permission for verification of your cumulative GPA?

__Yes

__No

9. Please indicate your student ID number: _____

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