Using Games from the Television Game Show

"Minute to Win It"

To increase students interests, engagement and knowledge

In Probability and Statistics

By

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Master of Science in Education – Mathematics

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Abstract:

Student interest and engagement is an important piece to increase learning. Motivating students is one of the biggest struggles for educators, and taking a motivational experience and linking it to meaningful learning is even more difficult for educators. In this study, I link a high interest, motivational activity to different concepts of probability and statistics in my eighth grade general education classes. I developed a probability and statistics unit based on games from the popular television game show "Minute To Win It". In each game students collected data, and the data was used to enforce each learning target (or math standard). The goal of this unit was to increase student engagement in class with activities, discussions and work completion; as well as increase overall knowledge in the standards in relating to probability and statistics. I found, through the use of student surveys, the activities were motivating to the majority of students, and students' showed an increase of knowledge through a pre- and post-test.

Introduction and Literature Review:

In my research, I did not find other studies relating game shows to probability and statistics topics in education at the middle school or high school level. However, there are studies on the relationship of motivating students by capturing their interest and how having student interest can increase knowledge. In Ames' 1992 study, she states that "Tasks that involve variety and diversity are more likely to facilitate an interest in learning and a mastery orientation (e.g., Marshall & Weinstein, 1984; Nicholls, 1989; Rosenholtz & Simpson, 1984).

Moreover, students are more likely to approach and engage in learning in a manner consistent with a mastery goal when they perceive meaningful reasons for engaging in an activity; that is, when they are focused on developing an understanding of the content of the activity, improving their skills, or gaining new skills and when task presentations emphasize personal relevance and meaningfulness of the content (Brophy, 1987; Como & Rohrkemper, 1985; Lepper & Hodell, 1989; Meece, 1991; Nicholls et al., 1985)" (Ames, 1992). The "Minute to Win It" games provided such an activity in that students were motivated to try them; the games are intriguing but require no athletic or high mental abilities. The games also gave students authority in developing the rules for the games and a sense of relativeness to the data they collected. Students were able to develop responsibility and independence in data collecting, and use self managing and monitoring skills through the "Minute to Win It" games. The lessons associated with each game, as well as students seeing their pre- and post test scores, gave students the opportunity to see progress and improvement. Azedo also refers to Ames' 92 study and summarizes her conclusions in that "she theorizes that fostering and sustaining students' long-term engagement is dependent on classroom activities devolving some authority to students (so that they may participate meaningfully and with a sense of agency), as well as on classroom evaluation that is based on criteria that emphasizes mastery, progress and improvement (so that students will come to value learning for its own sake). In addition, she proposes that classroom activities must include novelty, challenge, variety, and diversity" (Azedo, 2012). The "Minute to Win it" games not only provide variety, challenge and diversity, but they give students a sense of agency in knowing where the data they collected came from.

In the Hidi and Harackiew study, "Motivating the Academically Unmotivated", they found "creating environments that stimulate situational interest is one way for schools to

motivate students and help them make cognitive gains in areas that initially hold little interest for them."(Hidi & Harackiew, 2000). Math is not often a high interest, or well liked, area for students. Incorporating games into this unit was important in order to stimulate more interest for the students, into the material or standards being taught, and making the data they collected more relevant to students than data sets from the textbook. Hidi's investigations also conclude that "studies have examined features that make text less or more interesting, and how interesting text segments, topics, or themes influence the comprehension, learning, and writing of individuals. The results of these studies indicate that (a) certain text characteristics such as ease of comprehension, novelty, surprise, vividness, intensity, and character identification contribute to situational interest, … In addition to documenting how properties of educational tasks can promote text-based interest, more recent work has demonstrated how certain aspects of the learning environment, such as modification to teaching materials and strategies, and/or how tasks are presented, can contribute to the development of situational interest in a variety of areas (see Guthrie & Wigfield, in press; Hidi & Berndoff, 1998; Lepper & Cordova, 1992; Lepper & Henderlong, 2000)." This further emphasizes my reasoning for including the "Minute to Win It" activities in this unit, which was previously only text-based. The games add novelty to the curriculum, they are easy to understand and no student has any clear advantage. This draws situational interest to the probability and statistics concepts by using the students' results and data. Hidi also suggests that "focusing on the enhancement of situational interest in classrooms, educators can find ways to foster students' involvement in specific content areas and increase levels of academic motivation (Bergin, 1999; Hoffman & Haussler, 1988; Lepper, 1985; Mitchell, 1993)." Again, the Minute To Win It games provide such a situational intrigue in data collected, how to compare the data, and how to represent it for statistical comparisons. By using

these games I can incite students to feel the usefulness of math concepts, and how learning math can be more interesting than a hardship that they have to endure.

Purpose:

The purpose of my unit was to increase student engagement and knowledge in the area of probability and statistics by incorporating games from the television game show "Minute to Win It" with traditional lessons. The last unit in the eighth grade curriculum sequence, placed at the end of the school year, is on concepts of probability and statistics in the area of data representations and analysis. The end of the school year is a difficult time to retain student attention and keep them engaged in school work. The state mandated tests are over, spring fever is present, and summer break is right around the corner. In previous years the probability and statistics lessons all came straight from the textbook, with no or very few activities incorporated. I designed this unit to specifically place an activity, or game, for each concept in the probability and statistics unit. These activities, or games, were incorporated to gain or keep students' interests in the lessons. The activities or games, provide ample data for students to display, analysis, predict and use other various concepts of probability. The data collection is from the student's own classmates, and therefore place more relevance to the data than a random data set from the textbook would have. This would increase students' interest in using the probability and statistics concepts to analyze the data and compare the results. I designed this unit to draw on intriguing students by using their own data from the games they played, to increase the amount of classwork and notes completed, and to increase post-test scores after the unit is completed.

In this unit I encompass the national standards set by the National Council of Teachers of Mathematics (NCTM) and the Minnesota state standards. In the introduction to the Principles and Standards for grades 6-8, NCTM states, "In the middle-grades mathematics classroom, young adolescents should regularly engage in thoughtful activity tied to their emerging capabilities of finding and imposing structure, conjecturing and verifying, thinking hypothetically, comprehending cause and effect, and abstracting and generalizing."(NCTM, 2000) I encompass this idea by connecting each activity or game, with different learning goals from the state or national standard. Students are engaged in not only playing the games, but also collecting and having ties to the data. This interest is then carried over into applying various aspects from the learning goals.

From the Minnesota State Standards for seventh grade, this unit reviews concepts of finding probabilities, measures of central tendencies, and making histograms. In the North Branch district curriculum map, several of the high school probability and statistics standards for grade 9-12 are to be partly fulfilled in their 8^{th} grade year (if possible). This unit also meets part of the state high school standards for grades 9-12; in describing data sets using different data displays including box-and-whisker plots, stem-and- leaf plots, measures of central tendency, quartiles, designing simple experiments and include the sampling method used, and looking for bias in phrasing of questions for data collection (MDE, 2007). On the national level, from the Principles and Standards of School Mathematics (NCTM), they expect all students grades 6 -8 should be able to "formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them."(NCTM, 2000) Specifically NCTM states "In grades 6-8 all students should formulate questions, design studies, and collect data about a characteristic shared by two populations or different characteristics within one population; select, create, and

use appropriate graphical representations of data, including histograms, box plots, and scatterplots."(NCTM, 2000). Under "select and use appropriate statistical methods to analyze data", NCTM states "find, use, and interpret measures of center and spread, including mean and interquartile range" and "discuss and understand the correspondence between data sets and their graphical representations, especially histograms, stem-and-leaf plots, box plots, and scatterplots." Lastly, under "understand and apply basic concepts of probability", NCTM states "compute probabilities for simple compound events" and "use proportionality and a basic understanding of probability to make and test conjectures about the results of experiments and simulations."(NCTM, 2000). This unit is academically based on the standards listed above at the national and state level.

Design:

All students in my eighth grade general education math courses (in the North Branch Area School district) took part in the games and each lesson associated with them. I obtained permission from administration to conduct the unit I designed and I obtained permission from parents (Appendix A) to collect their students' data in the area of engagement, in the form of a student survey (Appendix B), and measure their knowledge of statistics and probability in a pre-test and post-test consisting of the same questions (Appendix C). The first day, I followed the unit plan that I developed (Appendix D), by gathering students' prior knowledge and having them take the pre-test. The second day, I conducted a game to simply introduce students on ways to collect different types of data. We also discussed different forms of data, categorical and numerical. Students made math glyphs, which are drawings based on different categorical data collection such as their age, whether they are male or female, etc. On days 3 through 8, a different game each day was played and a related lesson in probability and statistics was taught.

The start of every class had 3-4 warm-up questions that reviewed the previous concept, and then gave a glimpse at the concept that would be introduced that day. Students used their student packets (Appendix E) in class for collecting the data and applying different aspects from the lessons; they also used their notebooks for keeping track of terms, examples, and formulas, as we went through the lessons. On Day 9, students compared their data displays with other classes to analyze, make generalizations, and review for the post test. On day 10, students take the post test consisting of the same questions from the pre-test. Students then take a survey based on their engagement and interest in the activities.

In the data presented for my research I only used the last 4 digits of students' id numbers to keep their identity confidential. I collected their pre-test scores, and compared them to their post-test scores, to look for growth (Appendix F). Throughout this unit I also collected scores based on a percentage of how much of their packet they completed, and how many various notes they kept in their notebook (Appendix G). These scores helped me draw conclusions on student's engagement levels, and whether including the activities or games with each lesson had an impact on students following through on completing their classwork (packets), notes, and increasing their knowledge in the learning targets (or standards) for this unit.

Results:

After conducting my unit, I have mixed feelings on the results from my unit. Based on the pre-test and post test scores, this unit was highly successful in learning the probability and statistics objectives. 100 students in my 8^{th} grade general math courses were subjected to this unit. The overall pretest to posttest scores show that 97% of the students increased their scores, and the mean increase in score was by 10 points out of 36 total (Appendix F). Breaking the test

apart into probability and statistics, 91% of students increased their score in the area of probability from the pre-test to the post test score, with a mean increase of 4.5 points, and 96% increased their score in the area of statistics, with a mean increase of 6 points (Appendix F). However, although the scores did improve from pre-test to post –test, the percentage of students passing the post-test with a D or better (60% or more correct) was only 39%. That brings my mixed feelings. The unit showed gain in the amount students learned, however, there was not enough learning or retention to get the majority of students to earn what would be considered a passing score on the post-test.

In looking at the students' completed packets and notes, for assessing engagement levels, 57 students completed 75% or more of their packets, and 54 students completed 60% or more of the notes for the unit (Appendix G). Since this is the only year I have taught this unit, I do not have previous data to compare it to. I would conclude, though, that adding the games to this unit did not factor into students' completion of notes and packet. Barely over half the students completed the notes and packets at a satisfactory level or better. I also feel it needs to be stressed that this unit was placed at the very end of the school year. As this was the last unit, students were taking this post-test during the last few days of the school year, which could also have impacted the lack of students' efforts shown on the pre- and post-test.

Reflection:

Despite the mediocre results shown from the data, I was happily surprised by the classroom discussions that were held throughout this unit. Student participation in the games themselves were good, students felt comfortable participating and understood the different roles

within the groups. They collected the data well, and were willing to share their results with the class. Students also had great discussions between themselves, in pairs and in small groups, as well as whole class discussions. In other units, leading classroom discussions were difficult for me to orchestrate and maintain, but the data and comparisons students were able to make in this unit and helped to lead more successful discussions. Students recognized patterns, common trends, and made different arguments for their reasoning. Students were more willing to ask questions and share their thoughts during this unit, compared to any unit I previously taught this year. We also had many discussions on rules, fairness, and clarifications before each game.

Next spring, when I teach this unit again, I will be adding more review assignments as a part of the unit to better develop the concepts connected to each game, and the data collected. This additional review may by from workbook pages, or problems from their textbook, or problems I develop from their data (if possible, that would be my preferred assignment so the information stays relevant to student). I hope that by having students revisiting the concepts more often and frequently, it will help them to master the concepts better and be able to retrieve/perform it for the unit post-test. I would also like to include a unit project with this unit (Appendix H). This project would involve students designing their own games, collecting data from them, and then displaying the data collected from their games. This would not only help reinforce the concepts taught but it would also be another way to assess what students have learned, other than just the use of a post-test. I hope the additional assignments and the unit project would better express what students learn throughout this unit. I like to assess students using multiple forms of assessments, to draw out what students really know. Hopefully, between the unit project and pre-post test, and additional review, it will better demonstrate what students learned from the unit.

In this unit, I tried to encompass the domains of Bloom's taxonomy of learning. With each lesson's learning objectives students apply and produce various aspects of what they have learned from the lesson. At the end of the unit students are comparing and analyzing their data compared to their own class, as well as other classes. Adding the unit project will reach the top tier of Bloom's taxonomy with students having to criticize, justify and support the data they have collected about their games. The new version of Bloom's taxonomy has applying, analyzing, evaluating, and creating as the top tiers for students to achieve (Overbaugh). Throughout this unit, the learning objectives I set were to meet these different levels of Bloom's taxonomy.

The Master of Science (MSE) coursework including Educational Psychology, the Geometry and Statistics for educators courses from Bemidji, and the summer math courses offered by UW-River Falls, all helped build my repertoire of knowledge and apply it to what I teach. These courses were rigorous and having completed them built my confidence, and helped prepare me for tackling this Plan B research paper. This project has helped my professional development in many ways, by foremost giving me an opportunity to build meaningful lessons to enhance the curriculum used at North Branch Middle school, and the confidence to share some of these lessons at the Minnesota Council of Teachers of Mathematics (MCTM) conferences with other math teachers, in order to inspire other math teachers to incorporate more activities to engage their students, in their own lessons.

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Appendices:

A. Parent permission letter to participate in the unit and research.
B. Student survey after the unit
C. Pre- and post test of Probability and Statistical concepts
D. Probability & Statistics Unit overview for teacher use
E. Probability & Statistics student packet
F. Student test results (pre- and post scores by total and by categories probability and statistics)
G. Students' completion results of notes taken and packets complete
H. Addition to unit with student surveys and unit project

Appendix A.

Dear parents and Guardians, 4/29/12

We are ending the school year with a unit on probability and statistics, that goes with chapter 13 of the textbook. I have designed correlating lessons with this unit that involve students collecting data from playing games made popular from the NBC television show "Minute To Win It". The students will be playing the games: Wheel of a deal, Back Flip, Breakfast Scramble, Paper Scraper, and Speed Eraser. Each game is briefly explained on the backside, and more information and description of the game can be found at the NBC website www.nbc.com/**minute-to-win**-it/how-to/. I will be showing the video clip instructions for each game, providing the materials, and supervising the games. Students will be working in groups, as either a participant or timer. The data collected from each game will be used to reinforce the main concept from sections 13.1 on probability and odds, 13.2 on permutations, 13.4 on compound probabilities, 13.6 on measures of central tendencies, 13.7 and 13.8 on data displays of stem and leaf diagrams, histograms, and box and whisker plots. These concepts are all part of the 8^{th} grade curriculum and meet the Minnesota state standards.

I will be collecting data from this unit to incorporate in my master thesis. The data I will be including are students' scores on pre- and post test, as well as daily assignments and students' survey responses. This information will be reported in my master thesis, however all student names will be kept strictly confidential. I do not anticipate any risk to students from the research with these lessons. In fact, I hope to find increased student engagement, and learning from these lessons. By signing below, you are endorsing the use of your students' scores in my research thesis. Again their names will be kept confidential, and the data I use will be addressed as group data (aggregated).

Please sign the form below and have your student sign as well if you are willing to allow the work they do for this section of the course to be used as data in this research project. Your student will still be required to complete the activities, assignments, and

quizzes for this section regardless of whether you sign the consent or not. Your signature serves to indicate your consent to have their work on this section of material used in the research project. If you have any concerns about this unit or the research I will be conducting, please feel free to call or email myself or Todd Tetzlaff, middle school principal.

Thank you for your support and understanding in this process. I look forward to seeing positive results from this unit.

Sincerely,

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Graduate student in Masters of Science in Mathematics Education Program,
at the UW-River Falls

_____(Parent Signature) _____(Student Signature)

Printed Name: _____ Printed Name: _____

If you have any concerns about the research in this study, please contact:
Dr. William Campbell, Director of Grants and Research
104 North Hall, UW-RF, 715-425-3195
This project has been approved by the UW-River Falls Institutional Research Board for the Protection of Human Subjects, protocol # H2012-W074

Wheel of a Deal: Players separate 20 playing cards, one at a time, into 5 stacks of cards (all the same denomination). Section 13.1 starts with the basic introduction to probability and odds, students will play the game "Wheel of a deal" and find the probability of flipping the same card in a row, and the odds of flipping over the various types of cards in the pile. We will further explore how the time it takes to separate the cards reduces (or increases) based on the odds and probability of getting the same card twice.

Separation Anxiety: Players will separate a bag of M&M's into separate containers for each color. This game will be used with section 13.2 on permutations, students will be calculating the amount of different ways the M&M's can be arranged. Since there are at least 5 different colors to a bag of M&M's, we will look at permutations of 5.

Back Flip: Players will balance pencils, in increments of 2, on the back of their hands and flip them off to catch them. The data collected, maximum amount of pencils students

could catch in their hand, will be used to illustrate the concept of median, mean, and mode. This activity focusing on an amount that can vary greatly depending on the person, so the distribution of the data will be best for finding measures of central tendencies.

Breakfast Scramble: Players will put together a puzzle, from a cereal box cover cut into 16 pieces, and record the amount of time it took. The times for the class will then be collected and recorded and used with section 13.7 on drawing Stem & Leaf Plots. In this activity various amounts of time are recorded, all of which are two digits, this data presents well in a Stem & Leaf Plot because the data is at least two digits, and the shape of the data can relate to demonstrating central tendencies.

Paper Scraper: Players will build a tower of index cards alternating two cards with a single fold in between a flat index card to make different levels. The highest number of levels reached, keeping balanced, at the end of a minute will be recorded and collected for the class. That data will then also be used with section 13.7 on drawing histograms. This amount collected is typically under 10, and the histogram is good visual representation of the data so students can compare the frequency of the different levels being obtained.

Speed Eraser: Players must bounce a pencil off its eraser, one at a time, into a cup. The final amount of pencils in a cup at the end of a minute will be recorded and collected for the class data. This will be used with section 13.8 on making box & whisker plots. The data will be looked at for demonstrating the five number summary (minimum, maximum, upper and lower quartiles, and median).

Appendix B.

Minute-to-Win-It Student Survey Name _(not necessary)__

Use the scale of 1-5 (1 being the lowest, 5 being highest) to fill in the blanks and then answer ***all*** questions:

1. How interested you were in participating in the games: _____

Which one was your favorite? Why?

Was there one you didn't enjoy?

2. How interested were you in using the data that included your own: _____

Were you more or less interested in using data that included your own, compared to data lists taken from the textbook?

3. How interested were you in comparing your data to the class data? _____

4. How interested were you in comparing your data to the all the classes data? _____

5. How would you rate your participation during this unit (1-low, 5- high):

In the classroom activities:____

Homework completion:____

Quiz/Test Scores: _____

General Understanding of the concepts:____

Appendix C.

Name: _____ Class: _____ Date: _____ ID: A

Propability & Statistics Unit quiz

1. You toss a number cube. Find the probability of rolling the number 2.

____ 2. After the introduction of a new soft drink, a taste test is conducted to see how it is being received. Of those who participated, 48 said they preferred the new soft drink, 112 preferred the old soft drink, and 40 could not tell any difference. What is the probability that a person in this survey, chosen at random, preferred the new soft drink?

a. $\frac{3}{7}$ b. $\frac{6}{19}$ c. $\frac{3}{10}$ d. $\frac{6}{25}$

3. A bag contains two blue marbles and one red marble. A marble is randomly drawn. What are the odds in favor of picking the red marble?

4. If the probability of an event occurring is $\frac{6}{13}$, what are the odds in favor of the event?

5. The probability of an event is $\frac{5}{12}$. Find the odds against the event occurring.

6. **GRIDDED RESPONSE**
What is the total number of possible outcomes when one coin is tossed and one ten-sided die is rolled?

____ 7. A picnic cooler contains 5 sandwiches made with rye bread, 4 sandwiches made with whole wheat bread, 6 made with oat bread, and 3 made with onion rolls. If only the sandwiches on rye bread and onion rolls have mustard on them, what is the probability that a sandwich selected randomly from the cooler has mustard on it?

a. $\frac{4}{5}$ b. $\frac{2}{5}$ c. $\frac{4}{9}$ d. $\frac{1}{2}$

8. A special deck of cards contains three each of the numbers from 1 to 8 and four each of the numbers 9 and 10. One card is drawn at random from the deck. What is the probability that the card is a number greater than 7?

9. A bag has 5 red blocks and 3 green blocks. Sonya takes a block out of the bag at random, records the color, then replaces the block in the bag. She does this 40 times. Based on the number of each color of blocks in the bag, how many times would you predict that red blocks were chosen and green blocks were chosen?

____ 10. Eight people are entered in a race. If there are no ties, in how many ways can the first two places come out?
a. 16 b. 112 c. 28 d. 56

Find the value:

____ 11. 7!
a. 2520 c. 5040
b. 10,080 d. 40,320

12. ${}_5P_4$

13. Four people must stand in a row for a group photo. How many different ways can they be lined up for the photo?

____ 14. A spinner is divided into 8 equal parts and numbered from 1 through 8. What is the probability of spinning a number less than 4 or greater than 7 in a single spin?

a. $\frac{1}{2}$ b. $\frac{3}{8}$ c. $\frac{1}{8}$ d. $\frac{5}{8}$

Tell whether the events are *independent* or *dependent*. Then answer the question.

15. Two urns both contain green balls and white balls. Urn I contains 3 green balls and 5 white balls, and Urn II contains 2 green balls and 4 white balls. A ball is drawn from each urn. What is the probability that both balls are green?

____ 16. A drawer contains 2 red socks, 7 white socks, and 9 blue socks. Without looking, you draw out a sock and then draw out a second sock without returning the first sock. What is the probability that the first sock and the second sock are both red?

a. $\frac{4}{17}$ b. $\frac{1}{81}$ c. $\frac{1}{153}$ d. $\frac{1}{4}$

17. A drawer contains 4 single red socks, 9 single white socks, and 2 single blue socks. Without looking, you draw out a sock, you replace it and draw out a second sock. What is the probability that the first sock and the second sock are both red?

18. Find the median of the data. 24, 30, 36, 19, 41, 19, 28, 8, 32

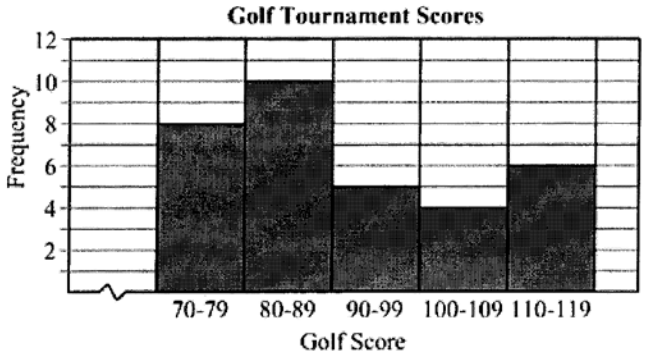
____ 19. Name the mode or modes of the data.
29, 6, 16, 1, 9, 1, 7, 10, 25, 7, 25

a. 10 b. 1, 29 c. 1, 7, 25 d. 12.4

20. Open-ended Problem: The table below gives the grades for the last quiz in an Algebra class. To find the mean of the grades, Laura found the sum of the grades (33) and divided by the number of grades (14). She got an average of 8.25. The correct mean is 9. What did she do wrong?

Quiz grade	Frequency
10	6
9	4
8	3
6	1

____ 21. The scores for the 33 participants in a fund-raising golf tournament are represented in the graph below. In which interval is the median score found?



a. 90-99 b. 100-109 c. 80-89 d. 70-79

____ 22. Jake's test scores for the first term of chemistry class were 78, 68, 73, 94, and 62. Which of the measures of central tendency or dispersion would make Jake's test scores seem as high as possible?

a. mode b. mean c. median d. range

____ 23. You weigh six packages and find the weights to be 32, 22, 72, 27, 67, and 62 ounces. If you include a package that weighs 152 ounces, which will increase more, the median or the mean?

a. The median and mean are affected the same amount.
b. The median and the mean will stay the same.
c. The mean increases more.
d. The median increases more.

24. Make a stem-and-leaf plot of the data.
29, 32, 36, 31, 48, 25, 54, 53, 40, 27, 23, 59, 42, 28, 40

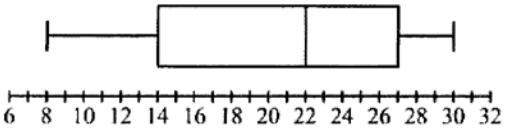
____ 25. Which of the following is a list of the data represented by the stem-and-leaf plot below?

2	6 8 8
3	4 7 7
4	0 1 5 5
5	2 3 9

a. 26, 34, 41, 52, 37, 53, 28, 45, 59, 40, 37, 28, 45
b. 28, 28, 24, 27, 37, 30, 31, 45, 45,42, 4, 53, 59
c. 6, 8, 8, 4, 7, 7, 0, 1, 5, 5, 2, 3, 9
d. 28, 2, 24, 27, 37, 30, 31, 45, 4,42, 4, 5, 59

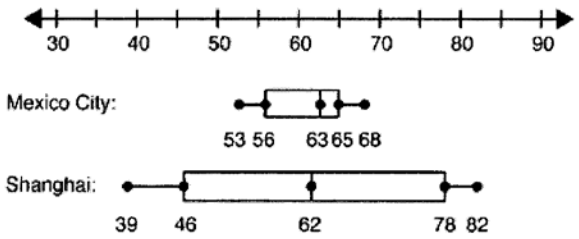
26. Draw a box-and-whisker plot of the data.
32, 29, 25, 25, 28, 34, 26, 37, 36, 34, 27, 34, 29, 37, 27

____ 27. Which data are represented by the box-and-whisker plot?



a. 27, 20, 8, 21, 30, 26, 14
b. 27, 22, 8, 21, 32, 26, 14
c. 27, 22, 8, 13, 30, 26, 14
d. 27, 22, 8, 21, 30, 26, 14

The box-and-whisker plots below show the average monthly temperatures for Mexico City, Mexico, and Shanghai, China, in degrees Fahrenheit.



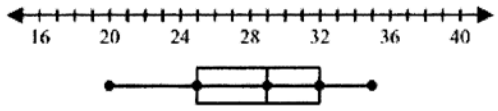
28. Which city has a higher median temperature?

____ 29. Thirteen golfers were asked what their score was on their last game. The scores are shown below.
86, 75, 72, 85, 78, 88, 74, 74, 83, 85, 77, 57, 77
Find the range and the outlier(s), if any, of the golfers' scores.
a. range 32; no outliers
b. range 31; outlier 57
c. range 32; outlier 57
d. range 31; no outliers

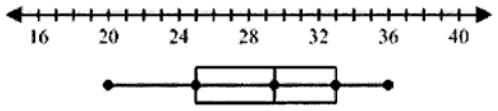
____ 30. Only one of the box-and-whisker plots correctly displays data about the ages of team members on a company baseball team. The statements below are all true about the team. Use the statements to correctly choose the box-and-whisker plot.

· The youngest member is 20 years old.
· About 75% of the members are between 25 and 34 years old.
· No one is older than 34 years old.
· About 50% of the members are at least 29 years old.

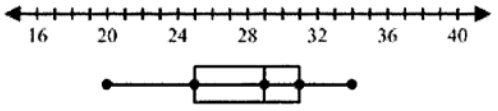
a.



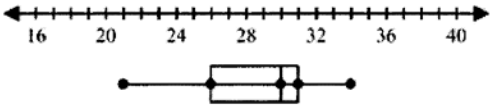
b.



c.



d.



Appendix D.

Minute to Win It Games

Probability & Statistics Unit

8th Grade Math courses, Mrs. Bateman Room 801

Overview:

Day 1: Pre-test and introduce unit

Day 2: Opening lesson

Day 3: Lesson 1- Simple probability, odds, and sample spaces with the game “Separation Anxiety”

Day 4: Lesson 2 - Probability of compound events with “Wheel of a Deal”

Day 5: Lesson 3 - Permutations with “Breakfast Scramble”

Day 6: Lesson 4 - Measures of central tendencies and dispersions with “Paper-Scraper”

Day 7: Lesson 5 - Stem-and-leaf plots and histograms with “Back Flip”

Day 8: Lesson 6 - Box-and-whisker plots with “Speed Eraser”

Day 9: Compare class data displays and review

Day 10: Post test

Learning targets:

Students will be able to find sample spaces and simple probabilities, odds in favor and odds against an event happening.

Students will be able to find permutations using a formula.

Students will be able to find the probability of a compound event.

Students will compare measures of central tendencies and dispersion.

Students will be able to make stem-and-leaf plots and histograms.

Students will be able to make and interpret box-and-whisker plots.

Materials:

Student packets

Three medium sized balloon per group

Snack size bags of M&M's (per student)

Playing cards – sets of 20 cards (4 – aces, 4- Kings, 4 – Queens, 4- Jacks, 4 -10's)

Breakfast box front covers, cut into 12 pieces all the same size

Sets of index cards (3" by 5"), 10 flat cards with 20 folded cards

Sets of 12 pencils (non-sharpened, all the same length and size)

Sets of 7 pencils with one plastic cup (masking tape on the bottom)

Various materials for student games (index cards, pencils, cotton balls, cups, etc)

Opening Lesson: Defying Gravity

Learning objective: Students are to accurately record data using a tally system. Introduce different forms of data.

Materials: student packets, three medium sized balloons per group.

Game: Defying Gravity – tap 3 balloons to keep them off the ground for 1 minute.

http://www.nbc.com/minute-to-win-it/how-to/episode-233/defying-gravity/

Students will be introduced to the game "Defying Gravity" by the video provided from the NBC website. The object of the game is to keep the balloons in the air for 60 seconds and students are to record the number of taps the participants uses to keep the balloons up in the air. The timer watches the clock, the recorder makes tally mark for each tap made, and the participant keeps taping the balloons to keep them in the air. I will illustrate the recording with tallies after

the video of the game instructions, then students will be taken to a larger area for the game playing (gym if available or outside if weather permits). Each group member will take turns having a different role in the group, timer, recorder and participant.

Conclusion: Students will come back into the classroom, and record their total number of taps on the whiteboard. There will be a whiteboard area for the number of taps and if they passed the challenge, and a separate white board area for the number of taps and if they failed the task. Students then will write and discuss any comparisons that can be made in their packets. We will discuss what type of data we collected numerical or categorical. Students will make math glyphs based on their own categorical data collected in certain areas.

Discussion Questions:

- What type of data was collected?
- What factors would make this game more or less fair?
- What was the class range in amount of taps?
- Where did your amount fit in the data? Does that surprise you?

Glyph Instructions:

Size of your head (Round, narrow) based on age (12, 13)

Hair (straight, curly, bald, spiked) based on how they traveled to school (walked, bus, got a ride, bike/skateboard)

Nose (long, round) based on lunch choice (hot, cold)

Eyelashes (long, short, none) based on amount of tardies (5 and less, 5-10, 10 or more)

Continue with features based on class dynamics

Glyph reflection questions:

- Look at your glyph, let's organize into sets, if you had
  - Curly hair stand along the back wall
  - Straight hair stand along the front wall
  - Spiked hair stand along the window wall

- bald (no hair) stand along the door wall

If you are in the union of curly hair and a long nose, go into the center of the classroom.

- What set(s) is not in the center of the classroom?

If you are the intersection of spiked hair and long eyelashes, go into the center of the classroom. - What set is not in the center of the classroom now?

(Keep doing further intersections, unions, etc.)

Student Notes:

Categorical data: data collected can be sorted into different categories (non-numerical)*

Numerical data: data that consists of taking a count*

Math glyph: a pictorial form of data collection. A picture or display, where certain aspects are dependent on categorical data i.e. Drawing a face, the hair style is dependent on the age, the nose size is dependent on the grade of school, etc. *

Lesson 1: Separation Anxiety

Learning Target: Students will be able to determine sample spaces, and find simple probabilities, odds in favor and odds against an event.

Materials: Student packets, Snack size M&M's packages

Game: Separation anxiety – Students must separate a pile of M&M candies into 5 separate containers in a set color order.

http://www.nbc.com/minute-to-win-it/how-to/episode-123/separation-anxiety/

Students will be first shown the instructional video of the game "Separation Anxiety", provided by the NBC website. Then we will discuss the rules and clarifications. Working in pairs for this activity, one student will act as timer while the other student is the participant. The participant may not open the package of M&M's until the timer says go, therefor not being able to see the amount of different colored candies inside. After each student has been the participant, then each pair will record their combined total candies, and candies of each color. Only after

students have recorded their amounts can they start to eat their candy, and I will give the definition of probability of an event and against an event. I will also lecture on the independent and dependent events, and odds in favor and against an event. These will be notes that students take in their notebook. Then students will have time to discuss and answer the questions in the student packet.

Discussion Questions:

- What color was the most popular? What is probability of drawing that color if all the M&M's are combined together?
- What color was the least popular? What is it's probability?
- If I take a M&M out, and not replace it, how does it affect the probability of the next draw being the same color? Different color? (i.e. Taking out a blue, and then drawing another blue)
- If I take out two M&M's (orange and a green), not replace them, how does it affect the probability of drawing a blue next?
- How are the odds and probability of an event related?
- What are the odds of drawing one M&M and it not being brown?

Student Notes:

Probability: the measure of the likelihood of an event occurring. Probability is number from 0 to 1 and can be expressed as a decimal, fraction, or percent.

Independent event: two events, if the occurrence of one event has no effect on the occurrence of the other.

Mutually exclusive: two events have no common outcomes

Dependent event: two events, if the occurrence of one event affects the occurrence of the other.

Odds: comparison of number of favorable to unfavorable outcomes when all outcomes are equally likely.

Odds in favor: Number of favorable outcomes to the number of unfavorable outcomes.

Odds against: Number of unfavorable outcomes to the number of favorable outcomes.

Lesson 2: Wheel of a Deal

Learning Target: Students will be able to calculate the probability of compound events.

Materials: student packets, playing card sets of 20 cards (any random cards or different or same denominations)

Game: Wheel of a Deal – students must separate 20 playing cards into 5 groups of identical cards, 1 at a time.

http://www.nbc.com/minute-to-win-it/how-to/episode-214/wheel-of-a-deal/

Students are first introduced to the game of "Wheel of a Deal" by the video provided by NBC website. The rules and clarifications are then discussed. Each group of 3 students (timer, participant, recorder) are to separate the cards into the same denomination, one at a time, in under 60 seconds. The cards are to be shuffled well before the start of the timer, they must remain face down until it is that cards turn to be separated. Students are to record the time it takes students to separate the 20 cards into the different denominations, if they aren't all separated by the end of 60 seconds then students are to record how many cards are left in the stack to sort. After students have played the game three times, rotating through each group member role, then they will take the following notes on compound probabilities (using the words and/or). After students have completed the notes, then they will answer the questions in their packets, relating to this game.

Discussion Questions:

- Name differences between how we played the game in class compared to how they played the game on the television show.
- How do you think those differences affected our results?
- How do you think it would affect the results if we didn't shuffle the cards, all the kings together, all queens together, etc.?
- How many face cards were in the set of cards you were given?
- If you don't replace a card, after is sorted from the stack, how does it affect the probability of the next card being flipped over?

Student notes:

<u>Compound event</u>: Combines two or more events, using the word *and* or the word *or*.

- To find the probability of mutually exclusive events (no common occurrence) add the probability of both events. To find the probability of compound events that overlap, have at lease one common occurrence, and the probability of both events and subtract the probability of the overlap.

Lesson 3: Breakfast Scramble

Learning Target: Students will be able to find the number of permutations for given events.

Materials: Student packets, cereal box cover cut into 12 equal size pieces (one for each group)

Game: Breakfast scramble – students assemble the front of cereal boxes that have been cut apart, similar to putting together a puzzle, in under 60 seconds.

http://www.nbc.com/minute-to-win-it/how-to/episode-232/breakfast-scramble/

Students will be first introduced the game "Breakfast Scramble" by the instructional video provided by NBC's website. The students will work in pairs, one timer and one participant, to unscramble the 9 pieces to form the cereal box cover. After each student has played the game, I will go over permutations and using them to find probabilities. Students will take the following notes in their notebooks, and then complete the questions from their packet. The participants will put their times on the board for the last question to be answered.

Discussion Questions:

- How many ways do you think there are to arrange the puzzle pieces?
- Let's start by looking at smaller puzzle size, what if it had 4 pieces
  How many ways could you arrange the 4 pieces to form a square?
  What if you had 6 pieces? 8 pieces? After examples with smaller numbers introduce factorials. Then go back to the larger, full sized puzzle.

  Extension – What if some pieces from another puzzle got mixed together and you now have 15 pieces, but you know the puzzle is 3 rows of 4 pieces? Go into the explanation of Permutation of n objects at a time.

Student Notes:

<u>Permutations:</u> arrangement of objects in which order is important.^{o}

<u>Factorial:</u> (notation n!) the product of integers from 1 to n! = n (n-1) (n-2) (n-3) …^{o}

<u>Permutation formula of n objects:</u> ${}_nP_n = n!^{o}$

<u>Permutation of n objects taken r at a time, where r≤ n:</u> ${}_nP_r = n!/ (n-r)!^{o}$

Lesson 4: Paper Scraper

Learning target: Students will compare the measure of central tendencies, and dispersions.

Materials: Student packets, 10 flat index cards (3" x 5") and 20 folded with center seam (per group)

Game: Paper Scraper – students build towers out of index cards, two pre-bent cards and one flat card per layer.

http://www.nbc.com/minute-to-win-it/how-to/paper-scraper/

Students are first introduced to the game "Paper Scraper" by the instructional video provided by NBC's website. Students will work in groups of three (timer, recorder, participants) to build stories consisting of two bent cards and one flat card. Rules and clarifications will be discussed for consistency (no additional folds in the cards, how long does the tower have to stay balanced, etc). After students have each been the participant, students will record their data on the board. I will review the three measures of central tendencies, most students have heard them before but need a reminder, and we will also discuss when each measure is best to be used. Students will also be introduced into measure of dispersion in use of the range. They will take the notes listed below in their notebooks, and then discuss in groups and answer the questions in their packets.

Discussion Questions:

- What was the class' mean amount? Median amount? Mode?
- Compare your class to the other hours. Were the means similar? Median? Mode? Explain a reason for the results.

Give examples of higher and lower values and have students find the affect on the three measures.

Student Notes:

Mean: or average, sum of all quantities divided by the number of quantities.°

Median: middle number when the values are written in numerical order, if the data set has an even amount of values the median is the mean of the two middle values. ° This measure is not influenced by outliers at the extremes of the data sets, typically used if there are extreme values in the data set that can distort what might be typical. House prices, salaries, etc. *

Mode: value that occurs most frequently, there may be more than mode, no mode, or one mode.[0] Very useful for categorical data, shirt sizes, ice cream flavors, etc. [*]

Range: difference of the greatest value and the least value.[o]

Lesson 5: Back Flip

Learning Target: Students will use the data collected to make stem- and – leaf plots and histograms.

Materials: Student packets, Sets of 12 pencils

Game: Back Flip – students catch increasingly larger sets of pencils, by first balancing them on the back of their hand.

http://www.nbc.com/minute-to-win-it/how-to/episode-221/back-flip/

Students will first be introduced to the game "Back Flip" provided by the NBC website. All rules and clarifications will be discussed, then students will work in groups of three (timer, recorder, participant). Each participant can take multiple attempts to reach the goal of catching 12 pencils. After students have played the game, I will show students examples of stem-and-leaf plots and histograms. I will give them the steps of making a histogram, and then students will have time to make their own stem-and- leaf and histograms based on their groups data. We will also discuss how the range, and median can be found using the two displays of data.

Discussion Questions:

- Using the stem-and-leaf plots, find the median. Was there a mode?
- What advantages could you see from displaying the data in a stem-and-leaf plot?
- What similarities do you see between a bar graph and a histogram?
- What differences do you notice between a bar graph and a histogram?
- Where do the three measures of central tendencies fall on the stem-and-leaf plot?
- Where do the three measures of central tendencies fall on the histogram?

Student notes:

Stem-and –Leaf Plots: data display that organizes data based on the digits and displays the distribution, the stem being a leading digit, and a leaf being last digit. A key must be provided in order to interpret the data presented.[o]

Step 1: separate the data into stems and leaves

Step 2: write the leaves in increasing order per stem

Frequency: the number of data values in that interval°

Frequency table: used to group data values into equal intervals with no gaps between intervals, and no intervals overlapping.°

Histogram: bar graph that displays data from a frequency table, the bars are equal width, and the length indicates the frequency. There are no spaces between bars.°

Step 1: Choose intervals of equal size that cover all the data values.

Step 2: Organize the data using a frequency table.

Step 3: Draw the bars of the histogram using the intervals from the frequency table.

Lesson 6: Speed Eraser

Learning target: Students will be able to make and interpret box –and whisker plots.

Materials: Student packets, 1 plastic cup per group and seven pencils

Game: Speed Eraser – Students bounce pencils into a cup, one at a time, off the eraser.

http://www.nbc.com/minute-to-win-it/how-to/episode-233/speed-eraser/

Students will be introduced to the game "Speed Eraser" using the video provided by the NBC website. The students will work in groups of three (timer, recorder, participant) to tap the pencils into a cup. The cups will be held down using a piece of tape on the bottom, and a distance from the desktops will be designated, as well as all other rules and clarifications will be determined (if a pencil bounces out of the cup, etc). Students are to tally the amount of pencils they get to stay in the cup at the end of 60 seconds, and will also record the number of attempts with tally marks. After students are finished playing the game, I will introduce quartiles, and box-and-whisker plots. The following notes will be taken in students notebooks, and then they will take the class data and display it using box-whisker-plots. Students will also look at other classes box-and-whisker plots to determine similarities and differences, find the medians, and other quartiles.

Discussion Questions:

- Would you say we had any outliers from the class data set? Explain.

- Where do you find the median in the box-and-whisker plots?
- Why do “they” use the word quartile?
- Identify the different quartiles from the class data.
- Why is range of quartiles not always the same?

Student Notes:

Box-and-Whisker Plots: Organizes data into four groups (quartiles), data is divided in lower and upper halves by the median (marked by a line inside the box). o

Lower quartile: the median of the lower half of the data, and below o

Upper quartile: the median of the upper half of the data and above o

Interquartile range: difference of the upper quartile and the lower quartile (represented by the box) o

Outlier: value that is widely separated from the rest of the data in a data set o

Day 9: Review and compare:

Learning targets: review pervious learning targets

Materials: transparencies of each classes data displays, student packets

Students will be given transparency copies of the different classes data displays (stem-and-leaf plots, histograms, box-whisker-plots). Students will be able to overlap the transparencies to compare the classes’ data and make conclusions. The conclusions made will be recorded in their packets and students will answer the questions in the packets.

Day 10: Post Test

Appendix E.

Name _____

Hour_____

Minute to Win It

Probability & Statistics

Student Packet

Opening Lesson: Balloon Tap

Three members per group

Show an example of a tally below (show up through 12 tallies):

Record the number of taps for your group member to keep the balloon in the air:

# of taps per group member: _____ _____ _____

Member: #1 #2 #3

Look over the class data on the board, discuss with your group members any generalizations, or comparisons that can be made. Record below your group members observations:

_____

_____

On a separate sheet of paper you will be making a glyph of a face based on certain categorical data decided by the class. Follow the teachers directions closely, put your name on it and turn it in separately to be displayed.

Lesson #1: Separation Anxiety

Two members per group

Record the amount of time it takes to separate the M&M's candy into separate colors.

_____ _____

Record the number of each different colored candy in your combined packages:

Red: Orange: Yellow: Green: Blue:

Brown: Purple:

Total amount of pieces:

1) What is the probability of drawing a brown candy from your bag?

2) What is the probability of not drawing an orange candy?

3) What is the probability of drawing a green or red candy from your bag?

4) Would a draw of a blue candy, replacing it and drawing a second blue candy, be independent or dependent events? Explain.

5) What is the probability of drawing a red, not replacing it, and then drawing a blue?

6) What is the probability of drawing a brown, not replacing it, and drawing a second brown?

7) What are the odds of drawing a blue?

8) What are the odds against drawing a green?

9) What are the odds of drawing a red or yellow?

10) What are the odds of drawing a purple?

11) Give an example of mutually exclusive events with the candy pieces:

Lesson 2: Wheel of a Deal

Groups of Three

Record the time it takes for each group member to separate the cards, if the cards are not completely separated at the end of 60 seconds, record the amount of cards left to separate in the stack:

Time: _____ _____ _____

#Cards: _____ _____ _____

Now look at the cards that were given in your stack, record each denomination and how many of each below:

Example: 10's = 3, 9's = 2, 5's = 4, etc.

1) What is the probability of flipping a face card out of your stack? (face card – king, queen, or jack)

2) What is the probability of flipping over a face card and then a non-face card?

3) What is the probability of flipping 2 face cards?

Lesson 3: **Breakfast Scramble**

Groups of two

Record the time it takes to unscramble the puzzle pieces to form the cereal box cover:

_____ seconds _____ seconds

Record your times on the board (first participant on the left, second on the right),

Record the class times below:

1) How many ways is there to arrange the puzzle pieces?

2) How many ways is there to arrange the puzzle pieces for just the first row?

3) What is the probability of placing the correct piece in the top left corner, out of all the pieces, on your first grab?

4) Looking over the whole class data, was the second participant faster or slower than the first? What possible reasons explain the result?

Lesson 4: **Paper Scraper**

Groups of three

Record below the number of stories of the tower before it falls, or at the end of 60 seconds (Use tallies as each layer is built, It's hard to count it after it falls):

_____stories _____stories _____stories

Record on the board the total number of stories for each group member. Record the class data below:

1) Find the three measures of central tendencies for the class data:
Mean: Median: Mode:

2) What was the range of the class data set?

3) The goal for the television show is 10 stories, do you agree or disagree with this amount? Explain your reasoning.

4) If we wanted to set a more attainable goal, but not everyone accomplished it, what would you suggest? Explain your reasoning and refer to a measure of central tendency for support of your number.

5) Which measure of central tendency best represents the data?

Lesson 5: **Back Flip**

Groups of three

Record the highest number of pencils caught in 60 seconds for each group member.

Participant 1: **Attempt 1: ____** **Attempt 2:____** **Attempt 3:____**

Participant 2: **Attempt 1: ____** **Attempt 2:____** **Attempt 3: ____**

Participant 3: **Attempt 1: ____** **Attempt 2:____** **Attempt 3: ____**

Record your highest amount caught on the white board.

Record the class data below:

1) Use the class times from breakfast scramble to make a back-to-back stem- and – leaf plot (first participant compared to the second participant):

2) Use the class data from back flip to make a frequency table and histogram on a separate sheet of paper.

3) According to your charts, how many classmates would make the television goal of 12 pencils?

Lesson 6: **Speed Eraser**

Record the number of pencils that stay in the cup at the end of 60 seconds, also record the number of attempts (pencils tapped) with tally marks, for each group member:

Participant 1: Number of pencils: _____

Number of attempts: _____

Participant 2: Number of pencils: _____

Number of attempts: _____

Participant 3: Number of pencils: _____

Number of attempts: _____

Put your data of the number of pencils on the white board, and number of attempts. Record the class data below:

Attempts made:

Number of Pencils in the cup:

1) Make a box-and-whisker plot of the class data for number of pencils in the cup:

2) Make a box-and-whisker plot of the class data for the number of attempts made:

Identify the median value, lower quartile, upper quartile and inter quartile range on each box-and-whisker plot.

3) The goal of the television show is 7 pencils in 60 seconds, did 50% of the class make the goals?

4) Based on your classes data, what should the goal be for 50% of the students to make the target? What should the goal be for 75% of the students to make the class target? Explain your results.

Review & Compare:

Align the transparencies of the classes' stem-and-leaf plots. Find the measures of central tendencies for each class.

1) Did the classes have similar times for the “Breakfast Scramble” game? Use the statistics you have found to support your answers.

2) Align the transparencies of the classes histograms. What conclusions can you draw from the classes’ data from back flip: (write three conclusions below)

3) Align the transparencies of the classes’ box-and-whisker plots.

Which class had the highest median value?

Which class had the largest interquartile range?

Which class had the lowest, lower quartile?

Which class had the highest, upper quartiles?

4) Was there any class that overall had more students making the goals set by the television? If so which one, and explain why or why not.

Appendix F.

Student:	Pre-test Score	Post-test Score	
255	6	9	3
358	16	30	14
139	15	25	10
176	11	27	16
23	12	24	12
243	10	21	11
364	11	22	11
271	5	21	16
543	9	19	10
360	6	14	8
316	9	14	5
73	4	23	19
50	6	13	7
460	2	6	4
371	7	15	8
184	1	9	8
76	8	26	18
405	10	19	9
85	7	18	11
30	16	17	1
984	9	16	7
548	3	15	12
220	5	21	16
627	11	32	21
144	7	22	15
537	7	18	11
295	5	19	14
147	11	28	17
67	11	26	15
275	9	20	11
251	8	27	19
237	11	19	8
276	7	18	11
559	9	15	6
266	18	17	-1

428	5	19	14
171	7	16	9
408	6	16	10
449	7	15	8
49	11	27	16
207	4	5	1
208	1	3	2
282	8	21	13
338	8	8	0
83	8	23	15
306	10	23	13
62	4	11	7
8	6	11	5
199	10	25	15
333	3	14	11
508	9	27	18
162	3	9	6
68	10	14	4
397	4	22	18
309	2	13	11
19	11	28	17
146	8	16	8
609	8	10	2
326	7	24	17
330	9	19	10
416	8	26	18
285	11	24	13
201	11	28	17
46	8	18	10
352	18	28	10
173	5	25	20
556	10	29	19
189	5	16	11
368	5	10	5
498	10	23	13
369	4	24	20
42	10	26	16
456	10	25	15
43	4	5	1
493	5	28	23
198	6	16	10

454	4	19	15
495	5	2	-3
444	2	4	2
12	4	14	10
926	8	18	10
310	10	29	19
160	3	15	12
99	5	8	3
381	9	25	16
72	11	24	13
80	5	14	9
31	3	12	9
9	7	14	7
529	4	16	12
542	6	10	4
831	10	14	4
487	3	12	9
353	3	15	12
41	5	17	12
121	3	7	4
166	2	11	9
230	3	4	1
451	6	16	10
650	3	1	-2
			10.51
Percentage that increased			0.970297
	Average Increase in score		10.51

Student:	Pretest Probability	Post Test Probability	
255	3	3	0
358	4	15	11
139	5	12	7
176	7	16	9
23	5	12	7
243	5	13	8
364	5	10	5
271	2	12	10
543	4	9	5
360	3	4	1
316	5	8	3
73	3	11	8
50	3	6	3
460	1	3	2
371	4	7	3
184	1	5	4
76	5	14	9
405	5	8	3
85	4	11	7
30	5	8	3
984	5	9	4
548	3	6	3
220	3	11	8
627	6	15	9
144	7	8	1
537	2	6	4
295	2	4	2
147	6	14	8
67	4	13	9
275	3	8	5
251	2	13	11
237	7	9	2
276	5	5	0
559	6	5	-1
266	3	8	5
428	3	11	8
171	3	10	7
408	3	7	4
449	3	7	4

49	5	14	9
207	1	3	2
208	2	1	-1
282	4	11	7
338	5	2	-3
83	5	11	6
306	5	12	7
62	2	5	3
8	2	3	1
199	6	12	6
333	3	10	7
508	2	13	11
162	3	5	2
68	5	6	1
397	3	8	5
309	0	3	3
19	4	15	11
146	4	5	1
609	6	3	-3
326	3	10	7
330	4	6	2
416	2	12	10
285	6	12	6
201	8	15	7
46	2	8	6
352	7	17	10
173	4	12	8
556	4	15	11
189	3	7	4
368	4	5	1
498	4	13	9
369	3	11	8
42	4	13	9
456	6	10	4
43	3	2	-1
493	5	16	11
198	3	7	4
454	2	9	7
495	3	1	-2
444	2	3	1
12	3	4	1

926	5	8	3
310	6	15	9
160	1	9	8
99	1	4	3
381	7	12	5
72	6	6	0
80	3	4	1
31	3	6	3
9	5	6	1
529	3	8	5
542	5	4	-1
831	7	9	2
487	3	5	2
353	2	5	3
41	2	4	2
121	2	3	1
166	2	6	4
230	3	2	-1
451	5	9	4
650	1	0	-1
			4.52
	Percentage that increased		0.910891
	Average increase in score:		4.52

Student:	Pretest Statistics	Post Test Statistics	
255	3	3	0
358	4	15	11
139	5	12	7
176	7	16	9
23	5	12	7
243	5	13	8
364	5	10	5
271	2	12	10
543	4	9	5
360	3	4	1
316	5	8	3

73	3	11	8
50	3	6	3
460	1	3	2
371	4	7	3
184	1	5	4
76	5	14	9
405	5	8	3
85	4	11	7
30	5	8	3
984	5	9	4
548	3	6	3
220	3	11	8
627	6	15	9
144	7	8	1
537	2	6	4
295	2	4	2
147	6	14	8
67	4	13	9
275	3	8	5
251	2	13	11
237	7	9	2
276	5	5	0
559	6	5	-1
266	3	8	5
428	3	11	8
171	3	10	7
408	3	7	4
449	3	7	4
49	5	14	9
207	1	3	2
208	2	1	-1
282	4	11	7
338	5	2	-3
83	5	11	6
306	5	12	7
62	2	5	3
8	2	3	1
199	6	12	6
333	3	10	7
508	2	13	11
162	3	5	2

68	5	6	1
397	3	8	5
309	0	3	3
19	4	15	11
146	4	5	1
609	6	3	-3
326	3	10	7
330	4	6	2
416	2	12	10
285	6	12	6
201	8	15	7
46	2	8	6
352	7	17	10
173	4	12	8
556	4	15	11
189	3	7	4
368	4	5	1
498	4	13	9
369	3	11	8
42	4	13	9
456	6	10	4
43	3	2	-1
493	5	16	11
198	3	7	4
454	2	9	7
495	3	1	-2
444	2	3	1
12	3	4	1
926	5	8	3
310	6	15	9
160	1	9	8
99	1	4	3
381	7	12	5
72	6	6	0
80	3	4	1
31	3	6	3
9	5	6	1
529	3	8	5
542	5	4	-1
831	7	9	2
487	3	5	2

353	2	5	3
41	2	4	2
121	2	3	1
166	2	6	4
230	3	2	-1
451	5	9	4
650	1	0	-1
			4.52
	Percentage that increased		0.910891
	Average increase in score:		4.52

Appendix G.

Student:	Percent Packet Complete:	Notes:
255	75%	0
358	100%	12
139	100%	13
176	75%	13
23	25%	0
243	75%	0
364	100%	0
271	50%	15
543	75%	9
360	25%	4
316	75%	5
73	75%	0
50	50%	6
460	100%	13
371	0%	7
184	50%	0
76	100%	13
405	100%	12
85	100%	11
30	100%	0
984	50%	0
548	0%	3
220	50%	6
627	100%	12
144	100%	4
537	100%	5
295	75%	11
147	100%	10
67	25%	8
275	100%	13
251	100%	0
237	100%	13
276	100%	9
559	100%	8
266	100%	13
428	50%	3
171	100%	13

408	100%	13
449	25%	9
49	75%	13
207	50%	2
208	25%	1
282	100%	11
338	50%	6
83	100%	13
306	100%	11
62	100%	13
8	100%	0
199	100%	13
333	50%	7
508	100%	15
162	25%	6
68	50%	6
397	50%	15
309	100%	14
19	100%	15
146	100%	14
609	0%	0
326	50%	15
330	100%	12
416	100%	14
285	100%	0
201	100%	15
46	0%	12
352	75%	12
173	75%	13
556	50%	8
189	75%	12
368	0%	0
498	25%	0
369	100%	15
42	75%	0
456	100%	13
43	50%	0
493	25%	14
198	75%	15
454	100%	15
495	0%	0

444	25%	13
12	75%	0
926	50%	13
310	100%	15
160	100%	12
99	25%	9
381	100%	12
72	50%	0
80	50%	15
31	50%	0
9	25%	15
529	75%	12
542	25%	7
831	25%	8
487	25%	0
353	100%	15
41	50%	13
121	0%	0
166	25%	0
230	25%	4
451	0%	0
650	0%	0

57 students with 75% or more complete packet work
54 students with the 60% or more of the notes completed

Appendix H.

Day 11- 12: Lesson 7 – Students design surveys and sample sizes, student displays of data collected

Day 13 - 14: Unit Project – Student's design their own games, and display the data collected from the games.

Lesson 7: Student Surveys

Students will be taking a survey of the different activities, and lessons they have done. Then students will be working in pairs to make surveys based on the games they played. Their surveys will want to collect information on students favorite and least favorite games played. We will discuss surveys, various samples, populations, and bias questions (see notes below that students will be taking in their notebooks). After students have made their surveys, they will decide on the sample or population that they want to conduct their survey with. Last students will need to present the findings, data, from their surveys. They can pick how to best represent the results from their surveys. Students can refer to the rubric scale for grading criteria, in their student packets.

Student Notes:

Survey: study of one or more characteristics of a group[0]

Biased question: A question that is worded to favor a particular answer, or makes assumptions that may or may not be true.[o]

Population: entire group you want information from (i.e. all of the 8th graders in North Branch)[o]

Sample: a part of the population.[o]

Random sample: every member of the population has an equal chance of being selected.[o]

Systematic sample: a rule is used to select members of the population.[o]

Convenient sample: only members of the population are easily accessible are selected.[o]

Self-selected sample: members of the population select themselves by volunteering.[o]

Unit Project:

Students will be designing games, collecting data from participants doing their games, displaying this data and deciding a goal for the game, if their game was used on the television show. Students have to use commonly found items, such as pencils, cups, index cards, paper clips, rubber bands, etc. Students need to make an instructional video explaining their game. Students have to determine what type of data will be collected and how they will be displaying it. Then students need to justify the goal they determined for the television show based on the data and statistics they determined. Students will have the checklist and grading scale rubric to use and refer to in their packets.

Additional to Student Packet Pages:

Lesson 7: Student surveys

You will be taking a survey based on the activities and lessons we had in the unit. The results are to be anonymous, please do not put your names on them, and be honest with your answers. Then you will be making your own surveys based on the games you have played in class. You want to determine the favorite and least favorite game of the students from my math classes. Follow the steps below:

First - Decide how you will collect your data (questions, scale answers, etc): Write your questions here

Second- Decide what type of sample you will be using and how you will record your data:

Third- Carry out your survey:

Fourth- Decide on the best method to display your data and the conclusions made. Display these on a separate piece of paper.

Survey Grading Checklist:

- The questions used are printed, nonbiased, and easy to understand.

- The sample population determined is described and how the data was collected is thoroughly explained.

- The data collected is well organized and turned in.

- The data is displayed neatly and accurately.

4- All four areas of the checklist are met with accuracy and neatness

3- Three of the four areas are met with accuracy and neatness

2 – Two out of the four areas are met with accuracy and neat ness, and/or one area of the checklist is missing or not included

1 – More than one area of the checklist is missing, and/or only 1 of the four areas are met with accuracy and neatness

0 – Three or more of the areas of the checklist are not turned in, and/or all of the areas do not meet accuracy or neatness levels.

Unit Project:

You are to design your own Minute to Win It game. The game must be based on the 60 second guidelines, use commonly found items and be safe for a classroom environment. Once you have decided on your game, you must make a short instructional video explaining your game (similar to ones watched in class). Then decide on the data that could be collected from your game and how to best use or display that data. We will be having a game day, where students will be trying out the different games and you can collect data. You will last need to display the data you collected using the learning targets from lessons in this unit.

Unit Project Checklist:

- Your game is safe and uses commonly found items
- You made a short instructional video of your game
- You collected data from your game in an organized form
- Your data collected is displayed in an accurate manor and uses one or more learning target from this unit.

Unit Project Rubric:

4 – All of the checklist criteria is met

3- Three out of the four items on the checklist are met

2 – Half of the items of the checklist are met, or you are missing one piece entirely

1 – Only one of the items on the checklist are met, and/or you are missing one or more pieces of the checklist