LET'S PLAY: USING GAMES IN THE SCIENCE CLASSROOM TO REDUCE STUDENT STRESS AND INCREASE CONTENT UNDERSTANDING

by

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In presenting this professional paper in partial fulfillment of the requirements for a master's degree at Montana State University, I agree that the MSSE Program shall make it available to borrowers under rules of the program.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

The impact of using games in the classroom to reduce student stress and increase content understanding was studied in a seventh grade life science classroom. An additional area of focus was the effect games had on classroom climate. Prior to treatment, classroom games were not used in the classroom. Data Collection Instruments consisted of a Classroom Attitude Survey administered before and after treatment, assessments before and after treatment, student interviews and a teacher journal of reflections and observations. A variety of games were used during the teaching of a unit on digestion and at the end as a review before the summative assessment. The results showed little improvement in content understanding or student stress. An improvement in classroom climate was observed with students arriving on time to class with an excitement to play the games.

INTRODUCTION AND BACKGROUND

The Medfield public schools have been focused in recent years on student stress. The students I teach go to school at Thomas A. Blake Middle School in Medfield, Massachusetts. It is a moderately affluent suburb of Boston with an estimated population of 12,660 and a median family income in 2010 of $132,012 per year (Advameg, 2013). Blake Middle School is a sixth through eighth grade middle school with an enrollment of 695 students (Massachusetts Department of Elementary and Secondary Education, 2012). I currently teach seventh grade science to four life science classes. It is not a racially diverse community with 91% of the school population being Caucasian (Massachusetts Department of Elementary and Secondary Education, 2012). Medfield is a community with parents motivated to see their children do well in school. Our students often experience the stress of wanting to do well on tests and quizzes and if games will help reduce test related anxiety, it would be an important strategy for teachers in our district to use.

Medfield's focus on student stress is of no surprise, considering the difficult time the neighboring town of Needham, Massachusetts has had with teen suicides. From 2004 to 2006, four teens from Needham committed suicide (O'Brien, 2007). This has caused the town of Needham to take a closer look at many factors that may have played a part in the situation, including student stress. Medfield, as a neighboring town, has also focused their attention on student stress. As a classroom teacher in Medfield, I am always mindful of the level of stress the students in my classroom are experiencing and look for ways to reduce student stress.

Student stress can arise from a variety of sources and academic grades are certainly one of them (Balamurugan & Kumaran, 2008). In a high-performing district

such as Medfield, the expectation is that the children will do well in school, and this push for grades can result in a great deal of stress for students who are struggling to achieve good grades. I have found that students appear to be much less stressed before assessments if they have had plenty of class time to prepare. Prior to assessments, I have had positive results with going over the material in a traditional manner, having the students fill out a study guide followed by a game, to review the concepts in a light-hearted manner. Using games in the classroom has seemed to help some of my students struggling with stress.

Stress is a factor for both teachers and students and having some fun in the classroom is a strong stress releaser for both. In working with seventh grade students, I have found that taking the time to play has helped lighten up even the most serious students and has created a relaxed classroom atmosphere. Games in the classroom have been an important way for me to blend content work with play to reduce the stress for all.

To evaluate student opinions regarding the use of games in the classroom prior to the research, 12 students in my life science classes were interviewed. The students consisted of four high-level students, four average students and four low-level students. The students were questioned on whether they remembered specific instances of games being used in their classes and if they recalled the content that a specific game was covering. Test anxiety was also addressed and questions were asked to discover the strategies that help students alleviate test anxiety. All but one student was able to easily recall an instance of a teacher using a game in the classroom, and those that remembered a game were also able to describe the game they played. Of the 11 students who were able to recall the games, only one was not able to describe the content the game was

teaching. All 12 students reported that games in the classroom help them to understand the material being covered.

Ten of the 12 students responded that they found the games fun, and interestingly the one student unable to recall a specific instance of a game being played did respond that he enjoyed games in the classroom. One student was ambivalent about playing games to review for a test or quiz. This student responded that, “Games don’t make any difference. I learn just as well when the teacher just talks.” One student added additional information when asked if they enjoy games, “Games are fun because they are hands on and that is how I learn.” Students were also asked if games help them feel less nervous before tests. Four students felt that playing review games before a test helps them to feel less nervous. One reported that, “Playing a review game before a test helps me to see what I still need to study.”

The majority of students responded positively about the use of games in their classrooms and could recall the content being covered in those games. Eleven of the 12 students were able to clearly remember the subject matter taught during the game which supports the idea that games may help with content retention. Working in teams, when playing games, was enjoyed by all but one student. The team work skills developed in collaborative games may help students feel less stressed around peers in the future.

The focus of this study was to investigate the effects of using games in the science classroom to reduce student stress and increase content understanding prior to assessments. An additional sub-question is the effect games have on classroom climate. I hope that in sharing the results of the research with my colleagues we will be able to develop strategies to assist in reducing stress among our students.

CONCEPTUAL FRAMEWORK

Public education in the United States has been under fire since the release of *A Nation at Risk: The Imperative for Educational Reform* (Gardner et al., 1983). At that time, the College Board SAT test scores were dropping, increasing numbers of students were in need of remedial services upon entering college, and comparisons of students in the United States compared to students in other countries were not reflecting well on our students here in the U.S. (Gardner et al., 1983). Increased focus on the public school system resulted and the No Child Left Behind Act (NCLB) was developed to address the concerns with education. NCLB mandates an increase in state testing to monitor progress, or lack thereof, and more attention to time in learning has increased the rigor of the school day for students (U.S. Department of Education, 2002). In reviewing the progress since NCLB was enacted in 2002, the percent of college preparation courses offered at high schools has increased, but the reading scores of our students has not (Department of Education, 2008). It seems as if students want to do well, as seen in the increase in students taking college prep courses, but the lack of an increase in their reading scores reflects that students have not significantly improved their basic skills. When students are expected to perform above their ability level and endure a school day without a break, an increase in stress will result (Elkind, 2001).

Student stress created by an increase in demands has become a focus in many schools. The quick answer would be to reduce academic rigor, but our gifted students can suffer from a lack of academic rigor (McCollister & Sayler, 2010). The challenge arises in finding a way for schools to increase rigor without imposing too much stress on their students.

Stress can either immobilize or motivate someone to achieve and occurs when there is an imbalance between demands and an ability to cope with those demands (Sedere, 2010). As schools strive to increase rigor, it is important to provide opportunities for healthy stress, eustress, for students, but to be mindful of students lacking the skills to deal with stress (Suldo et al, 2008). Children have varying degrees of abilities and those with difficulties learning must always be closely monitored for stress. In Japan where "do or die" examinations dictate a child's academic future, many students have developed a school allergy. The stress of the examinations have manifested as true illness in some children (Seldere, 2010). In Hong Kong, where girls experience much greater pressure from families to do well in school, more social bullying has been found when there is an increase of academic stress (Leung & To, 2009). Not only can stress negatively affect the well-being of an individual child, but also the children around them.

Student stress can arise from sources other than high-stake tests. In the drive to be the best in a classroom, students can feel the pressure of not measuring up to a parent's expectation. Students will give up all they enjoy when cultural, economic, or parental pressure drives them to achieve perfection (Brown et al., 2009).

Often children suffer the most stress when academic expectations exceed their ability (Elkind, 2001). This stress can result in a reduction of student achievement. In multiple studies, student stress was evaluated in low-income minority students and it was found that with increased stress, student grade point averages (GPA) went down (Alva & de los Reyes, 1999; Cunningham et al., 2002; Gillock & Reyes, 1999). As schools strive to up the ante in the fulfillment of NCLB, the stress response of their students may actually have a negative impact on their scores.

In a different study on the effect of stress on a students' GPA, non-minority students in a high-achieving program were evaluated and the research showed that the increase of academic stress did not lower their GPA, but it did affect the mental health of the students (Suldo et al., 2008). For these high-achieving students, the stress motivated them to do well, but it did take a toll on their overall health.

Academic achievement is not the only stressor affecting children today. Our children are busier and busier, frequently shuttled from one activity to another and the many activities they participate in affect their stress level. Students with many activities felt an increase in their stress level when it was combined with two or more hours of homework each night. When asked what they would do if they had more free time, they would choose to spend more time relaxing with their friends (Brown et al., 2011). Children innately understand the benefit of time spent with peers and the correlation of that time together with stress reduction.

Helping children cope with stress creates a healthy environment for them. Children who are able to cope positively with stress have similar characteristics of "social competence, impression management, self-confidence, independence and achievement" (Elkind, 2001). Providing opportunities during the school day for students to develop these characteristics is critical and may help with their abilities to deal with stress. Yoga, reading, and humor have also been found to reduce student stress. Engaging students in these types of activities will help them learn lifelong skills which may help them cope with stress (Rizzolo et al., 2009). In addition, it was found that the social structure of school can be a great source of stress, and classrooms that assist students in navigating the social world of their peers will help them be more at ease and experience less stress in

school (Swick, 1987). Activities that encourage and develop confidence and social interactions can only help students suffering from stress. The interaction of participating in games in the classroom supports social development as students compete, or work together to complete the task assigned (Nemerow, 1996). This experience provides an opportunity for students to learn social skills.

Games have long been used in classrooms to enhance education and they may also aid students by exposing them to the skills necessary to cope with stress. Games in the classroom equate to a session of play and in studies of the brush-tailed rat, *Octodon degus*, rats playing with their rat peers improved their social and emotional health (Colonnello, 2011). Perhaps, in turn, students will improve their social and emotional health by playing with each other. Games will also improve a student's peer relations which in turn will help mediate a form of stress for many students (Nemerow, 1996).

It is also important to provide students with experiences of eustress during their school day. Competition can provide opportunities for eustress, and for many that drives motivation. Playful opportunities of competition in the form of a classroom game allows for eustress under the watchful eye of a classroom teacher. While teaching with games the teacher must be mindful of students for whom this may cross the line and become a stressful experience. In a study of classroom games it was found that events that are tied to strong emotions, whether happy or sad, are remembered longer (Nemerow, 1996). If a game in the classroom makes students happy, then there is a greater chance that the concepts taught within the game will be remembered longer.

Along with providing students with skills to reduce stress, games may also enhance student understanding. Students interviewed a year following a learning

experience using a game reported that they retained the information for a longer period of time (Nemerow, 1996). Interestingly, students exposed to a game method of learning acceleration and velocity in a computer simulation alone resulted in a decrease of academic achievement although they did report a higher level of enjoyment with the learning activity. Students became so focused on getting more points to win that they forgot about the learning concept being taught. When the game was partnered with a metaphor, academic achievement increased. Games used alone, without careful thought to helping students isolate the content, will not always equate to academic success (Rieber & Noah, 2008).

The public education system in the United States is focused on continuing the path to academic excellence (U.S. Department of Education, 2002). In monitoring and enacting programs to ensure this improvement, students suffer stress from the high stakes assessments and the push to succeed. In the classroom, teachers must provide opportunities to help students experience eustress and to help those who lack the resources to deal with their stress (Elkind, 2001). Using games as a teaching strategy can provide opportunities for students to develop the skills to relate to their peers which also nurture skills critical in dealing with stress (Colonnello, 2011). Games in the classroom will also provide memorable experiences that will help students remember the information covered in the game (Nemerow, 1996). Games can help a teacher put some play into a child's day along with reducing stress and increasing retention of the information taught.

METHODOLOGY

I studied the impact of using games in the classroom to reduce student stress and increase content understanding. An additional focus was the effect of games on classroom climate. Prior to beginning the research, an Informed Consent Exemption Form was signed by the principal of Thomas A. Blake Middle School, Nat Vaughn (Appendix A). The research methodology for this project received an exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was maintained. The treatment consisted of teaching a unit on digestion to four seventh grade classes ($N = 80$) incorporating classroom games during the unit and again at the end as a tool for reviewing. Prior to the treatment, classroom games were not used as a teaching tool in the classroom.

The treatment consisted of using classroom games while teaching a unit on digestion. The first game was a Digestion Bingo game to introduce the vocabulary that would be used in the unit (Appendix B). The Digestion Bingo game was played again later in the unit with more difficult questions about the functions of the organs to check on understanding. After learning about diseases of the digestive system, the Digestion Board Game was played to evaluate the understanding of the possible diseases/problems of the digestive system (Appendix C).

Figure 1. Students playing the Digestion Board Game.

The final game was the Digestion Review Chain Game to prepare for the summative assessment (Appendix D). This game consisted of questions on strips of paper that students answered in teams. When the questions were answered correctly they were linked together and the next question strip was given to the partnership. The longest chain would win and the students were sent home with all the questions and answers to review for the test.

A variety of data collection tools were used to evaluate the effect of classroom games as a teaching strategy. To evaluate the effect of classroom games on stress levels, confidence and opinions of classroom climate, the Classroom Attitude Survey using a

Likert scale was administered to all students prior to the treatment and again following the treatment (Appendix E). A Likert scale rating of *never, almost never, almost always,* and *always* was used. The answers were also rated 1-4 respectively, allowing the answers to be averaged and then compared pre and post-treatment.

The Games in the Classroom Interview Questions were also used prior to the treatment (Appendix F). A sample of 20 students comprised of an equal number of boys and girls and a mix of ability levels were interviewed. The interview was repeated post-treatment and the results were used as a comparison to the data gathered in Classroom Attitude Survey.

The impact of classroom games on content understanding was evaluated using the Digestion Assessment given before and after the treatment unit to compare gains in understanding of the material (Appendix G). The Digestion Summative assessment had additional questions including an open response question, but data from those questions were not used in the comparison to the pre-assessment (Appendix H). A comparison of the average grades on summative assessments in non-treatment units and the treatment unit was used to evaluate the overall success of students during the treatment unit. The score on the entire Digestion Summative Assessment was used for this comparison.

In addition to the survey and interviews, I kept a journal during the process of the research. Journal entries included both my reflections and classroom observations. The journal provided data on classroom climate, and student stress level along with interesting comparisons to student interview and survey data. The forms of data collection are outlined in the Data Triangulation Matrix: Using Games in the Classroom to Reduce Student Stress and Increase Content Understanding (Table 1).

Table 1
Data Triangulation Matrix: Using Games in the Classroom to Reduce Student Stress and Increase Content Understanding

Data Collection Instrument					
Focus Question	Pre-treatment Classroom Attitude Survey	Post-treatment Classroom Attitude Survey	Pre-treatment and post-treatment Assessments	Student Interview Pre- and post-treatment	Teacher Journal (reflections and observations)
Will games reduce student stress?	X	X		X	X
Will the use of games increase content understanding?	X	X	X	X	X
How will the use of games affect classroom climate?	X	X		X	X

DATA ANALYSIS

A comparison of the results of the Classroom Attitude Survey taken before and after the use of classroom games showed an improvement in the average response of students *almost never* feeling confident to *almost always* feeling confident before tests and quizzes ($N = 80$) (Figure 1). Students *almost always* feel nervous before tests and quizzes and there was no change in that response with the addition of classroom games.

In terms of extra help prior to tests, the majority of students *almost never* stay for help, and there was no change in this with the addition of games.

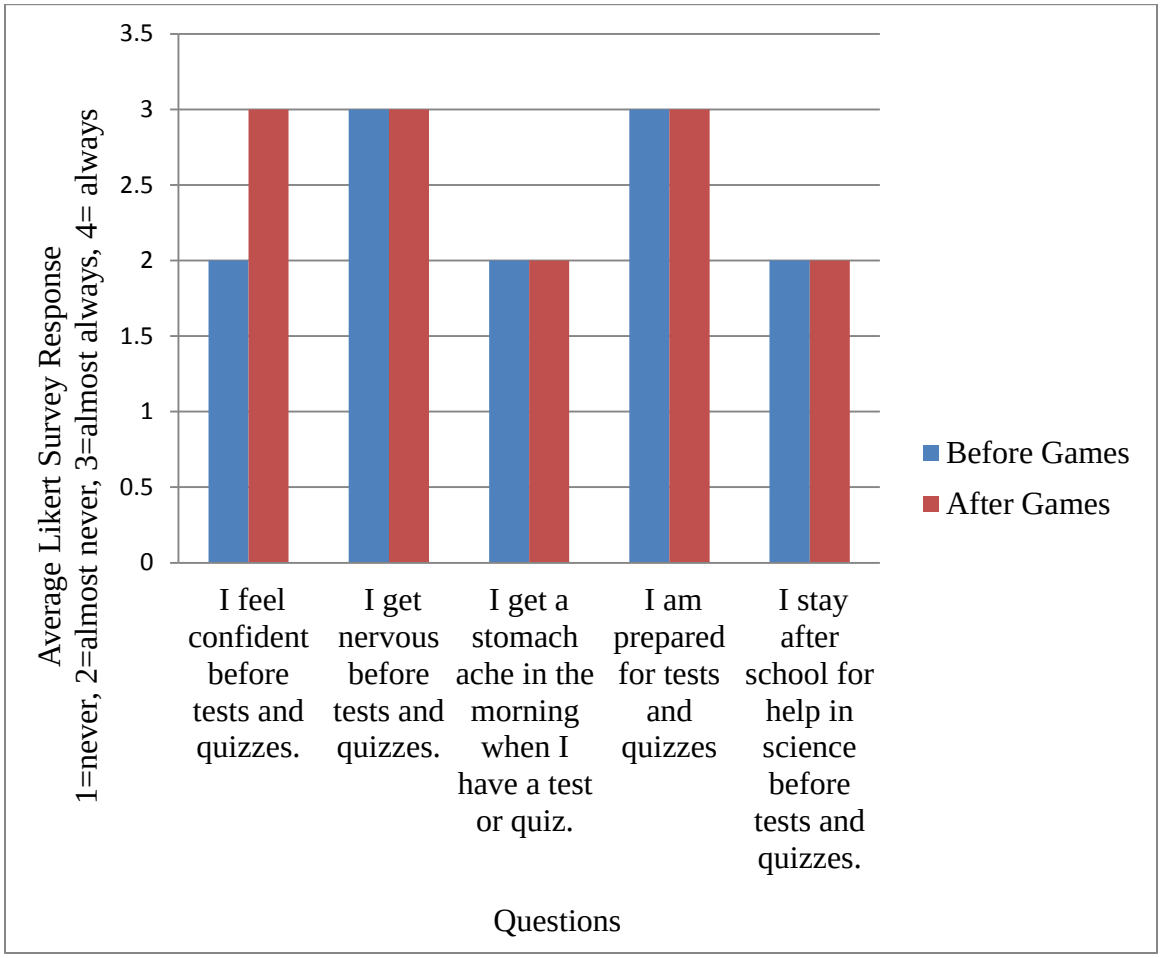

Figure 2. Responses to classroom attitude survey related to test stress, (N = 80).

Students were also interviewed (n = 12) using the Games in the Classroom Interview Questions to evaluate their opinions on the use of games in the classroom prior to using the games (Appendix F). Student stress before assessments is often verbalized by the students as being “nervous.” When students were asked if they get nervous before tests, only two responded that they do not. Students were then asked what helps them to not feel nervous. Six students reported that knowing that they have studied enough helps them feel less nervous, one responded that staying after school with a teacher helps. Four

students felt that review games before a test helps them to feel less nervous. One reported that, “Playing a review game before a test helps me to see what I still need to study.” All students felt that having additional time in class to review the material on assessments helps them to feel less nervous.

Ten of the 12 students responded that they found the games fun. Interestingly, the one student unable to recall a specific instance of a game being played in a classroom did respond that he enjoyed games in the classroom. One student was ambivalent about playing games particularly before a test or quiz. This student felt that “Games don’t make any difference. I learn just as well when the teacher just talks.” One student brought up the condition of groups in games, “Games are fun most of the time. But it depends on who is in your group. Sometimes the people you are with can be a pain.” Two students added additional information when asked if they enjoy games and added that, “Games are fun because they are hands on and that is how I learn.”

In terms of homework, there were no changes in the average response to questions pre and post-treatment (Figure 2). Students, on average, *almost never* spent more than two hours on homework and *almost never* got stressed when completing their homework. Having time in their schedules to complete homework was not a concern for most with most reporting that they *almost always* had enough time in their schedules to complete their homework. On average, students *almost never* felt stressed by homework.

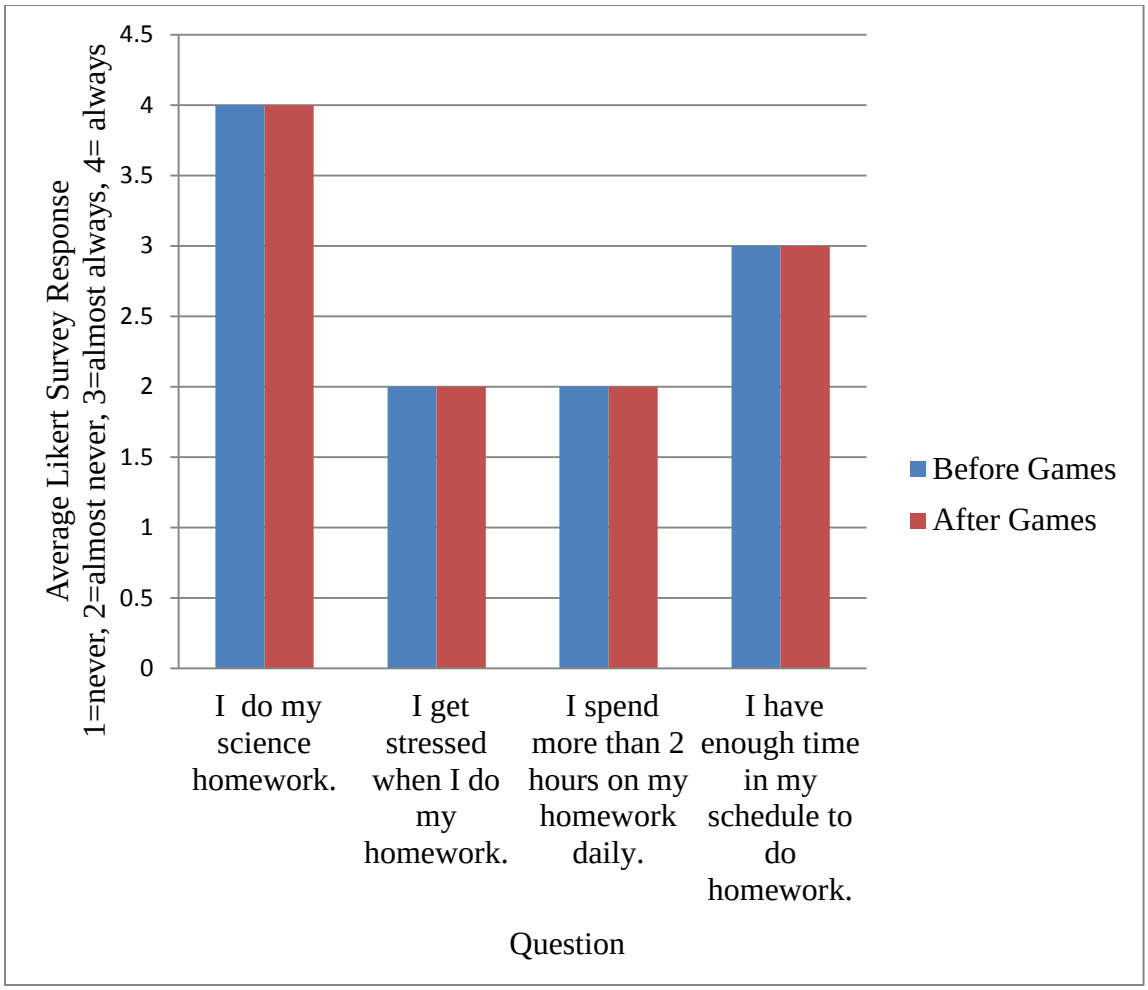

Figure 3. Responses to Classroom Attitude Survey related to homework, (*N* = 80).

Questions relating to the students' comfort level in class also showed little change pre and post-treatment (Figure 3). Most students were *almost always* happy to come to school and the addition of games in the classroom did not change the result. In the science classroom the average response was that students were *always* comfortable in science class. Most students *almost always* like to raise their hands and talk in science class, and *almost always* enjoy working with other students. The majority of students report that they *almost always* have fun in science class. The only change in responses pre and post-treatment related to classroom comfort was seen in late arrival to class. Prior to treatment the average response was *almost never* and after treatment the average

response was *never*. Teacher journal entries also observed students running into class excited to find out if it would be a “game” day.

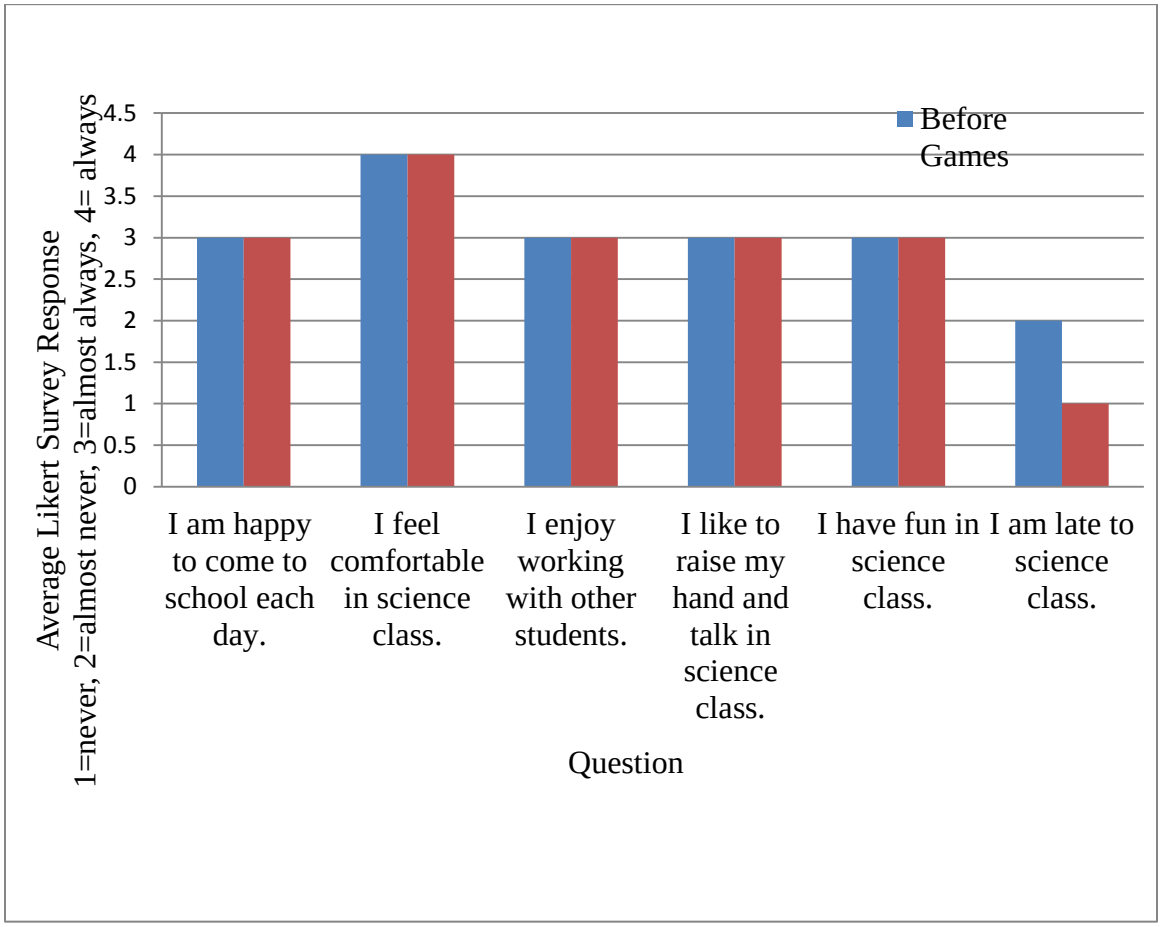

Figure 4. Responses to Classroom Attitude Survey related to classroom comfort, (*N* = 80).

To evaluate the possibility of the game itself causing stress, students were asked how they felt about having winners and losers in classroom games using the Games in the Classroom Interview Questions (Appendix F). Of the 12 students interviewed, 11 students were comfortable with having winners and losers, “Teachers sometimes have everybody be winners and it’s just not as much fun!” One student didn’t care for winners and losers saying, “I don’t like it. Sometimes you lose and you still know the material. Losing doesn’t mean you don’t know.” Similar results were found when the students

were asked about their feelings regarding playing games in teams. In terms of working with teams, 11 of the 12 enjoyed working in teams, “I like teams because we get to network with our friends.” One student preferred to work alone, but did not explain why. Notes in the teacher journal also reflected students feeling comfortable during classroom games. There was one instance of a student feeling stressed by the game, but this student had also struggled with the work in this unit.

A comparison of the Digestion Assessment (Appendix G) given before the teaching unit incorporating games and after the unit showed an improvement in the average score from 41% to 94% (Figure 4). As seen in the scatter plot, the range of scores on the pre-assessment was much larger than on the post-assessment. All students showed a gain in understanding of the concepts taught.

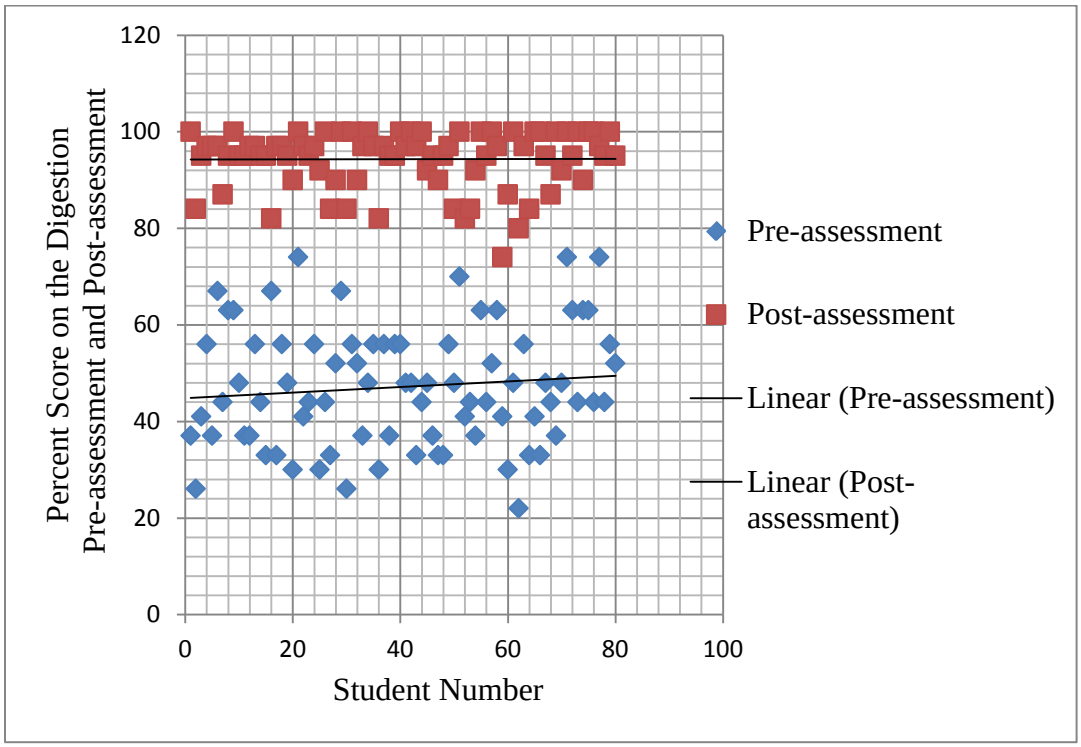

Figure 5. Comparison of student scores on the digestion assessment, (*N* = 80).

A comparison of scores on summative assessments prior to the treatment unit compared to the summative assessment for the treatment unit showed no improvement in the average grade due to the classroom games (Figure 5). The class average of the summative assessment was 87% while the previous units had scores of 90% and 88% respectively.

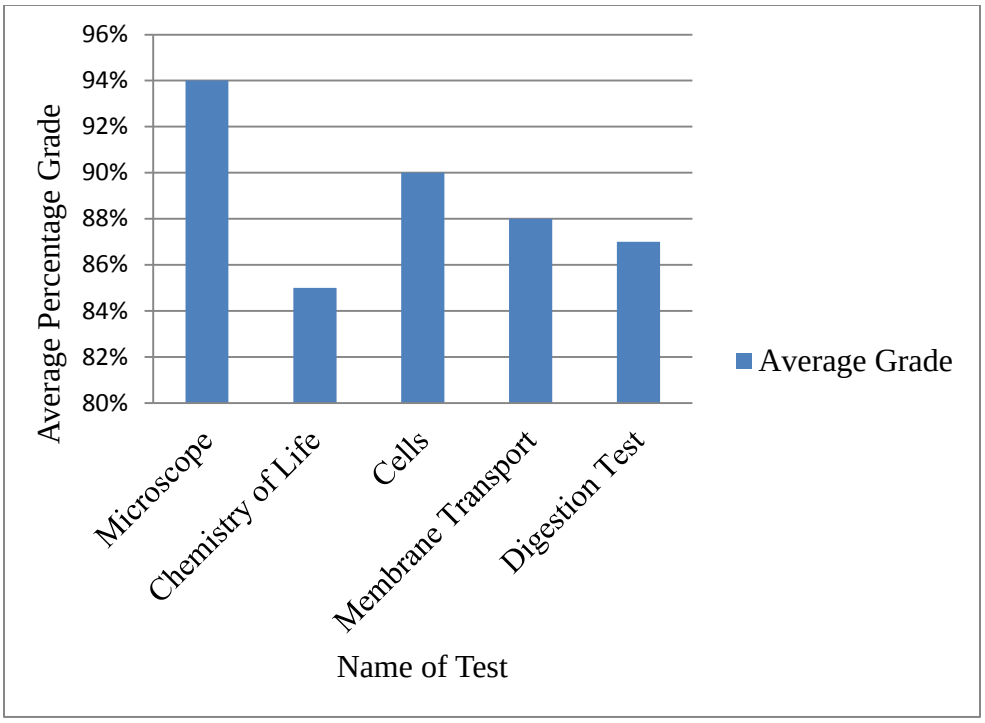

Figure 6. Average scores of summative assessments, (*N* = 80).

In answering the Games in the Classroom Interview Questions centered on whether games help content understanding, all but one student was able to easily recall an instance of a teacher using a game in the classroom (Appendix F). The same students were also able to describe the game they played. Of the 11 students who were able to recall the games, only one was not able to describe the content the game was teaching. The student unable to recall the content is a struggling learner. All 12 students reported that games in the classroom help them to understand the material being covered. In the

teacher journal there were notes indicating concern regarding students not participating in the final review game, and it was also noted that those same students did not do as well on the post-assessment.

INTERPRETATION AND CONCLUSION

According to this study, the use of games in the classroom provided little reduction of student stress and little improvement in content understanding. The results of the Classroom Attitude Survey showed little change pre and post-treatment with the exception of two questions that reflects a small reduction in students stress. When asked if they felt confident before tests and quizzes, student responses improved from *almost never* to *almost always*. When students' feel confident before assessments, they experience reduced stress as was reflected in the research (Elkind, 2001). Interviews and teacher observations in my classroom supported students' feelings of confidence before assessments when games were used to prepare.

An indication of improved attitude towards science class with the addition of classroom games was the reduction in students being late to class. This reflected a lower level of avoidance towards class, which in turn indicated a higher level of comfort in class. The addition of games, and the social benefit of working together with peers, helped students feel more comfortable in class and excited to arrive on time each day. Students experiencing stress will benefit from a break in their day in a classroom using games as a teaching strategy.

In terms of content understanding, the assessment data showed little effect of the use of classroom games. The increase in scores from the pre-assessment to the summative assessment did not reflect a dramatic improvement. Medfield is a high-performing district

and most students work hard to do well. The drop in average assessment score compared to previous units was expected as the material we study, and the questions used to assess understanding, become more complex. In the interviews, students did report that they tended to remember the topics they have learned in a game format better, and that may mean the basic information is remembered longer (Nemerow, 1996).

Homework is often a topic of discussion with parents. There are concerns regarding excessive amounts of homework assigned and the stress it causes students. The results of the survey pertaining to homework do not reflect that this was an area of a great deal of stress for my students. In looking at student stress, it is important to evaluate all areas that could potentially cause stress, and students do not report that homework is a major source of stress. With the addition of games in the classroom, additional time needed at home to prepare for assessments was a concern of mine. I was pleased to see that the addition of classroom games did not impact the time spent at home studying.

The use of classroom games had a direct effect on classroom climate. The students were happy to engage in the games, and while playing, I had plenty of time to wander around and check on their understanding. Although the data do not reflect a dramatic improvement in assessment scores, classroom games certainly made their day a little more relaxed and fun. The relaxed atmosphere and joking around during games clearly demonstrated the importance incorporating activities in a student's day to help deal with stress (Rizzolo et al., 2009).

VALUE

In the process of researching the use of classroom games as a teaching strategy, I discovered the importance of gathering data on what I believed to be true. Although I

always informally asked my students their feelings on a lesson, by collecting data from all students, I have a clearer picture of the impact of my teaching decisions on all my students. The skills of collecting data in a classroom are of great value and a critical skill for all educators. I look forward to continuing to use data collection in my classroom, and sharing my results with my colleagues.

In implementing a classroom research project, I have certainly become a better teacher. As my school district strives to always make data driven decisions, it is just as important to make decisions in my classrooms based on data. What I "feel" to be the best way to teach is wound around my own learning style. I need to always step outside of my personal comfort zone and collect data from the different learners in my classroom to discover what will work best in the microcosm of my four classroom walls.

Student stress is not a topic to be underestimated in high performing schools where the expectation is that all students will do well and move on to a competitive college or university. The use of classroom games is not frivolous in this situation, given the need to provide our students with a break from the demands of their school day. Simple classroom games also give students an opportunity to build social relationships, which is so important in alleviating their stress. The games don't need to involve the latest technology and as one student said, "I don't know why the teachers think we have to always use the fancy technology. Sometimes we can just play a game and have fun."

I expect stress will continue to be a topic of discussion in schools. As we help our students navigate the world, it will be important to provide them with skills to deal with their stress while at the same time moving forward with their learning. Games and other activities in the classroom help to break up the day, and teach important coping skills as

groups of students work together towards a common goal (Colonnello, 2011). The development of eustress is also fostered in classroom games. Healthy competition helps students develop resilience in the face of losing (Suldo et al., 2008). Classrooms are not only places for teaching content, but also places where teachers can help foster the development of healthy humans. Although my research does not show a dramatic reduction in student stress, or improvement in content understanding, playing games will continue to be a part of my teaching practices. It can never hurt to have some fun with children.

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APPENDICES

APPENDIX A

EXEMPTION REGARDING INFORMED CONSENT

Exemption Regarding Informed Consent

I, Nat Vaughn, Principal of Thomas A. Blake Middle School, verify that the classroom research conducted by Judith Silva is in accordance with established or commonly accepted educational settings involving normal educational practices. To maintain the established culture of our school and not cause disruption to our school climate, I have granted an exemption to Judith Silva regarding informed consent.

(Signed Name)

Nathaniel A. Vaughn

(Printed Name)

10/26/12

(Date)

APPENDIX B

DIGESTION BINGO

Digestion Bingo

Use the list below to fill in the spaces on your bingo board. Be sure to cross off the words as you write them in. Keep this paper in your binder. We will use it again!

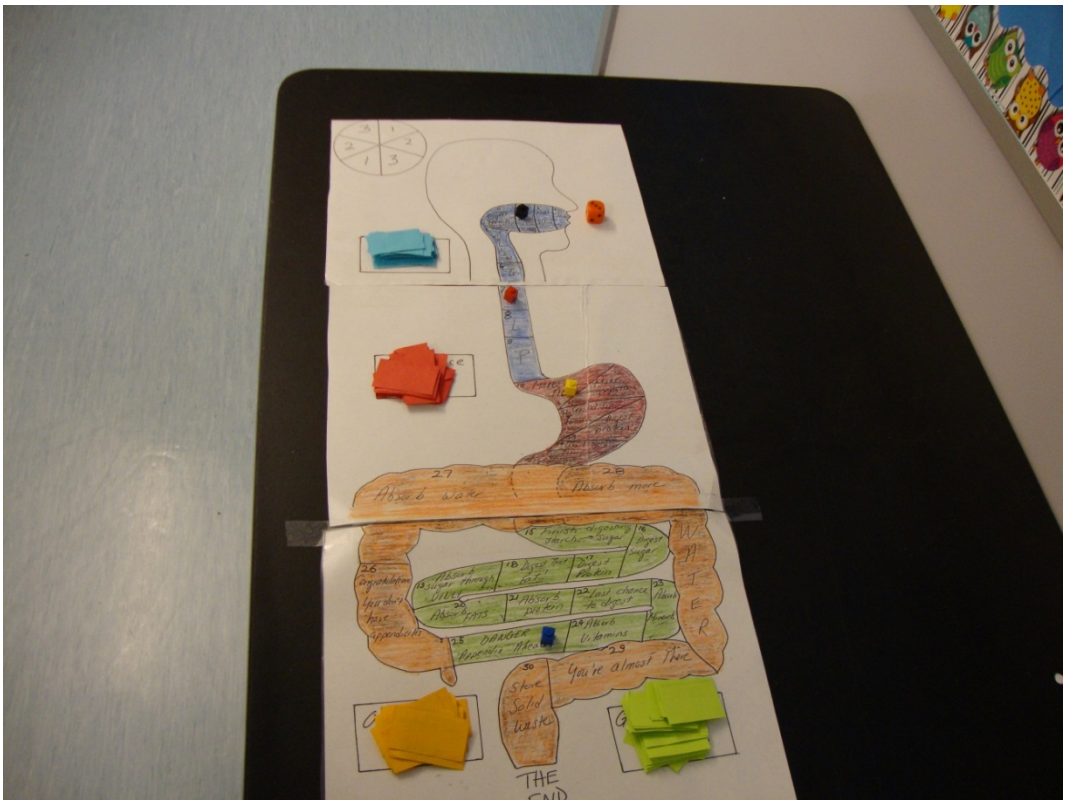
		FREE		

amylase
anus
appendix
bicarbonate
bile
bolus
chyme
duodenum
esophagus
epiglottis
gall bladder
hydrochloric acid
large intestine
liver
lipase
pancreas
pepsin
peristalsis
pharynx
rectum
salivary glands
small intestine
stomach
villi

APPENDIX C

DIGESTION BOARD GAME

Digestion Board Game*



*Created by Wendy Cohen

DIGESTION GAME RULES

1. Roll the die to determine the order of play. Highest number goes first, etc.

2. If necessary, change seats so that you are seated around the table in the order you will play.

3. Roll the die to determine how many spaces you will move.

NOTE: 1 or 4 = move 1 space forward

2 or 5 = move 2 spaces forward

3 or 6 = move 3 spaces forward

4. After you have made your move, you should take a chance card and move as instructed. You must read the card to the group and explain why the circumstance on the card would cause the instructed move.

5. Continue through the digestive system until someone reaches THE END.

NOTE: Although you do not have to roll the exact number to land on

THE END, you must actually leave the digestive system to win.

6. When the first person reaches THE END, the game is over. Record points on your score card as follows;

winner = 4 points

2nd place = 3 points

3rd place = 2 points

4th place = 1 point

7. Begin a new game.

Digestion Game Cards

GREEN CARDS

Ate Ex-lax instead of chocolate MOVE AHEAD 1 SPACE	Villi are not absorbing GO BACK 1 SPACE	Gas attack GO BACK 1 SPACE	You are low on starchase and can't digest bread MISS 1 TURN
Lots of starchase; starch is digested into sugar MOVE AHEAD 2 SPACES	You ate a low fat meal MOVE AHEAD 2 SPACES	Stomach acid denatures your proteinase GO BACK 1 SPACE	Gall stones in gallbladder block flow of bile MISS 1 TURN FOR SURGERY

Active pancreas speeds up digestion TAKE EXTRA TURN	Extra bile produced in liver MOVE AHEAD ONE SPACE	You're not eating enough protein to make enzymes. GO BACK 1 SPACE	GO BACK 2 SPACES
Villi increase the absorption of amino acids MOVE AHEAD 1 SPACE	Lots of Lipase! Digest extra fat for extra energy! MOVE AHEAD 1 SPACE	Peristalsis! TAKE AN EXTRA TURN	Go directly to Square # 22

ORANGE CARDS

You're not drinking enough water- CONSTIPATION MISS NEXT TURN	Diarrhea MOVE AHEAD 2 SPACES	Congratulations – no food trapped in appendix! MOVE AHEAD 1 SPACE	Appendicitis MISS NEXT TURN FOR SURGERY
Go to square #29	Rectum full GO TO THE END!	The anus is a sphincter muscle. GO TO THE END!	Not eating enough fiber. GO BACK 2 SPACES

RED CARDS

Burp! GO BACK 1 SPACE	Stomach flu attacks! MISS NEXT TURN THROWING UP	Looking for the Alka Seltzer GO BACK 2 SPACES	You ate my husband's cooking – stomach needs pumping. GO BACK 1 SPACE
You ate a low protein meal. MOVE AHEAD 2 SPACES	GO TO #15	Ulcer attack! You need to visit the doctor. GO BACK 1 SPACE	You make extra pepsin and digest a lot of protein quickly. MOVE AHEAD 2 SPACES
Hunger pains! MOVE AHEAD 1 SPACE	Peristalsis! MOVE AHEAD 2 SPACES	Grind up that food! GO AHEAD 1 SPACE	Heartburn! MISS NEXT TURN

BLUE CARDS

You didn't chew enough GO BACK TO #1	You tried to swallow too much food and choke. MISS 1 TURN FOR HEIMLICH!	You took too big a bite you pig. MISS NEXT TURN	You have fast acting saliva. MOVE AHEAD 1 SPACE

You need more amylase to digest an extra starchy meal. GO BACK 2 SPACES	Dry mouth slows down digestion. Go back to # 2	GO TO # 4	Peristalsis! MOVE AHEAD 2 SPACES
Swallow! MOVE AHEAD 2 SPACES	You are enjoying a tasty meal. TAKE AN EXTRA TURN	GO TO # 7	Chew! Chew! MOVE AHEAD 1 SPACE

APPENDIX D

DIGESTION REVIEW CHAIN LINK GAME

1	the ball of food formed by the tongue
2	the chemical created by the liver to break down fat
3	A cell can't be as big as an elephant because…….
4	the muscular contractions that occur all along the digestive system
5	Cells with their own job to do are_____.

6	made in the pancreas and neutralizes stomach acid
7	the liquid containing partially digested food, enzymes and water
8	name the enzymes that digest starch, lipids and protein
9	The heart is an _____.
10	stores bile

11	removes the water from the waste
12	Increases the surface area to increase the nutrients being absorbed in the small intestine
13	List the four major kinds of tissue.
14	What are the levels of organization in living organisms?

APPENDIX E

CLASSROOM ATTITUDE SURVEY

Classroom Attitude Survey

Period_____ Male____ Female_____

Please circle your choice below each question. Participation in this research is voluntary and participation or non-participation in this interview will not affect your grade or class standing in any way.

1. I am late to science class.

   Never Almost Never Almost Always Always

2. I feel confident before tests and quizzes.

   Never Almost Never Almost Always Always

3. I am happy to come to school each day.

   Never Almost Never Almost Always Always

4. I get stressed when I do my homework.

   Never Almost Never Almost Always Always

5. I get a stomach ache in the morning when I have a test and quiz.

   Never Almost Never Almost Always Always

6. I enjoy working with other students in science class.

   Never Almost Never Almost Always Always

7. I feel comfortable in science class.

   Never Almost Never Almost Always Always

8. I get nervous before tests and quizzes.

   Never Almost Never Almost Always Always

9. I spend more than 2 hours on all my homework daily.

   Never Almost Never Almost Always Always

10. I stay after school for help in science before tests and quizzes.

Never Almost Never Almost Always Always

11. I have fun in science class.

Never Almost Never Almost Always Always

12. I like to raise my hand and talk in science class.

Never Almost Never Almost Always Always

13. I do my science homework.

Never Almost Never Almost Always Always

14. I am prepared for tests and quizzes.

Never Almost Never Almost Always Always

15. I have enough time in my schedule to do the homework for all my subjects.

Never Almost Never Almost Always Always

APPENDIX F

GAMES IN THE CLASSROOM INTERVIEW QUESTIONS

Games in the Classroom Interview Questions

Participation in this research is voluntary and participation or non-participation in this interview will not affect your grade or class standing in any way.

1. Can you think of a time when you played a game in a classroom related to the subject you were studying?
2. What was the game? Can you describe it?
3. Can you describe the subject matter the game was teaching you?
4. How do you feel when you play a game in class? Is it fun?
5. Do you think games help you to understand the topic being taught?
6. How do you feel about winners and losers in games in the classroom?
7. Do you like the games better when you play in teams? Why?
8. When a teacher plays a game to review for a quiz or test, do you think the game helps you do better on the test or quiz?
9. Do you ever get nervous before tests and quizzes?
10. What helps you feel less nervous before a test and quiz?
11. Is there anything else you would like to share about this topic?

APPENDIX G

DIGESTION PRE ASSESSMENT

Digestion Pre Assessment

Please write your answers on the answer sheet.

Part A- Multiple Choice

1. What is the large, reddish brown organ that produces bile?

a. liver b. small intestine c. pancreas

2. The kind of digestion that involves breaking, crushing, and mashing of food is called

a. bolus b. absorption c. physical digestion

3. Enzymes help digestion by

a. chemically digesting food into small molecules
b. physically breaking up food into small pieces
c. adding water to food

4. The villi increase absorption of nutrients due to

a. increased surface area
b. extra enzymes
c. extra mucus production

5. Pepsin can work only in the presence of

a. acid b. saliva c. bile

6. The gallbladder

a. makes gall b. stores bile c. makes acid

7. Lipase

a. digests lipids b. is an enzyme c. both of these

8. The organ of the digestive system where the most absorption of food occurs is the

a. mouth b. esophagus c. small intestine

9. Food is moved down the esophagus by muscular contractions called

a. peristalsis b. diffusion c. absorption

10. Bile is useful in the digestion of

a. sugar b. fats c. protein

11. Food passes through all of the following digestive organs EXCEPT:

a. gall bladder b. large intestine c. esophagus d. anus

12. Villi are found in the

a. small intestine b. stomach c. large intestine d. liver

13. The muscular organ that squeezes food into chyme is called the

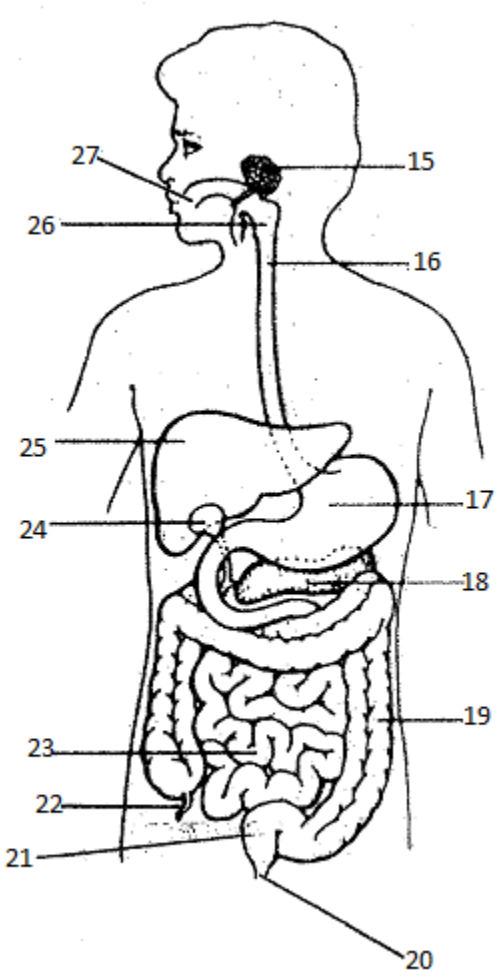
a. appendix b. esophagus c. stomach d. large intestine

14. What do you call the ball of food that is swallowed?

a. absorption b. bolus c. enzyme

Part B - On your answer sheet, label the diagram of the digestive system:

Spelling counts – Use the multiple choice answers above as a word bank.



Name _____ Page _____

Digestion Pre Assessment Answer Sheet

Multiple Choice answers here:

1._____
2._____
3._____
4._____
5._____
6._____
7._____
8._____
9._____
10._____
11._____
12._____
13._____
14._____

Diagram: **SPELLING COUNTS!**

15. _____
16._____
17. _____
18._____
19. _____
20._____
21. _____
22._____
23. _____
24._____
25. _____
26._____
27. _____

APPENDIX H

DIGESTION SUMMATIVE ASSESSMENT

Digestion Summative Assessment

Please write your answers on the answer sheet.

Part A- Multiple Choice

1. Your ____ breaks down the food you eat into nutrients that can be absorbed into your body.

a. endocrine system c. digestive system
b. lymphatic system d. urinary system

2. What is the large, reddish brown organ that produces bile?

a. liver b. small intestine c. pancreas

3. The kind of digestion that involves breaking, crushing, and mashing of food is called

a. bolus b. absorption c. physical digestion

4. Enzymes help digestion by

d. chemically digesting food into small molecules
e. physically breaking up food into small pieces
f. adding water to food

5. The villi increase absorption of nutrients due to

d. increased surface area
e. extra enzymes
f. extra mucus production

6. Which statement explains why amoebas do not grow large enough to be seen with the naked eye?

a. A larger cell has a higher surface-area-to-volume ratio than a smaller cell
b. A larger cell has a lower surface-area-to-volume ratio than a smaller cell.
c. A larger cell has the same surface-area-to-volume ratio as a smaller cell.

7. Pepsin can work only in the presence of

a. acid b. saliva c. bile

8. Two or more tissues working together form an

a. organ. c. opus.
b. organ system. d. opuscule.

9. The gallbladder

a. makes gall b. stores bile c. makes acid

10. Which of the following is an example of an organ?

a. a plant leaf c. heart

b. stomach d. All of the above

11. Lipase

a. digests lipids b. is an enzyme c. both of these

12. A person has about 200 different kinds of cells; each specialized to do a particular job. This means that the person

a. does not need tissues. c. is multicellular.
b. does not need organs. d. is unicellular.

13. The organ of the digestive system where the most absorption of nutrients occurs is the

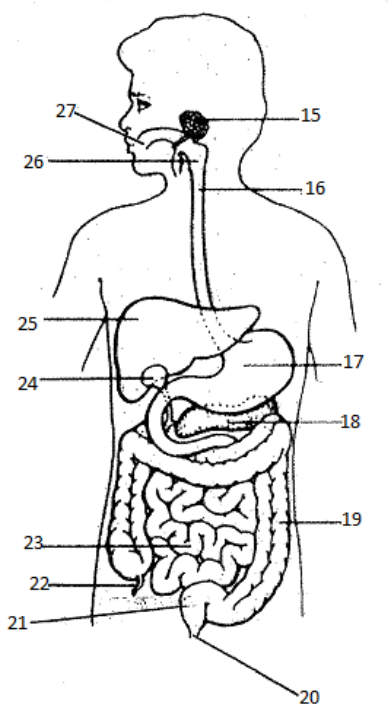
a. mouth b. esophagus c. small intestine

14. It is the role of the _____ to receive and send electrical messages throughout the body.

a. nervous system c. endocrine system
b. lymphatic system d. integumentary system

Part B - On your answer sheet, label the diagram of the digestive system:

Spelling counts – Use the multiple choice answers as a word bank.



Part C- Multiple Choice Continued……..

28. Food is moved down the esophagus by muscular contractions called
    a. peristalsis b. diffusion c. absorption

29. Cells are
    a. structures that contain all of the materials necessary for life.
    b. found in all multicellular organisms
    c. sometimes specialized for particular functions.
    d. all of these

30. Bile is useful in the digestion of
    a. sugar b. fats c. protein

31. Food passes through all of the following digestive organs EXCEPT:
    a. gall bladder b. large intestine c. esophagus d. anus

32. Why is an elephant larger than a human?
    a. It has larger cells than a person does.
    b. It has a larger surface area-to-volume ratio of its cells
    c. It has more cells than a person does.
    d. None of the above

33. Villi are found in the
    a. small intestine b. stomach c. large intestine d. liver

34. The muscular organ that squeezes food into chyme is called the
    a. appendix b. esophagus c. stomach d. large intestine

35. What do you call the ball of food that is swallowed?
    a. chyme b. bolus c. enzyme

36. Different ____ work together in an organ.
    a. organ systems c. organisms
    b. tissues d. prokaryotes

37. The ability for the body to maintain a stable internal environment even though it is very cold outside is called
    a. homeopathy. c. homeomorphism.
    b. homeostasis. d. home control.

38. Which of the following are the major tissues found in the body?
    a. epicranial, dermal, muscle, and connective tissues
    b. dermal, epicotyl, blood, and connective tissues
    c. epithelial, nervous, muscle, and connective tissues
    d. epineural, neural, dermal, and muscle tissues

Part D- Answer the question as directed on the answer sheet.

Name_____ Class Period_____

Digestive System Summative Assessment Answer Sheet

Part A. Multiple Choice- Please put the best answer to the question on the line. ½ point each

1._____

2._____

3._____

4._____

5._____

6._____

7._____

8. _____

9._____

10._____

11._____

12_____

13._____

14._____

Part B- Please write the name of the part of the digestive system on the line. ½ point each

15._____

16._____

17._____

18._____

19._____

20._____

21._____

22._____

23._____

24._____

25._____

26._____

27._____

Part C- Multiple Choice cont. ½ point each

28._____

29._____

30._____

31._____

32._____

33._____

34._____

35._____

36._____

37._____

38._____

Part D- Mrs. Silva was sitting on the couch with Tonka correcting papers on Saturday, and they both were hungry. Tonka went into the kitchen to get them a snack. He is a very talented dog! He came back with some cheese and crackers for them to eat. The cracker is a carbohydrate, and the cheese has protein and fat. Please **describe the path** the cheese and crackers will take through the digestive system. Include the important **chemicals** that will be involved at each spot. **Bullet the information!** 10 points total

MOUTH	_____ _____ _____ _____ _____
ESOPHAGUS	_____ _____ _____
STOMACH	_____ _____ _____ _____ _____ Continued on the next page!

SMALL INTESTINE	_____ _____ _____ _____ _____ _____
LARGE INTESTINE	_____ _____ _____ _____
RECTUM	_____
ANUS	