THE EFFECTIVENESS OF USING INTERACTIVES ON STUDENT'S IN A HIGH SCHOOL HUMAN ANATOMY CLASSROOM

by

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ABSTRACT

My students have a difficult time staying attentive for long periods of lecture which leads to declining test scores. This project examines the integration of various interactive and visual activities to a traditional lecture-based high school anatomy class. The effects on short-term comprehension as well as long-term understanding along with student engagement and interest were studied. The effects of instructor comfort were also considered.

This project made additions to the traditional lecture that was already being used in a high school Human Anatomy class in a small rural school in Iowa. The additions included podcasts, multiple pictures, short videos imbedded in the PowerPoint lectures, games used with iTouches, Webquests on the computer, and full length videos.

Data were collected using preunit, postunit, and delayed assessments to determine student long-term and short-term comprehension. Also included were interviews of students and an on-line survey of students. The student interviews and an on-line survey were used along with an on-task checklist was used to gauge student engagement and student interest. In order to address instructor comfort, an instructor journal was used along with an interview and instructor assessment.

The data indicate positive results as to students' short-term understanding and long-term retention of concepts. There was also an increase in student engagement and student understanding during the treatment units. Finally, there was an increase in instructor's comfort level during the treatment units.

INTRODUCTION AND BACKGROUND

Human anatomy is a difficult course for most students. There is a surplus of new terms to learn, new concepts to understand, and new images to master. It is a difficult course and in the best of situations can be daunting. I have noticed as the year progresses my students seem less and less engaged in class. The students still try to pay attention but their enthusiasm for the material and the class starts to wane. I try to use anecdotes and other gimmicks to keep them interested but by the second semester the subject matter becomes less interesting and it becomes more and more difficult to keep their attention.

I noticed the students are slightly less distracted when we are watching a video. I speculated that I could use the students' selective attention to my advantage and still be able to deliver all of the material I feel is necessary. I decided to explore using podcasts, short videos, and more diagrams imbedded in my lecture. I also wanted to add some well-developed Webquests and games, which can be played on iTouches. I surmised that the additions to my lecture along with the Webquests and games could decrease student weariness and, thereby, increase student interest and understanding.

I hoped by performing this capstone project I would improve my Human Anatomy class and at the same time answer a couple of questions. My project focus question is what are the effects of using interactive games and animations on students' understanding of high school anatomy concepts? My project subquestions are as follows: what are the effects of using interactive games and animations on student engagement in class activities; what are the effects of using interactive games and animations on student interest in class activities; what are the effects of using interactive games and animations

on students' long-term memory of anatomy concept; and what are the effects of using interactive games and animations on my comfort level with the information and my thoughts on pedagogy.

The project was conducted during one section of Human Anatomy at East Marshall High School in Legrand, Ia. It is a small, rural district surrounded by corn fields and attended by students who most likely have parents who attended this school. The school has 20% free and reduced lunches and has little ethnic diversity. This particular class had 17 students in it, all of which planned on taking Human Anatomy again in college.

The purpose of my study was to find a new way to deliver a large amount of information in a format other than lecture. It should be helpful to a large number of teachers who still employ text PowerPoint slides out of habit or teachers who lecture without them and would like to rejuvenate their lectures. It need not be science lectures and could even be used by other professionals who are asked to give presentations on a regular basis. I aimed to have less lectures and more Webquests and games, and to enliven those classes in which I did use lecture.

There are many people who helped with this project and have been indispensable to me. The six members in my support team each provided support in their own way. Dee Kilmer and Tom Hallgren are both English teachers and were utilized for proof reading and help with formatting. Dee has just finished her Master's degree from another institution so she has unique insight. Shari Smith, who is working on her PhD in Online Education, is a science teacher in my school who helped me design the procedures and was an invaluable resource with respect to technical issues. The fourth member of my support team is my principal, Rex Kozak, who leads our Virtual Reality program. He is

especially interested in anything involving technology in the classroom. Shannon Walden, who was my instructor for a human anatomy class at Montana State University, was my science reader and provided many helpful suggestions. My main advisor, Jewel Reuter, has been indispensable guiding me through this process and helping to shape the project and the paper.

CONCEPTUAL FRAMEWORK

As technology encroaches on more and more of society, there is a strong push to use it in the classroom but it must be effective and not just a novelty. In order to justify the time and money spent incorporating interactive aspects into a curriculum, there must be a benefit to both the students and the instructor. There have been many studies testing the effectiveness of technological additions to a traditional lecture class with most finding it to beneficial if the additions are high quality visuals, demanding enough, and embraced by the instructor.

In order for interactives to be useful, they must demonstrate their effectiveness over the previously used method of teaching. Marsh, Giffin, and Lowrie (2008) tested the efficacy of using 3D tutorials of embryo folding with lecture over only lecture in a college embryology class. The scientists found there to be a significant improvement of those students who first heard the lecture then were allowed to use tutorials. Marsh et al. (2008) allowed the students to use the module and tested them after each trial and noted it was important the students have a certain amount of base knowledge before the interactives became useful because the students performed better on the postunit assessment the second time around. The students need to have enough familiarity with

the material first to thoroughly appreciate the concepts being represented; otherwise, there is not enough information to connect to the visuals.

Gookin, McWhorter, Vaden, and Posner (2010) tested a group of college anatomy students using an animation depicting glomerular filtration rate and also found the students who watched the animation performed better than the students who were only exposed to text materials on the subject. In a survey of the students conducted by Gookin et al. (2010), the students felt a combination of the two methods would be the most beneficial. The students felt they needed a visual aspect to tie to a concept but also the text helped with a thorough understanding on the complicated topic.

Neumann, Neumann, and Hood (2011) was particularly on point with respect to my capstone project because the researchers used animations integrated into a traditional lecture format in a college statistics class to determine if student engagement and comprehension were affected. A majority of the students felt the technology aided in their understanding; others remarked it helped them to visualize the content of the lecture. The students in the study felt the animations helped them to be more engaged and did not feel that animations were simply a gimmick. An interesting addition was the authors reminded educators that the additions of technology needed to be weighed against the extra costs, time, and technical problems that may arise. Technology should not be used on a whim and should be practiced as any new method of instruction should.

Clark (2008) surveyed university history students to determine how well PowerPoint lecture held the attention of students. She found that the supplements were a good addition to a lecture and even more effective if the slides included graphs and pictures. Clark held the PowerPoints needed to be visually interesting and the instructor's ability to use the technology also had an impact. Clark believed it was the variety of the lecture that ensured the students would continue to pay attention and multiple modalities

could be used. This study supports my hypothesis if there are multiple visual and auditory stimuli the students will remain engaged.

Salajan et al. (2009) addressed student engagement using several 3D interactive techniques in college dentistry anatomy instruction. Some of the interactive visual components were designed by the instructors who would later use them. The researchers tallied the number of times one of the 3D interactives were used by the students in various classes. This tallying system verified some students returned to it multiple times in order to better comprehend a difficult concept with the students in the more advanced classes returned to this interactive more frequently. The interactives kept the students engaged and showed the students who understood the importance of completely grasping the concepts were more engaged. The dentistry students were able to go back and look at these animations in a way the students would not be able to with lecture or with dissection. Salajan et al. (2009) tested the effectiveness of the interactives by surveying the students on their perceptions of it. I do not feel this was a very effective way to test this; I think students' perceptions are useful but insufficient. I would have correlated how many times an interactive was used with their grade on that particular section of the test or frequency of interactives used with scores on the interactives. I am unsure of why that test wasn't performed other than it wasn't the purpose of the study.

Bryner, Saddawa-Kofeka, and Gest (2008) studied the use of modules with graduate medical students and found among other things modules increased the students' interest in the content. The students in the experimental group used the modules spent more time studying after using the modules even though the experiment did not directly affect their grade. The authors felt this showed an increased interest in the subject matter. These same students rated the modules as "extremely helpful" and the authors also found

students who used the modules were more likely to spend more time studying than those in the control group.

It is also important the students are able to retain the knowledge they have gained over a long period of time. Marsh et al. (2008) found the amount of time-lapse was important with 16 months yielding statistically insignificant differences between the control group and the tested group. However, the scientists found at four months after the initial exposure the students who had viewed the module performed much better on the quiz. Marsh et al. (2008) sent out copies of the modules to various anatomy instructors and asked about their likelihood of using them in the class. The instructors seemed very impressed with the modules and were excited to use them in their classes. Although instructor interest was not the direction of the study, the comments seemed to imply the modules increased the instructor interest in teaching the class. It appears a new technique that promises to make one's job easier and more effective will increase in instructor's interest.

Starbeck, Starčič Erjavec, and Peklaj (2010), attempted to test whether using multimedia would increase both short-term and long-term learning in undergraduate college genetics students. Genetics is different than anatomy in many ways but for this study it is a valid comparison. The researchers studied the effectiveness of using multimedia to teach large molecules and the visual concepts were similar enough their study can be used for comparison. What the researchers found was the multimedia group did significantly better than the other groups in improvement from the preunit assessment to the postunit assessment. This held true with short-term and long-term memory. The authors did emphasize all multimedia are not created equal. The person creating the modules needs to have constant consultation from an instructor who will be using the product.

There has been little research into the use of multimedia in classrooms and its affects on teacher comfort with the contents but Russell, Bebell, O'Dwyer, and O'Connor (2003) implies the more teachers use technology the more comfortable they become with it. It would logically follow that if the instructor is comfortable with the technology he or she will feel free to focus on the content. Many of the studies pointed out that it was necessary for the instructor buy into the technology used in order for it to be effective. That was not an issue because I have wholeheartedly bought into the use of technology in my classroom and chose the interactives that were used. Both of those aspects should contribute to a more comfortable learning experience for me and for the students.

All of the studies showed well-made interactives and computer modules can be very helpful in student achievement as well as student interest. I think it is important to stress the tool used must be quality in content and presentation to be effective. It must also be emphasized that a good instructor is also crucial. Gadgets are fun but if they are used arbitrarily learning may not result. It appears that using the interactive tools and computer modules along with videos and short podcasts should help to engage and interest my students along with increase their knowledge in both the short-term and long-term. The issue of my comfort with the content should also increase simply because I will learn new things as I find new information; the more I learn the more comfortable I feel.

METHODOLOGY

Project Treatment

I used a nontreatment unit and two treatment units so that I have a point of comparison. Historically, both units have been equally difficult for my students. The nontreatment unit was over a chapter that is concerned with fundamentals of the nervous

system and nervous tissue. The treatment units pertained to the central nervous system and the peripheral nervous system. The nontreatment unit involved mostly lecture with two quizzes and one lab. I utilized lecture with the notes from the chapter in front of me and a PowerPoint presentations on the board, consisting of mostly bulleted text. This is the technique that I have used the majority of the class thus far. The students also had a reflex lab near the end of the section as is normal throughout the semester. The class rarely has a full week of lecture and Fridays are generally reserved for a lab or video. I followed a similar plan of no more than four days of lecture followed by a video or lab on Friday in both the nontreatment and treatment units.

The treatment units utilized many more visual activities. I used the PowerPoint bulleted slides and notes from the chapter but added many things to the slides. The additions can be found in journals in Appendix A with the additions highlighted. The additions included audio podcasts, short videos, and additional pictures. I used a brain identification game 3D Brain Tutor on iTouches, which allowed the students to identify the parts of the brain and view various cross-sections of the brain. They also performed a hands-on lab that involved using their senses and answering questions about which parts of the brain were being used, which was related to the brain tutorial. They also used a Webquest that showed the students different brain parts and asked questions of each. This required the students to associate visual information with the previous lectures. I continued to use lecture for the majority of the unit, but added more pictures and short videos to the PowerPoint presentations.

The PowerPoint presentations came with the textbooks and I have modified the text on the slides to suit what I thought was important. Over the years I have added text and taken some away but the slides were still mostly bulleted text. The PowerPoint

presentations for the treatment units would appear similar at first glance but the treatment unit slides have more pictures and less text but the main difference is there were audio files added. When a slide with an audio file attached came on the screen, the audio started immediately and the students took notice and listened. A short video was occasionally inserted in between two slides and would also play immediately when it appeared. A sample of the PowerPoint presentations in the nontreatment section can be found in Appendix A. A copy of the lecture notes can be found in Appendix B and the lesson plans can be found in Appendix C.

Data Collection Instruments

I have chosen human anatomy class because it is the only class I teach that I predominantly use lecture. The rest of my classes are much more inquiry based. In those classes I've moved more away from the books and more toward activities.

I teach at a small, rural school in Iowa, East Marshall High School in Legrand, IA. The students are all white. Twenty of our students are on free and reduced lunch programs. This class is open to juniors and seniors but is mostly taken by seniors. There are 17 students in the class; 13 are seniors. It's considered an upper-level class and is taken by students who plan on taking anatomy again in college. Their intended majors range from nursing to physical therapy to premedicine.

My students are bright and very determined. They want to get as much as possible out of this class and I try to provide them with as much knowledge and background as possible. My students come into the class knowing it's going to be difficult. They are an inquisitive group with questions coming every day. The dynamics

make for interesting and lively discussions. Human Anatomy is truly my most engaged and interested class, however, even interested students can get bored with repetitious lecture.

I used multiple-data points and types of data to better understand the effects of my project. My triangulation matrix can be found in Table 1. Using these specific multiple assessments helped assure me I was looking at all of the necessary issues. I used three data sources for each question.

Table 1
Triangulation Matrix

Research Questions	Data Source 1	2	3
What are the effects of using interactive games and animations on students' understanding of anatomy concepts?	Preunit assessments comparisons with postunit assessments	Postunit interviews with concept questions	Surveys about memory and understanding
What are the effects of using interactive games and animations on students' engagement in class activities?	Instructor constructed on-task checklist Preunit and Postunit assessments	Postunit interviews with questions about memory and understanding	Surveys about memory and understanding
What are the effects of using interactive games and animations on students' interest in class activities?	Instructor constructed on-task checklist Preunit and Postunit assessments	Postunit interviews with questions about student preferences and attitudes	Surveys about student preferences and attitudes
What are the effects of using interactive games and animations on students' long-term memory of anatomy concepts?	Student survey with questions about memories and understanding	Student interviews with concept questions about memory and understanding	Postunit assessments comparisons with Delayed assessments
What are the effects of	Teacher Journal with	Teacher Interview	Self-Assessment

using interactive games and animations strategies on my comfort level with the information.	prompts	conducted by peer

Student understanding was the primary focus of my project. To measure understanding, I administered a preunit and a postunit assessment to compare the scores. The preunit assessment was given before the unit started and again on the last day of the unit; it can be found in Appendix D. I also used an interview to determine how the students felt about their understanding of concepts from the different sections; the questions from which can be found in Appendix E. I chose ten of the students randomly based on availability but did not get all of the information I needed. I later interviewed three of my graduated seniors by means of Facebook chat and was able to obtain even better information. I was able to see that the students were online, click on them and ask them what they thought of the treatment units. They could reply back and I could cut and paste their answers directly into the interview section of the data. The information obtained through the online chat was much more direct and useful than any of the interview questions and was the main data used when analyzing learning. Both sets of interview answers can be found in Appendix F. All of the students filled out an online survey on surveymonkey.com (Appendix G). The survey has similar questions about their understanding of the material.

I was also concerned with student engagement in class. The instrument I used for that particular piece of data is the on-task checklist (Appendix H). I had two predetermined times in class in which I noted whether a student was either on-task or not; the times were generally 10 minutes into class and with 10 minutes left of class. These data were very helpful in determining if the students were interested in the activities each day. The interviews and surveys had questions as to if the student's felt they paid

attention during the different sections and were used to a lesser extent to check for student's engagement in the lesson.

I also measured the student's interest in the class activities. I again used the checklist, interviews, and surveys to measure their interest in the class. If the students are on-task, it should follow the students are interested but it's beneficial to make sure it is true. The students may have appeared to be interested by the checklist but if that assumption is invalid the interviews and surveys should expose that. The interviews had specific questions as to if the students were interested in the activities and chapter in general.

Another one of my goals was to ensure my students have long-term retention of this knowledge. I used the postunit and delayed unit assessment 14 days after the postunit assessments as a comparison. The students had no prior knowledge of when any of the assessments would be and we did not go over the answers. The surveys and interviews also helped to make sure the students understood what was being presented. This was obviously an important goal of mine and it was the one of the goals I tried to design the entire intervention around.

The last aspect is my comfort level. I chose the nervous system unit for its timing. This is my least favorite unit and comes right at the beginning of second semester. The students come back from the winter break when it is cold and they would still like to be on break. I hoped by starting the semester off on a positive note I could keep the morale up until we were able to get to the more interesting units. This is where my journal was indispensable. The journal prompts (Appendix I) have questions about my comfort level. I also asked for a peer to interview me about my feelings after the project has finished. She has been through a similar program and knows what I am

looking for. The last data point is simply self-assessment. No one is going to know better than me if I am comfortable with what is being taught.

This unit started as soon as we returned from winter break. I used the topic of nerves as the nontreatment unit and it barely lasted a week. The central and peripheral nervous systems were the topics of treatment units. The brain unit for Treatment Unit 1 was considerably longer with 13 days of instruction. The second treatment unit required a more reasonable eight days in length. Altogether the entire intervention lasted just over seven weeks and was completed by the middle of February. A detailed timeline can be found in Appendix J.

DATA AND ANALYSIS

Data from the treatment and nontreatment units were compared in order to determine the effects of games and interactives on student's understanding of human anatomy and my subquestions. During each unit, data were collected and triangulated in order to answer each question. The use of preunit and postunit assessments allowed the comparison of the percent change in understanding of the units. Data from the preunit and postunit assessments along with the percent change can be found below in Table 2. The results show a greater gain in understanding in the two treatment units than the nontreatment unit as exhibited in the percent change.

Table 2
Percent Change in Assessment Scores for All Units from Preunit to Postunit

Description of Data	Nontreatment Unit	Treatment Unit 1	Treatment Unit 2
Preunit Assessment	32.50%	1.20%	1.85%
Postunit Assessment	80.00%	29.80%	64.77%
Percent Change	146%	2383%	3400%

As expected, there was an increase in scores from the preunit assessment to the postunit assessment in each unit, but the nontreatment unit had less of an increase than both of the treatment units. The nontreatment preunit assessment was considerably higher than the treatment units, which may account for the less dramatic increase in scores. There was a striking difference still in the percent increase in the scores for the nontreatment unit and the treatment units. These data suggest that the students learned the information from the treatment units better than the nontreatment unit.

I believe this was the most useful tool in determining student comprehension. The students clearly had a higher rate of improvement in the two treatment units than the nontreatment unit. Their scores show that although the material was difficult in all three units there was a greater gain in knowledge when exposed to multiple forms of instruction. The hypothesis was true, that implementation of additions to the traditional lecture resulted in greater learning for the students involved.

Data were also collected using interviews, in which the students expressed how they felt that the additions to the lecture helped them to understand things more completely. One student said that he "really liked the brain app" and asked "Can we do something like that again? I used it to review for the quiz." The interviews support the findings from the preunit and postunit assessments, adding iPod games, and computer Webquests helped the students to comprehend difficult material.

Data on the question of student comprehension were also collected through an online survey in which all of the students (100%) replied that they would like to use games or iTouch applications again in a future unit. They also said that they felt like they comprehended the first treatment unit best (53.8%) and the second treatment the least (7.7%). So clearly, the data were not completely consistent in that they felt most

comfortable with the information in the first treatment unit but performed best in the second treatment unit.

Altogether, the variety of podcast, videos, and games helped the student's understanding of anatomy concepts. They had a deeper understanding of the treatment units than the nontreatment units, which I believe can be attributed to the interventions. The interventions exposed the students to the information repeatedly and in a variety of ways, which allowed them to, most likely, make more connections and then were able to recall that information at a later date. The change of pace probably helped to hold their attention and, therefore, allowed a greater possibility of learning.

Student engagement was important to me and could be measured in a number of ways. The best measure of that was the on-task checklist that was administered during class. Table 3 below shows the percentage of students on-task during the nontreatment unit.

Table 3
On-Task Student Averages for Nontreatment Unit, (N = 17)

	Nontreatment Day 1 Lecture		Nontreatment Lab Day 3	
	First half of class	Second half of class	First half of class	Second half of class
Average on task	77%	46%	100%	100%

During the nontreatment unit, the students were on-task for the first collection period during the lecture on the first day of the nontreatment unit but were less on-task during the second half. They tended to be more on-task during the lab the third day of the nontreatment unit, which I expected. Unfortunately, due to the brevity of that

chapter, it lasted only a week. This didn't allow for much data collection for the on-task checklist.

I had predicted they would be more on-task during the lecture on the treatment units but data shows that this was only partly true. The percentage of students on-task for the first treatment unit can be found in Table 4.

Table 4
On-Task Student Averages for First Treatment Unit, (N = 17)

Project Phase	First Half of Class	Second Half of Class
First Treatment Unit Lecture Day 1	77%	85%
First Treatment Unit Webquest Day 3	100%	100%
First Treatment Unit Guest Speaker Day 6	92%	92%
First Treatment Unit Lecture Day 7	69%	69%
First Treatment Unit Lecture Day 10	92%	62%
First Treatment Unit Webquest Day 13	89%	100%

In the first treatment unit, lecture occurred on first, seventh, and tenth days and an average of 79% of the students were on-task during the first part of the period during lecture. That was numerically similar to the nontreatment unit. An average of 72% of the students were on-task toward the second half of classroom lecture during the first treatment period. That was much higher than the nontreatment unit which had an on-task percentage of 46%.

The number of students on-task were higher during the second treatment unit, the averages for which can be found in Table 5.

Table 5
On-Task Student Averages for Second Treatment Unit, (N = 17)

	Second Treatment Unit Day 1 Lecture		Second Treatment Unit Day 3 Lecture		Second Treatment Unit Day 6 Lecture	
	First half of Class	Second Half of Class	First half of Class	Second Half of Class	First half of Class	Second Half of Class
Average on task	83%	67%	79%	100%	100%	100%

All three dates utilized lecture with additions of short podcasts, videos, and added pictures to help clarify the concepts. The students averaged 83% on-task during the first half of the lecture class period and 89% during the second half of the class. Using the on-task checklist, I concluded that the students were considerably more engaged during the treatment units than the nontreatment units. That is what I had hypothesized and data seems to suggest that their engagement can be attributed to the treatment.

The survey was also used to gauge their interest in the class. In the survey I asked what was their favorite way to learn anatomy concepts, with the idea that they would be engaged when they were doing something they enjoyed. Games were the preferred method of choice (61.5%), with labs (48.2%), and videos (40.8%) also selected. Lecture actually was a surprising choice for 23.1% of the students. Interestingly, not one student chose podcasts during lecture or videos during lecture as their favorite way to learn.

This shows that there are many options to hold the student's attention. The students enjoy many different types of learning modes with many students opting for many styles. When asked which method they would like added to the lecture, their first choice was discussion (84.6%) and I need to find a better way to work that into lecture. Many times they would get off topic on their questions and I would like to find a way to direct them back to the subject without shutting down their curiosity and learn how to use discussion as an effective teaching tool.

Curiously, more students opted for plain PowerPoint slides (7.7%) and PowerPoints with images (7.7%) than short videos and podcasts during lecture (0.0%, 0.0%). Their perception of what kept their attention may not match the reality of what actually worked since they didn't perceive the short videos as being helpful but the other assessment tools showed that they were. It is possible they may have enjoyed the PowerPoint presentations because they were easy to follow and take notes on. The podcasts tend to take more individual work to review and listen to again. The slides were directly about the information in the textbook and the content would have been easier to access a second time around and that may have colored their perceptions.

Using that information, I asked what their least favorite way to learn was during the interviews. I had expected to again hear lecture but the one that they liked least was just reading the text. One student responded that reading the book was "a complete waste of my time" because "there's no chance to ask questions". One said that he hated it when instructors told him to "go read it and come back and we'll talk about it". This is a separate issue in itself but interesting and something that needs to be addressed at another time.

It seems there were as many answers as there were students to the question of preferred methods of instruction. Again, I believe this shows that variety is truly the most important aspect when choosing a teaching tool. Some prefer lecture, while others prefer discussion while still more prefer images on top of their lecture. As long as I keep things different and moving, I can hold their attention long enough for them to learn according to my observations. These observation suggest that the best way to add variety is to use the tools that I have implemented, Webquests, podcasts, and interactive - applications.

I was also concerned with their interest in the class and used the same data points that I did for student engagement. The on-task checklist did show them to be more engaged and by logical conclusion more interested when using podcasts or short videos. They were more interested when using hands-on activities, such as Webquests and traditional labs no matter which unit it was, as can be seen in Tables 5 ,6, and 7. The survey and interviews again showed that they enjoyed the applications and games as discussed above. One of my students told me later on Facebook chat that "I liked the little videos. It was a nice little change of pace." I made a note in my journal during the treatment unit that "They were good for the first part but when we started talking about the layers of the meninges they really started to zone out. I need to add pictures and possibly a video in there." I also changed things up from the lesson plans and pulled out some Left Brain/ Right Brain quizzes that lead to some interesting discussions. In my journal I noted that "They really enjoyed them. We had an interesting discussion about subjective tests and how these could be compared to IQ tests." and that it was "All in all a productive day." These data suggest that it shows that the additions need not be high-tech, just engaging.

Data once again seem to suggest this has the same implications as the conclusions from student engagement. If I can keep their attention, I am holding their interest and vice versa. The students like variety and enjoy it when things are new and different, which was not a surprise to me.

Long-term retention of information is always one of my major concerns while teaching this class. These students will most likely need to take another anatomy class in college and will need to be able to recall what they have already learned. One way in which long-term retention was evaluated was by using the same assessment tool that was used for the preunit and postunit assessment. I administered this assessment two weeks

after the unit had concluded, the comparison of scores can be found in Table 6 below. If long-term learning had taken place a small dip in the treatment unit scores is to be expected with a larger drop in the nontreatment unit.

Table 6
Percent Change in All Units from Postunit to Delayed

Description of Data	Nontreatment Unit	Treatment Unit 1	Treatment Unit 2
Postunit Assessment	80.00%	29.80%	64.77%
Delayed Assessment	70.00%	29.80%	57.08%
Percent Change	-12.5%	0.00%	-11.9%

There was a marked decrease from the postunit assessment to the delayed assessment for the nontreatment unit, no decrease in the first treatment unit and a slightly smaller decrease in the second treatment unit. This indicated that they did retain the information better during the first treatment unit than the nontreatment unit. The data show that there was long-term memory learning taking place with at least one of the treatment units. This was the longest unit with the most interventions and it most likely had the biggest impact on their learning.

Their delay assessment scores match directly with the survey data, the answers for which can be found in Appendix K, about which section the students felt they had learned the best. More of them felt they had a better grasp of the first treatment unit (53.8%) than the second treatment unit (7.7%) or the nontreatment unit (38.5%). This may be due more to the difference in the content of the units than the actual treatment. The first unit was very short and had receded farther in their memory. The third unit was also short with an abundance of new terms and that can overwhelm the students at times.

I tried to address the question of long-term retention directly during the interviews and I didn't get answers that address the questions. I noted that it "turned in to what do like about knowing what you know". What the students had to say was interesting but not useful for this area of focus. I went back later and asked the same question to some

of the students on Facebook chat. One girl replied that "I think it helped me prepare greatly for college. I could already see a huge help it gave me in my dual enrollment classes at (Marshalltown Community College) and feel much more comfortable going into a science field next year." Another girl who is currently taking an anatomy course at the community college replied "I am amazed at how much I can still remember. I'm not sure if the videos helped but I like when I can tie a picture to a memory or a story." Another student, planning on majoring in premedicine remarked "I would say my understanding of the subject has increased greatly because of the activities included during class time. Doing labs has really helped me to understand the concepts." It seems that they all enjoyed what they did and felt that it was beneficial to have taken this class.

The last component I was concerned with was my own comfort level. My journal addressed that aspect daily. I was anxious about the new aspects that were introduced to the lecture but quickly came to enjoy it and will continue to use them all. I wrote that during the nontreatment unit "There's a section that's very confusing without visuals. So, need to find a video or some kind of visual aid on polarization of plasma membrane". By the treatment unit, I was able to say that "This lecture is really what I would ideally like to move to for the majority of my lecture, where there are a couple of slides with words but most of them have pictures and occasionally there is a short video or podcast." In general, things ran smoother during the treatment units than the nontreatment unit.

I went back later and wrote a summation for each section. After the nontreatment unit, I remarked that "I'm glad this first chapter was so short because a plain lecture every day is getting very dull". There were some frustrations after the second unit that mostly dealt with school policies and my ability to access needed materials. At the end of the unit, I had some thoughts about how I would alter my process if I were to repeat it.

The journal showed that I became more and more comfortable as the activities progressed. I had some frustrations, which were to be expected but they were incidental and did not affect the outcome or the data. Reading through the journal, one can see that there were many distractions to learning and more things affecting the data besides the treatment such as snow days and standardized testing. There are always going to be uncontrollable issues and they shouldn't be discounted nor should they hold too much weight. The journal helped me see what was important in the long-term and what I felt in the short-term and I was able to tie those together to determine that the treatment unit did help with my comfort level and that I will continue to try to make new implementations in my class.

I also used an interview from a colleague that shows the same information. The only thing worth noting on this subject is that I said I was happy that I was able to pull the pictures into my lecture and will continue to do so. My own perception, which was my third assessment tool, was that I am now happier about the class. I was also getting tired of lecturing every day and now I look forward to using the new pictures, videos, and podcast. I enjoy looking for them and replacing the older ones with better pieces of information. I will continue to add more technologically based games along with hands-on activities and labs that should help the students excel in this class and in the future.

INTERPRETATION AND CONCLUSION

I had hoped the interactives would help the students to understand the anatomy concepts better. I found that to be true in all aspects. The preunit and postunit assessment showed a remarkable increase during the treatment units and only a modest increase during the nontreatment units. The survey and student interviews also showed

that the students felt that they understood the content in the treatment units better than the nontreatment units, in general. The assessment questions were very difficult and my students did more poorly than I would have expected all three times that they took the test. If I were to repeat this project, I would have rewritten the question to be more inquiry based and less recalling of information. In all, I believe the additions to the treatment unit were a factor in increasing the student's comprehension of the content.

The student engagement data were also positive. According to the on-task checklist, engagement was equivalent with a slight increase in the treatment unit than the nontreatment. I chose two predetermined days per week to take the data. If I were to change anything, it would be to take more data during the nontreatment considering I only had two days of taking data. I would also like to have more data for the days of lecture and less on the other days.

The survey data showed that they enjoyed a variety of different modes of delivery of instruction including games and even lecture. I should have tailored my questions more directly to answer my focus questions. I did not ask any questions directly about student engagement. I needed to ask directly if they preferred to have podcast and short videos during their lectures. The yes-or-no questions were not very helpful. The interview also did not yield the information I expected to obtain. They did not feel like they were incredibly disengaged during the lecture periods. Again, I did not ask the correct questions. I did not ask about student engagement during the interviews and had to use what little information I did collect.

The data were positive about student interest in the class. I assumed student interest and engagement were directly linked and so I used the same assessment tools that I used for student engagement. There was an increase in student interest during the treatment units or the nontreatment unit according to the checklist, surveys, and

interviews. The questions on the survey dealt more directly with student interest but the interview again did not yield much data. Due to my novice interviewing ability, I would probably try to find another assessment tool to use or develop my skills. I also learned that my students were more open to communication in the Facebook format and this might be an effect way to collect data.

One of my main goals of the class is to ensure long-term retention of the information. The delayed assessment showed that there was less of a loss of recollection in the treatment units than in the nontreatment unit. This shows that I was correct in making the additions to the lecture. The survey also showed that the students felt they held on to the information from the first treatment unit better than the second treatment unit or the nontreatment unit. The interview did not yield good data for this focus question. It might have been more effective to directly ask them what I wanted to know.

My comfort level was also of importance to me. The journal consistently showed that I became more at ease with the content as the unit progressed. I was also interviewed by a colleague and that yielded the same results. In the future I will keep better records of our discussions and only had a few emails to use for data on this. I also will add a 1-5 Likert Scale into my journal to rate my level of comfort so that I could quantify my comfort more easily.

I have learned that qualitative and quantitative data are both important in their own way. I used both types of data for all of my areas of concern. I have also improved my data collecting skills and learned that interviewing is much more difficult than initially thought to be. I will continue to implement more interactive games and Webquests to all of the units of the class.

VALUE

There are many implications to this study. I believe it confirmed that my original premise was correct; lecture alone is not an adequate form of delivery for instruction. There are many new and innovative techniques being developed all of the time. Remaining with the traditional lecture because it is the easiest to implement is not an adequate reason. Adding interactives such as games and Webquests not only help hold the interests of the students, it aides in short-term comprehension and long-term retention of the information.

This study has implications for what I will do in my classroom. Having said that, I am going to continue to try to find and create new activities to do in class. I will continue to pepper the lectures with new and interesting items. There are many interactive websites that are available for human anatomy. I am going to explore them and find the best ones to use. The more these students can work with these concepts, the better they should be able to understand them. I plan on adding as many pictures and short videos as possible to enhance the learning process. I have even started to add short videos to my other classes that are not predominantly lecture. I think that keeping things new and fresh not only adds to the student's interest but also to mine. That also may appeal to the low-achieving students who would like to work at a different pace than my lecture.

Through this process I have tried to expose the students to the many forms of learning that are available to them. They are not fond of reading so I have stressed that there are many podcasts that cover good introductory materials that can be obtained for free. They can also find useful videos that will enhance their understanding if an instructor is not available or able to answer their questions. Lastly, they have been

exposed to Webquests and applications that can be used to practice what they know and make learning more fun.

A good continuation of this study would be to isolate the different lecture additions to see which is the most useful. It would be helpful to know if Webquests should be used more often than podcasts and games. It would also be useful to know if the games need to be interactive or if they can be such things as board games and still retain all of the benefits. The researcher may find that they are best when used together, which is my assumption.

One of the unexpected learning opportunities was writing in a journal. I had never used that implement before and was a little apprehensive about its value. What I found was that I expended such a short amount of time for the benefit that it yielded. The journal proved very helpful when reviewing other data as well as organizing anything that seemed out of character, such as the shortened snow day that left the kids antsy and unable to focus.

This assignment has renewed my interest in finding new activities for class. That is always a challenge with time being a premium. I intend make it a priority and make sure that I keep things new and exciting for me as well as for the students. Their learning environment is as important as the content being presented and if they are involved and the instructor is interested then true learning can be accomplished.

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APPENDICES

APPENDIX A

TEACHER JOURNAL

1/5 – Nontreatment Day 1

- Preassessment and started lecture on Chapter 12
- The notes are a mess. Think of redoing them.
- There's two short videos in the powerpoints and wasn't ready for them so maybe think of having some kind of prompt
- Technology worked well. Set up the mimio during the last half of 2nd hour while they were working but could have easily done it when they were doing the pretest.
- Still need a video that shows a nerve impulse when it reaches threshold.
- So far so good with the unit. I hope the rest of it runs as smoothly.

1/6 - Nontreatment Day 2
Lecture Chapter 12

- There are a couple of parts that are a mess. Need to retype the outline with only the needed information and then delete the extra slides from the powerpoints.
- There's a section that's very confusing without visuals. So, need to find a video or some kind of visual aid on polarization of plasma membrane
- Technology worked fine
- It's looking like one more day with lecture and this chapter will be finished.
- Excited but frightened to start the treatment unit. I think I have everything ready and in place but I'm quite sure I will figure out that there are a lot of things that aren't as ready to go as I think they are.
- Still comfortable with the unit but see that this chapter will need more visuals added to it. Would like to find a game of some kind of interactive to go with this chapter although the labs do help quite a bit.

1/7 – Nontreatment Day 3
Reflex Arc Lab

- I took the last page off of the lab because it was confusing and everything seemed to flow nicely.
- It might be a little short tho, so I'm going to look into adding one or two more parts.
- I moved the table up on the sheet because it seemed to confuse the kids a little.
- I think the questions on the lab will help with the final question on the pre/post test.
- It was only worth 20 points. I'm going to think about adding some more questions on it.

1/10 – Nontreatment Day 4
Lecture Chapter 12

- We finished up with chapter 12. Everything seemed to flow well. No issues.
- We had some interesting discussions about disorders.
- I would like to find some more interesting ways to use my mimio.

So far everything seems to be going well. I'm glad this first chapter was so short because a plain lecture every day is getting very dull. There were a couple of parts that could really use a video or at least better pictures. I was promised VR visuals from Mr.

Kozak but that never came through. I'm glad I didn't count on it. If we open up utube maybe I'll be able to find a video to link to. Right now I am stuck drawing it out and I am not an artist.

All in all so far so good. Hope that I am able to collect all of the data that I need to. It still seems overwhelming at this poiont.

1/11 - Snow Day

1/12 - Treatment Unit 1 Day 1
Lecture Chapter 13

- We started the brain unit and did and overview of the brain in general.
- There was a short 60-second science podcast that discussed the new discoveries of nervous tissue regrowth.
- I need to find more and better pictures for the first part
- I recommended looking up the brain app that we will be using

1/13 - Treatment Unit 1 Day 2
Lecture and playing with Brain Tutor 3D on itouches

- I covered about 20 minutes of lecture and then let them play with the itouches.
- It a good idea but downloading the app took a lot of time.
- Also, since they are district wide I had to reserve them quite a while in advance. Luckily the timing worked out ok.
- I don't think I will use it again. It's good but not good enough to justify all of the time needed to get it ready
- I will still recommend that the students that have their own itouches and smart phones use it
- I need to look and see if there is an android version of it.
- The lecture went ok.

1/14 - Treatment Unit 1 Day 3
Webquest on the brain in the computer lab.

- It was very disorganized.
- I am frustrated that they feel like they need to be lead through everything step by step.
- I need to go through and make the directions clearer I guess.
- I also need to make sure I send my aide up and make sure she can access everything that she needs to.
- I am frustrated that we claim to be so technologically advanced here and there is so much that the kids cannot do. The can't download anything and while I understand that, it limits so much of what we can do.
- It had some great questions and I especially like the article on the teenage brain so I will definitely continue to use the idea.
- I did have some comments about how much they liked being able to review the brain app on their own at home. I would like to find more of these for their quizzes.

1/17 - Treatment Unit 1 Day 4
Brain ID quiz

- We had a shortened class due to a late start (snow)
- The brain ID quiz took almost the entire period so that's the only thing we did today.
- We did have an interesting discussion about how much they thought the app helped them with this.
- I could definitely tell who had went back and used the app again on their own.
- I am going to try to find more apps that will help them out in other chapters.

1/18 - Treatment Unit 1 Day 5
Teenage Brain Video

- I have been suffering through a cold and didn't have much of a voice so I opted to go with a video today and try to save my voice.
- I found a pretty decent video on the teenage brain, though we only got through the part about schizophrenia. I got it through the Discovery Ed website. Really love that site in a pinch.
- The kids really seemed to like it. It had just started to get into drug addiction when class ended so I think we may come back to it later.
- The technology worked fine today. I was actually amazed at how fast the video downloaded. Last year it would have taken at least 20 minutes and this year it was only about 3-4 minutes.

1/19 - Treatment Unit 1 Day 6
Guest Speaker - Mrs. Kilmer

- I knew these kids would be respectful to her since they have her as a teacher but I was amazed at how well behaved they were.
- She spoke about what caused her stroke and what the doctors told her.
- When asked for questions the students were hesitant so I asked a couple of questions that I genuinely wanted to know. Then they started to ask questions.
- I was afraid that what she had to say wouldn't fill the entire period but it did easily.
- The kids asked interesting questions, some of which she couldn't answer and I could speculate about but there were some that were beyond both of us. I was happy that they were thinking though.
- At the end of class I gave them an assignment that they had to "be Kilmer" for the rest of the day. They had to try to get around and do their everyday tasks with only one hand. That was very interesting.
    - Many of them barely made it to the next hour but some made it to the end of the day.
    - The ones that gave up said it was just too hard. I was a little disappointed that they gave up so easily.
    - I was surprised that it spread to students that weren't even in my anatomy class were trying to get along with only one hand.
    - Kilmer was impressed with the assignment and at how hard some of the kids were working at it.

- I would like to use more guest speakers because they reacted so well to this one. I need to look in to using other people that I can use. Our school nurse is a good example of a resource that isn't being utilized to its fullest.
- All in all a great idea that I would like to repeat.

1/20 - Treatment Unit 1 Day 7
Lecture

- I was very annoyed with them today. This is the only day that I am lecturing this entire week and a lot of them were talking and a little rude.
- I had to stop and chastise them.
- I'm a little disappointed in that I have decreased the amount of lecture and they seem to be worse about paying attention.
- It may be a one day anomaly and I am hoping so.
- The material was very dry but they still should have been able to hold it together for a day.
- There was additional pictures today that I used from the internet and one short two-minute video that came with the textbook imbedded into the lecture.

1/21 - Treatment Unit 1 Day 8
Senses Lab

- They were well behaved today and did a great job of working together.
- I love this lab. I may have to rethink the questions. They are pretty easy. Other than that, great day.

1/24 - Treatment Unit 1 Unit Day 9
Lecture

- I was again annoyed with the students lack of attention
- They did start to tune in a little better when we started talking about memories and how they are stored and lack of reliability of them.
- I should add a short activity in there. I'm sure I can talk to the psych teacher and get some great ideas.
- The technology worked fine but I hate that there are so many things to hook up and there ends of being wires everywhere and it's difficult to get the computer hooked up along with the speaker. I wish I could get the speaker system attached right so I didn't have to constantly attach and deattach it.
- I need to add some more videos and/or podcasts into this part to break up the monotony of my voice.
- There was only one short podcast on areas of the brain from PBS. It was very dull tho and I took it out right away so I won't use it again.

1/25 - Treatment Unit 1 Day 10
Lecture

- They were good for the first part but when we started talking about the layers of the meninges they really started to zone out. I need to add pictures and possibly a video in there.
- It was a short class but they did ok. I need to find some way to break everything up though.

- I'm thinking I should throw in the left brain/right brain quizzes sometime before this. The last couple of years the students have really seemed to enjoy them.
- There were no additions to the PowerPoint today due to the inability to find any interesting ones. After yesterday's dull one I didn't want to have a repeat.

1/26 - Treatment Unit 1 Day 11
Left Brain/Right Brain quizzes

- I decided that they were definitely tiring of lecture so I pulled out the left/right brain quizzes that I have used in the past. I wasn't planning on using them this year but it looked like I need to break things up a little.
- They really enjoyed them. We had an interesting discussion about subjective tests and how these could be compared to IQ tests.
- I was impressed because they all payed attention the entire time and seemed interested.
- I added a WIKI assignment to it. I assigned them to find some study that dealt with left-right brain research and tell what they found.
- I'll be interested to see what they come up with. I'm really trying to get them to be able to at least read and understand the abstracts of research papers and understand that there is a difference between an article about the research and the actual paper. I would like to get them to actually look up the research if possible.
- All in all a productive day.

1/27 - Treatment Unit 1 Day 12
Lecture with multiple videos and a short podcast

- We finished up Chapter 13 lecture. They were much better about paying attention.
- There was a short video imbedded in the lecture, a couple of good pictures, and a short podcast about teenage brains. I think they helped to break things up a lot. I would like to add more and more of these to the slide shows.
- This lecture is really what I would ideally like to move to for the majority of my lecture, where there are a couple of slides with words but most of them have pictures and occasionally there is a short video or podcast.

1/28 - Treatment Unit 1 Day 13
Video – Jill Bolte Taylor on Ted.com

- Everything went smoothly. They seemed to pay attention. I will definitely use this video again.
- I'm going to continue to try to do something other than lecture every Friday just to have a break.
- I might want to think about doing it some other day also.

Interviews – Round one were given

It was a very long unit. I wish there was a better way to pace it out. This chapter is so much longer than the others and there is just so much information. I might think about going through and deleting the unneeded info from the notes and the powerpoints. I showed quite a few videos during this unit and not all of them were good. I'm still struggling with finding decent videos and also struggling with our technology. I can't use

my DVD player with most of the videos that I get. Because of that I can't really expect a sub to show DVDs because I can't leave my computer there. Having said that, there's little I can expect a sub to do and I hate to completely lost a day.

I'm also frustrated with the technology at this school. Our principal goes out in to the community and brags about our VR (virtual reality) program. He says how the classroom teachers use it and that is a complete lie. I have been promised programs that never come through. Even if they made the programs I couldn't use them in class because the program needed to run them is PC only and we all have Macs. This is something that he doesn't seem to understand, that we get nothing out of it.

Also the kids aren't able to access a lot of things that I would love to use. They can't download anything so that if I want them to look at an interactive website they may or may not be able to do it. If it doesn't have the latest version of JAVA or Shockwave or whatever they need then they just cannot use it. That's ridiculous. The iTouches ended up taking up more time to download the game that we wanted than to actually use it. My aide spent 2 full class periods getting them on the iTouches and then we used them for one which meant it took 3 days to do one short app. Luckily no one else needed them or I wouldn't have been able to keep them for that long.

Just major frustrations with things that are out of my hands. As far as what I could control, things went well. I think the students enjoyed the added extras. I wish I could find more and be able to imbed them in the powerpoints so that I could use the mimio and have the kids use it. I am hoping that will come with time. There are a couple of sites that I would like to look in to. I just need to figure out if I can imbed them or if I will have to exit out of the powerpoint and then go back in.

1/31 - Treatment Unit 2 Day 1
Lecture

- I started lecturing on the last chapter which has it's moments but can be even dryer than the previous ones.
- I would like to find an introductory activity to do with it. It doesn't have to be long, just interesting.
- Other than that it was ok. I need to redo the notes and highlight the important parts and take out the other parts.
- I broke down and put a short video in that dealt with spinal cord injuries. It was okay and wasn't really part of the PNS but I wanted to add something. Unfortunately it also wasn't a great video. I'll just have to keep looking for good ones.

2/1 - Treatment Unit 2 Day 2
Lecture

- Snow has hit Iowa! We came to school knowing that we were dismissing at 12:20. Needless to say the kids were off the wall.
- Classes were 20 minutes and I managed to keep them engaged for 15 minutes of that. It was an uphill battle.

- I should have an interesting video or short activity in my back pocket for just such an occasion. They are not going to pay attention to me when all they want to do is stare out the window.
- But I got through another section.
- We didn't get to the section that had a podcast in it because of the shortened day and I'm not sure if it would have helped anyway.

2/2 - Snow day

2/3 - Treatment Unit 2 Day 3
Lecture

- 2 hour late start so 30 minute classes and the schedule was all off kilter. This class was now right after lunch.
- Surprisingly they did a good job of paying attention. Everything worked well.
- I need a lot more pictures and keep trying to find some short clips of videos but without being able to access youtube at school I'm at a disadvantage.
- There were a couple additional pictures in

2/4 - Treatment Unit 2 Day 4
Movie

- I took a personal day and had a wonderful sub.
- Unfortunately she couldn't get the video to work. I'm not sure why, I got it to work when I got back. So she played a trivia game with them. Oh well.
- The right brain/left brain quizzes probably would have been a good sub activity. Especially for someone like Becky. I will have to remember that.

2/7 - Treatment Unit 2 Day 5
Lecture

- ITEDs this week. Luckily I have mostly seniors in this class so most of the kids won't be staring at me like they are zombies. It does, however, make my classes 30 minutes long which actually may be a blessing.
- I used my day off on Friday to revamp the lecture slides. Most, if not all, have a visual to go with the text. I think that helped a lot.
- I also removed a lot of stuff that I didn't think was important.
- I tried to find a couple of short videos but couldn't find any that I could download and therefore imbed in the lecture. I will keep looking.
- There should be some in itunes but most of the anatomy stuff that I find is just video or audio of a professor lecturing. What a joke. That's even more dull than watching it in person.

2/8 - Treatment Unit 2 Day 6
Lecture

- Because of ITEDs and early out classes were only 20 minutes long.
- I lectured for a couple of minutes. They watched a short video about injury and they were all quiet and interested.
- We had a nice discussion about head and spinal cord injuries.
- All-in-all it was a productive 20 minutes.

2/9 - Treatment Unit 2 Day 7
Lecture

- We had 30 minutes classes after ITEDs.
- I finished up the unit and assigned the online survey.
- There was an interesting podcast on nerve injury. They thought he was a little corny and I agree but he has a lot of good information and I feel like I should expose them to podcasts that are useful and informative.

2/10 - Treatment Unit 2 Day 8
Post Test

- They seemed to take it very seriously and I was happy to see that they took most of the class period to work on it.
- I haven't graded it yet but from glancing at it they seem to be doing well on it.

2/11 – Treatment Unit 2 Day 9

- Interviews given

I can't believe it's finished already. I'm amazed and how quickly it went by. I guess all that's left now is to collect more and analyze the data. I plan on the kids doing the survey this week and doing the interviews next week during state wrestling and just catching the kids that are still here.

Looking back- I should have graded the pre/post test before I did the interview and survey. That way I would have had different questions to ask. I'm not sure how I could have improved the interview. It really wasn't useful at all and I know that's my fault. They didn't take to it well and I tried doing in alone, in small groups and in big groups and still no useful information.

APPENDIX B

POWER POINTS

Nervous System

- Master control and communication system
- Has three overlapping functions
  - Sensory receptors monitor changes inside and outside the body
    - Change – a stimulus
    - Gathered information – sensory input

Nervous System

- Processes and interprets sensory input
  - Makes decisions – integration
- Dictates a response by activating effector organs
  - Response – motor output

Basic Divisions of the Nervous System

- Central nervous system (CNS)
  - Brain and spinal cord
  - Integrating and command center
  - Interprets incoming messages
  - Dictates motor responses based on past experiences, reflexes and current conditions

Basic Divisions of the Nervous System

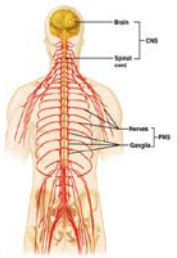

Figure 12.2

Sensory Input and Motor Output

- Sensory (afferent) signals picked up by sensor receptors
  - Carried by nerve fibers of PNS to the CNS
- Motor (efferent) signals are carried away from the CNS
  - Innervate muscles and glands

Sensory Input and Motor Output

- Divided according to region they serve
  - Somatic body region
    - External to ventral body cavity
    - examples
  - Visceral body region
    - Viscera within the ventral body cavity
    - examples

Basic Divisions of the Nervous System

- Results in four main subdivisions
- Somatic sensory
  - General somatic senses – receptors are widely spread
  - Senses are experienced on the skin and body wall
    - ex. touch, pain, vibration, pressure, and temperature

APPENDIX C

CLASS NOTES

Chapter 12 Outline

I. FUNCTION OF THE NERVOUS SYSTEM
- A. monitors changes inside and outside the body
  1. uses sensory receptors
  2. stimulus – each of these changes
  3. sensory input – the gathered information
- B. processes and interprets sensory input and makes decisions
  1. integration – process of making decisions
- C. dictates a response
  1. effector organs – muscles or glands that respond
  2. motor output - the response that is dictated

II. BASIC DIVISIONS OF THE NERVOUS SYTEM
- A. 2 Basics divisions
  1. CNS – central nervous system
     a. consists of brain and spinal cord
     b. integrating and command center
     c. interprets incoming messages
     d. dictates motor responses based on past experiences, reflexes and current conditions
  2. PNS – peripheral nervous system
     a. consists mainly of nerves that extend from brain and spinal cord
     b. cranial nerves carry signals to and from the brain
     c. spinal nerves carry signals to and from the spinal cord
     d. link regions of the body to the CNS
     e. ganglia – areas where the cell bodies of neurons are clustered
  3. how they work together
     a. sensory or afferent signals are picked up by sensory receptors in PNS and carried into the CNS
     b. motor or efferent signals are carried away from the CNS by nerve fibers in the PNS to innervate the muscles and glands
  4. further divided according to the body regions they serve
     a. somatic body region
        1. structures external to the ventral body cavity
           a. or structures of the outer body tube
           b. ex. skin, skeletal musculature, bones
     b. visceral body region
        1. mostly contains the viscera within the ventral body cavity
           a. or structures of the inner tube
           b. ex. digestive tube, lungs, heart, bladder
- B. 4 main subdivisions
  1. Somatic sensory
     a. general somatic senses
        1. senses whose receptors are spread widely throughout the outer part of the body

2. senses experienced on the skin and body wall
3. ex. touch, pain, pressure, vibration, and temperature

b. proprioceptive senses or proprioception – “sensing one’s own body”

1. detect the amount of stretch in muscles, tendons, and joint capsules
2. inform you of the position and movement of your body in space

c. special somatic senses

1. confined to relatively small areas
2. ex. hearing and balance, vision, and smell
3. equilibrium = balance

2. visceral sensory

a. general visceral senses

1. ex. stretch, pain and temperature
2. can be felt widely in the digestive and urinary tracts, reproductive organs and other viscera
3. can be referred to the outer tube
4. also nausea and hunger

b. special visceral sense

1. ex. taste
2. localized to the tongue

3. somatic motor

a. general somatic motor

1. signals the contraction of skeletal muscles of the body
2. voluntary nervous system

b. special somatic motor

1. does not exist because muscles are found throughout the body
2. branchiomeric muscles were once considered part of it
3. no longer – now part of general somatic motor

4. visceral motor

a. general visceral motor

1. regulates the contraction of the smooth muscle and cardiac muscle of the body and secretion of many glands
2. make up the ANS – autonomic nervous system
    a. controls the function of the visceral organs
    b. involuntary nervous system

APPENDIX D

LESSON PLANS

Lesson Plan
Day 1-4
Nontreatment Unit

Lecture over Chapter 12 - Fundamentals of the Nervous System and Nervous Tissue in Human Anatomy by Marieb, Mallatt, Wilhelm fourth edition

Lecture is based on my own notes and PowerPoint provided by the book's publishers that I have modified to fit my needs.

Lesson Plan
Day 5-17
Treatment Unit

Lecture over Chapter 13 - The Central Nervous System with my notes and PowerPoint. The lecture had multiple visual activities that were developed by students in my high school that are part of our Virtual Reality program.

Day 8 - Brain Tutor

Brain Tutor is a free app on iTunes that can be found at http://itunes.apple.com/us/app/brain-tutor-3d/id301362928?mt=8. The school has 15 iTouches that I checked out and downloaded the game on. The students used these iTouches and some of their own to play the interactive game for most of the class period. At the end they took a quiz over the major Broadman areas and the sulci.

Day 13 - Webquest on Reflexes
http://webteach.mccs.uky.edu/nursing/nur869/webquests/lab6/lab6.htm

Lesson Plan
Day 18-25
Treatment Unit

Lecture over Chapter 14 - The Peripheral Nervous system with my notes and modified PowerPoint. The lecture will have many visual activities that show the pathways of the peripheral nerves.

Day 18 - Webquest over peripheral nervous system and the senses
http://www.wyndmere.k12.nd.us/Web/html/bodysys/bswq.htm#Nervous

APPENDIX E

PRE, POST AND DELAYED UNIT ASSESSMENT

1. Draw a neuron and label the axon, cell body, dendrites, nucleus, Schwann cell, and impulse direction.

2. List the three basic subdivisions of the brain stem and list a major function of each.

3. Name 5 of the 12 pairs of cranial nerves and describe the structures innervated by each.

4. Give an example of a reflex and an evolutionary justification for that reflex.

APPENDIX F

INTERVIEW QUESTIONS

1. Do you feel like you understand the concepts better after playing the brain game? Explain.

2. Was there anything that surprised you or that you feel you misjudged? Yes or no and Explain.

3. Did you find the Webquest interesting?

4. Do you feel more comfortable with this section going into the test? Yes or no and Explain.

5. How do feel about your long-term understanding of the concepts? Explain.

APPENDIX G

INTERVIEW QUESTIONS WITH STUDENT ANSWERS

1. Do you feel like you would understand the concepts if I could find some interactive games? Explain.

Trevor - "brain game helped"

Tiff - "at least it broke things up a little"

Allie " I would really like more games. The computer game was fun and I thought it helped."

2. Was there anything that surprised you or that you feel you misjudged on the test? Yes or no and Explain.

Abby - "No, as long as you do the study guide there shouldn't be any surprises. You just have to do the study guide."

3. Have you ever used a Webquest? If so, did you enjoy it.

Pablo - "it's homework, I do it"

Sky - "like them better"

Chelsea - " I like things that apply to me"

Muntz "I didn't know that's what they were called. They were ok, some are better than others."

4. Do you feel more comfortable with the next section, circulation? Explain.

Trevor - "No more or less than any other."

5. How do feel about your long-term understanding of the concepts? (ie do you think this is helping you prepare for college?) Explain. (turned in to what do like about knowing what you know)

Brooke - " I love when I know what that is"

Jesse - "I love when I can call them on something that is ridiculous"

Tiff - "I like going to the doctor and sound smart"

Sky - "I like to tell people that you can get chicken pox in your vagina"

- "I like being able to talk to each other"

6. What is your least favorite way to learn?

lecture - Nick and Skyler and Jesse

Ben - Read out of the book - "go read it and come back and we'll talk about it"

Nick - reading the book is "a complete waste of my time", "there's no chance to ask questions"

Brooke - " I don't mind reading on my own, I just want to be able to discuss it after"

FACEBOOK

How do feel about using the podcasts? Did it help you remember things?

Chelsea - "I am amazed at how much I can still remember. I'm not sure if the videos helped but I like when I can tie a picture to a memory or a story."

What do you mean "tie it to"?

"I mean when I can remember you discussing something or telling a story that goes with something instead of just reading it in the book or seeing one picture."

" I can remember that part of the brain because it was on the app. because I went over it again and again and think I could still do it"

Allie- “I think it helped me prepare greatly for college. I could already see a huge help it gave me in my dual enrollment classes at mcc and feel much more comfortable going into a science field next year”

Parrish - I liked the little videos. It was a nice little change of pace.

Muntz- “I would say my understanding of the subject has increased greatly because of the activities included during class time. Doing labs has really helped me to understand the concepts."

APPENDIX H

ONLINE SURVEY

1. Rank your favorite way to learn anatomy concepts

games

reading from the textbook

video

labs

lecture

webquests

Other (please specify)

2. Do you think you learned the brain areas well from Brain Tutor?

yes

no

sorta

3. Would you like to do Webquest again with another unit?

yes

no

yes, with changes (please specify)

4. Are there any other activities that you would like to do in class that we don't do? (ideas from other classes)

APPENDIX I

ON-TASK CHECKLIST

	Lecture		Lab		Lecture		Comp. Lab		Guest speaker	
Dates	01-05	01-05	01-07	01-07	01-12	01-12	01-14	01-14	01-19	01-19
1	+	-	+	+	+	+	+	+	-	+
2	A	A	A	A	A	A	+	+	+	+
3	-	+	-	+	+	A	+	+	+	-
4	+	-	-	+	+	A	+	+	+	+
5	+	+	-	+	+	A	+	+	+	+
6	-	-	-	+	+	+	+	+	+	+
7	+	+	-	+	+	+	+	+	+	+
8	-	+	-	+	+	-	+	+	+	+
9	+	+	-	+	+	+	+	+	+	+
10	+	-	-	+	-	+	+	+	+	+
11	+	-	-	+	-	-	+	+	+	+
12	+	-	-	+	+	+	+	+	+	+
13	+	+	-	+	+	+	+	+	A	A
14	+	+	-	+	-	+	+	+	+	+
Avg. on-task	77%	46%	100%	100%	77%	85%	100%	100%	92%	92%

+ = on-task
- = not on-task
A = absent

First Treatment Unit

	Lecture		Lecture		Comp. Lab	
	01-20	01-20	01-25	01-25	01-28	01-28
1	-	-	+	+	+	+
2	+	+	+	+	A	A
3	+	-	-	-	+	+
4	A	A	+	+	+	+
5	+	+	A	A	-	+
6	-	-	+	+	+	+
7	+	+	+	+	+	+
8	+	-	+	+	+	+
9	-	+	+	-	A	A

10	+	+	+	+	+	+
11	+	+	+	-	A	A
12	+	+	+	+	+	+
13	+	+	+	-	+	+
14	-	+	+	-	+	+
Avg. on-task	69%	69%	92%	62%	89%	100

Second Treatment unit

	Lecture		Lecture		Lecture		quiz	
Dates	02-01	02-01	02-03	02-03	02-08	02-08	02-10	02-10
1	+	+	+	-	+	+	+	+
2	+	-	+	+	+	+	+	+
3	+	+	+	+	+	+	+	+
4	+	-	-	+	+	+	+	+
5	A	A	+	+	+	+	+	+
6	+	+	+	+	+	+	+	+
7	+	+	+	+	+	+	+	+
8	+	+	+	+	+	+	+	+
9	A	A	+	-	+	+	+	+
10	+	-	+	+	+	+	+	+
11	+	-	-	+	+	+	+	+
12	-	+	-	+	+	+	+	+
13	+	+	+	-	+	+	+	+
14	-	+	+	-	+	+	+	+
Avg. on-task	83%	67%	79%	100%	100%	100%	100%	100%

APPENDIX J

JOURNAL PROMPTS

1. What worked well today? (length, flow, notes) Explain.

2. Was there any time that didn't seem to flow well? Explain.

3. Did the technology all work today? If not how can I troubleshoot it before it goes bad next time? Explain.

4. Does anything need to be moved? Explain.

5. Does anything need to be omitted? Explain.

6. What addition visual activities need to be added? Explain.

7. Are you more or less comfortable about this unit? Explain.

APPENDIX K

TIMELINE

Start Project Implementation: January 4, 2011
Nontreatment Unit, 1 week - Nervous System Overview and Nervous Tissue
January 4, 2011 - January 7, 2011
Lecture 1/4-1/6
Video 1/7
on-task checklist on 1/5 and 1/7 and every Tuesday and Friday after that.
preunit assessment 1/4
Treatment Unit 2 -3 weeks - The Central Nervous System
Lecture with added visual activities 1/10-1/13 and 1/17-1/20
Brain Tutor game on 1/14
Webquest on 1/21
Interviews on 1/24
Treatment Unit 2 - 2 weeks - The Peripheral Nervous System
Lecture with added visual activities 1/24-1/27 and 1/31-2/3
Webquest 1/28
Senses Lab 2/4
Interviews on 2/7
Post test 2/8
End Project Implementation: Approximately February 10, 2011

APPENDIX L

SURVEY RESULTS

Human Anatomy - Unit 5

Response Summary
Total Started Survey: 13
Total Completed Survey: 13 (100%)
PAGE: HUMAN ANATOMY SURVEY

1. Rank your favorite way to learn anatomy concepts
answered question 13
skipped question 0

Response	Percent	Response Count
reading from the textbook	0.0%	0
video	30.8%	4
labs	46.2%	6
lecture	23.1%	3
games	**61.5%**	**8**
other	0.0%	0

2. Do you think you learned the Nerves unit well?
answered question 13
skipped question 0

Response	Percent	Response Count
yes	30.8%	4
no	23.1%	3
sorta	**38.5%**	**5**
sorta (please specify)	7.7%	1

3. Would you like use games or apps again with another unit?

Response	Percent	Response Count
yes	**100.0%**	**13**
no	0.0%	0
yes, with changes (please specify)	0.0%	0

4. Are there any other activities that you would like to do in class that we don't do? (ideas from other classes)
answered question 8
skipped question 5
Response Count

5. Which chapter from the unit did you feel like you understood the best?
answered question 13
skipped question 0

Response	Percent	Response Count
Ch 12 - Nerves	38.5%	5
Ch 13 - The Brain	**53.8%**	**7**

Ch 14 - Peripheral Nerves	7.7%	1
Other (please specify)		0

6. Understanding that lecture will be the majority of the presentation of the class will be lecture, what additions do you think help the most?
answered question 13
skipped question 0

Response	**Percent**	**Response Count**
Power Point slides	7.7%	1
Images on the Power Points	7.7%	1
short videos during lecture	0.0%	0
podcasts during lecture	0.0%	0
Discussions	**84.6%**	**11**
Other (please specify)	0.0%	0