Performance Based Learning and Assessment Task

Statistical Study

I. ASSESSSMENT TASK OVERVIEW & PURPOSE:
Students will complete a Statistical Study, which they will design, execute on a sample of the student body, and report their findings to their AFDA class. Students will need a strong background in topics covered in class to be able create a good study. During the presentation component they will show that they understand critical concepts.

II. UNIT AUTHOR:
Jason Grubb, Pulaski County High School, Pulaski County Public Schools

III. COURSE:
AFDA

IV. CONTENT STRAND:
Data Analysis

V. OBJECTIVES:
The student will be able to…

AFDA.8 The student will design and conduct an experiment/survey. Key concepts include

a) sample size;
b) sampling technique;
c) controlling sources of bias and experimental error;
d) data collection; and
e) data analysis and reporting.

VI. REFERENCE/RESOURCE MATERIALS:
Students will refer to the AFDA text book and class notes for concepts, definitions and examples of statistical studies. Students will use their Ti-83 calculator to help organize, compute, and graph data. Presentations will be done using Microsoft Power Point, and Microsoft Excel.

VII. PRIMARY ASSESSMENT STRATEGIES:
There will be three assessment components, 1) Self Assessment, student will complete and turn in along with their completed project. 2) Peer Assessment, students will evaluate classmates presentation portion of the project. 3) Teacher Assessment, I will complete the attached rubric for each student before, during and after their project.

VIII. EVALUATION CRITERIA:
The three forms of Assessment will be combined to give the student an overall combined grade for the project. The grade will be a weighted average: 80% Teacher Assessment, 10% Self-Evaluation, 10% Peer Assessment (average.)

IX. INSTRUCTIONAL TIME:
This project will last 9-days (85min blocks) of instruction time from introduction to presentation.

Statistical Study

Strand
Data Analysis

Mathematical Objective(s)

Students will be able to design and execute a statistical study. First students must choose a topic that will prove to be engaging to a class of peers, and provide evidence of data that can be used to calculate meaningful statistics. Students will select the appropriate sample size, sampling technique, identify bias and error, collect data, analyze data and report their findings to their peers.

Related SOL

AFDA.8 The student will design and conduct an experiment/survey. Key concepts include
a) sample size;
b) sampling technique;
c) controlling sources of bias and experimental error;
d) data collection; and
e) data analysis and reporting.

NCTM Standards

- Understand the differences among various kinds of studies and which types of inferences can legitimately be drawn from each.
- Know the characteristics of well-designed studies, including the role of randomization in surveys and experiments.
- Understand the meaning of measurement data and categorical data, of univariate and bivariate data, and of the term variable.
- Understand histograms, parallel box plots, and scatterplots and use them to display data.
- Compute basic statistics

Additional Objectives for Student Learning:
Students should have general knowledge of composition of a formal paper. The report should be well organized, using multiple paragraphs, proper spacing and grammar.

Materials/Resources
Graphing Calculators, presentation materials include a projector, smart-board, desktop computer, colored pencils, rulers, and poster board. While creating their presentation the students should have access to a desk-top or laptop computer, with a minimum of Microsoft Office for word processing, presentations and creating graphs or other visuals.

Assumption of Prior Knowledge
- collecting and ordering data; computing mean, median and mode; displaying data in graphs and various charts
- Students should have experience analyzing data from various forms, computing mean, median, and mode.
- Students should be able to identify sample, sample space and sampling technique in previous problems

- Students should be able to talk about statistics and clearly present their thoughts on the data collected and calculations made.

Introduction: Setting Up the Mathematical Task

- In this activity, you will design, execute and present the results of a statistical study on the student body at PCHS.
- This project from start to finish will span 9 days (85 min blocks) of class-time. See attached timeline. You may need to work on components of this at home outside of class time.
- Students should reflect on class lessons about Data Collection and Analysis.
- Review different types of sampling techniques that could be used and the pros/cons of each.
- What information do you think would be interesting to know about your classmates at PCHS.
- Do you think your classmates would be interested in hearing statistical data about the topics that you are considering?
- What makes a Statistical Study interesting to readers?
- Have you ever participated in a student survey or experiment?
- The class will participate in a 20-30 minute discussion to talk about the above questions and share thoughts.
- Students will be paired by their choosing for this project.
- What mathematical calculations from previous lessons will you use to help you report your findings?
- Your study will have five parts: Design, Data Collection, Data Analysis, Presentation, and Written Report.

Student Exploration

- Students will brainstorm interesting topics for statistical studies on high school students
- Students will pair up and choose one topic to explore
- Students will design their Statistical Study and determine what determine what data they would like to collect
- Students will create data collection sheets and collect data from students in the student body, in the hallways, at lunch or in classrooms (with permission.)
- The teacher will be answering questions, looking over students work, approving topics, sharing ideas on sampling method, asking students about the information that they hope to gather and what they intend to do with it.
- The teacher will be showing students how to use computers and graphing calculators to compute, and display data.
- The teacher will be circulating the classroom giving advice and clarification on the final presentation and report

Monitoring Student Responses

- Students will collect and organize their data, prepare a written report as well as a verbal presentation
- They must include 2 visuals to be displayed during their presentation to communicate their findings to the class ie graphs, tables, etc.
- Student groups will also prepare a 2 page report, describing their findings and any bias they may have found
- Students will complete peer evaluations while listening to classmates presentations
- Following completion of each presentations students will have an open-forum discussion where we will talk about the project, and students will share what they found interesting about the study, and ask any questions that they may have.

Assessment List and Benchmarks

- See attached rubric.

Statistical Study

AFDA

Student will work in pairs to design a statistical study to investigate Pulaski County High School. The study must be approved by the teacher (more than just a yes or no question). The following guidelines must be followed.

- Should follow guidelines for a good experiment or survey.
    - Experiment must be done using 50 separate participants.
    - Observational study or Survey must be conducted on 100 people.
    - Survey must be at least 10 questions long.
- Collect both qualitative and quantitative data.
- Students should calculate appropriate statistical measures.
- All data must be recorded and turned in.
- Along with the data students will write a report describing their data collection, sampling methods, possible sources of bias, results, reaction to results and comparisons to similar studies found using internet searches or classmates studies.
- Students will make inferences about the data and include that in the report.
- Along with the data and report, students must provide two graphical representations of the data (not part of the one page report.)
- Students must also make a 5 – 10 minute presentation to the rest of class (can include anything students want to help with their presenting.)

Tentative Schedule for this project

- Day 1 classroom discussion and intro to project
- Day 2 on your own to collect data
- Day 3 on your own to collect data
- Day 4 Students will type up their data, make their graphical representation, and start typing their report.
- Day 5 Students will continue to type up their data, make their graphical representation.
- Day 6 Complete project and polish presentation.
- Day 7 Students will start their presentations.
- Day 8 Students will finish their presentations.
- Day 9 Make-ups for presentations and discussion of peer reactions to studies.

Guidelines for the report:

- Explain why you chose your topic.
- Explain the sampling technique and why you used this method.
- Provide examples of raw data.
- Explain what the calculations represent and how they describe the data.
- Make inferences about the data, compare the data you found to what you thought you may find.
- If applicable draw comparisons to national data, other published studies, or classmates results of similar studies.
- Explain why you choose the graphical representations you did and how it relates to the data collected
- 12 point font, 1-inch margins, double-spaced.
- Include your name, name of study and class as header.

PBA Rubric (your score for each topic will be highlighted)				
	0	**1**	**2**	**3**
Appropriate topic	Inappropriate topic	Appropriate topic	Good topic that peers can relate to	Interesting topic that will interest many peers
Desired data	Did not plan to record acceptable data	Planned to record some data	Planned to record multiple types of data that can be used to find meaningful statistics	Data collected is carefully planned and geared to interest peers and provide meaningful information about the school population
Planned Sampling Method	Did not plan a method of sampling	Selected a sampling method but not the most appropriate for this purpose	Chose an appropriate sampling method, plan of execution will meet most aspects of sampling method	Chose an appropriate sampling method Excellent job describing sampling method and intended execution of sampling
B. Data Collection	**0**	**1**	**2**	**3**
Appropriate amount	Did not collect data	Collected less than 50% of desired data	Collected 50-99% of desired data	Collected the desired amount of data (either 50 or 100 depending on type of study)
Executed intended sampling method	Did not use any type of sampling method	Did not execute intended sampling method	Loosely executed intended sampling method	Precisely executed intended sampling method and
Organization	Did not organize data	Data was organized somewhat	Data was well organized after collection and easy to read	Data was well organized during collection, and easy to read, presentation of data was very neat.
C. Data Analysis	**0**	**1**	**2**	**3**
Computed Meaningful Statistics	Statistics were not computed	Statistics were computed with procedural mistakes	Statistics were computed with computational mistakes	Statistics were meticulously computed, with no mistakes
Compared results to expected results	Results were not compared to expectations	Data from similar studies was not found	Results were compared to data found on internet from similar studies	Results were compared to similar studies, thoughtful insight was provided to determine likeness and difference
Accurately described results of study	Did not describe results	Offered explanation that did not fit data	Explanations loosely fit data	Explanations precisely fit data and were well communicated
D. Presentation	**0**	**1**	**2**	**3**
Length	No Presentation	Less than 4 min	4-6 min	6-10 min
Delivery	No Presentation	Eye-contact and volume level needs	Eye-contact and volume level was good	Presenters engaged audience, accurately referred to visuals, and

		improvement		confidently presented the results of their study
Visuals	No Visuals	At least 1 Visual	2 Visuals that display the data accurately	2 Visuals that are mathematically accurate, easy to read and colorful
Accurately interpreted and presented findings	No Presentation	Presented and shared results of their statistical study	Presentation included mathematical analysis of the data, and interpretation of results	Interpreted results and accurately presented them to the audience, using appropriate math terminology and procedure
E. Written Report	**0**	**1**	**2**	**3**
Length and Format	No report	Paper is less than 2 pages	Paper is correct length but has formatting errors	2 or more pages, correct format, neat and well presented paper
Punctuation and Grammar	No report	5 or more misspellings or grammatical errors	Less than 5 misspellings or grammatical errors	No misspellings or grammatical errors
Description of Data	Data not described	Data is described with little accuracy and detail	Data is described with good accuracy and detail	Data is described with excellent accuracy and in depth detail, readers have a strong understanding of content
Insight and reaction to findings	No insight or reaction	Incorrect conclusion from data	Offered insight and reaction to findings	Offered well-described insight and reaction to the findings in the Statistical Study
Bias	No suggested source of bias	Inaccurately identified source(s) of bias	Accurately identified sources(s) of bias	Accurately identified source(s) of bias and described how they could have affected the data

80% Teacher Evaluation: _____

10% Average of Peer Evals on Presentation:_____

10% Self Evaluation: _____

_____

Students Final Grade: _____

AFDA

Statistical Study

Summer 2015

Cornhole Fun!

My experiment was to see how many points each student could get as if they were in a real game of cornhole. Cornhole is a game in which players or teams compete to toss mini corn-filled bags, four per round, onto a board and hopefully through the whole on that board. Teams alternate their tosses, much like horseshoes. Points are awarded based on the outcome of each round. Each bag that lands and rests on the board earns 1 point, while each bag that goes through the hole earns 3 points. The cornhole boards that were used are regulation size boards. The bags used in the experiment were also weighted to regulation weight, as well as regulation size. I made and painted my own corn hole boards in which I used. I used the same type of paint that is used of the professional boards so that the bags would slide across the boards the same. During my experiment, the students threw eight bags each, fifteen feet away from the board. Their point totals were based upon the sum of the points scored for their 8 tosses.

The sampling technique that I used was convenience, since I only asked folks that were in the hallways during 4^{th} block. Had I picked from a list of all students in the school, then I could have a more random sample. I did my best to avoid bias, by taking the first students that I came across in the hallway, not minding their age, sex, experience, or interest level. I was successful acquiring data using females and males along with a variety of grade level and some teachers and staff members. For my data, I asked what grade the student was in, the age of the student, the sex of the student, and if they had played cornhole before or not. Apparently, cornhole is quite popular in Pulaski County, because all of my subjects said that they had experience playing the game. There was a disproportionate amount of eleventh and twelfth graders due to the availability of the students. During my math class there was a larger number of upperclassmen in the hallways and in the common areas of the school. My slightly more based on males, because males were more available to participate in my experiment.

There was a wide range of points scored by participants in my experiment. The points varied from a minimum of zero and a maximum of fourteen. In order to analyze the information collected I wanted to find the measures of central tendency: the mean, the median, and the mode. The mean for this data was 7.34 points out of twenty-four total possible points per 8 bags. The median, or the middle number of all the data, was a score of eight. I had two modes which were eight and ten, which is the numbers that occur most within the data. I also found various percentages that are based on my data collection. I found that fifty eight percent of the student who did the experiment are males and the other forty two percent are females. I also wanted to break the data up into classes, so that I could better display frequency, relative frequency, and cumulative frequency. The first class was zero through two, the second class was three through six, the third class was seven through nine, my fourth class was ten through twelve, and the fifth class was thirteen through fifteen. The frequency is the amount of times each number occurs throughout the experiment, and the relative frequency I found by dividing each classes relative frequency by the total number of experiments. To get the cumulative frequency, I added the relative frequency to the previous classes' relative frequencies. By studying these three types of frequencies, I was able to see how closely my data was grouped, and how the cumulative frequency increased with each class. The large majority of my data fell in the middle three classes, which means that my data has some characteristics of normal distribution.

When I first decided to do this experiment, I did not think this is how the data would turn out. I was hoping to take a stratified sample and get an even amount of participants from each grade and an even amount of males and females. I too expected to have the opportunity to compare the students that had experience playing cornhole to the students that did not have experience. I was pleasantly surprised to see that cornhole has become such a local favorite, however the lack of "new players" forced me to forgo those comparisons.

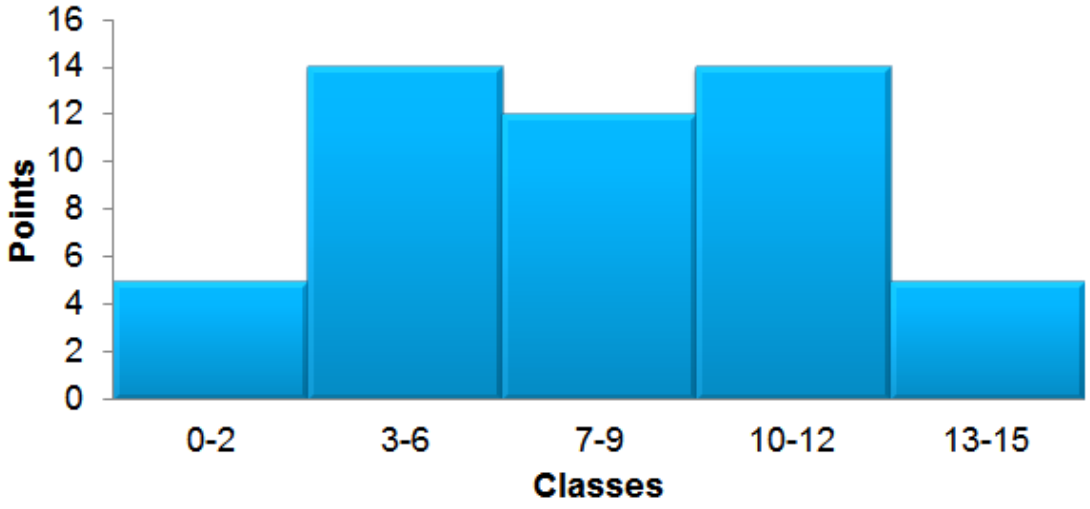
I also want to point out a couple of sources of bias in my experiment. There were no students with zero experience; therefor this cannot be an extremely accurate representation of the population. I know that there is a large number of students at PCHS that have not played cornhole in the past, or have not even heard of it. The data presented represents a large number of upperclassmen, compared to underclassmen, which makes my sample not an accurate representation of our student body.

Through completing this experiment I found that the skill level of my sample was not as spread out as I previously thought. The data shows that 80% of the sample falls within a few points of the mean. Only 20% of the subjects scored more than thirteen points or less than three points. Over half of the 50 participants scored within six points of each other, this is a terribly close range considering the possible range of zero to twenty-four points. I do believe that if I had the opportunity to continue my experiment on the whole student body, or on a much larger sample, that we would find much more diverse data, with a much wider range.

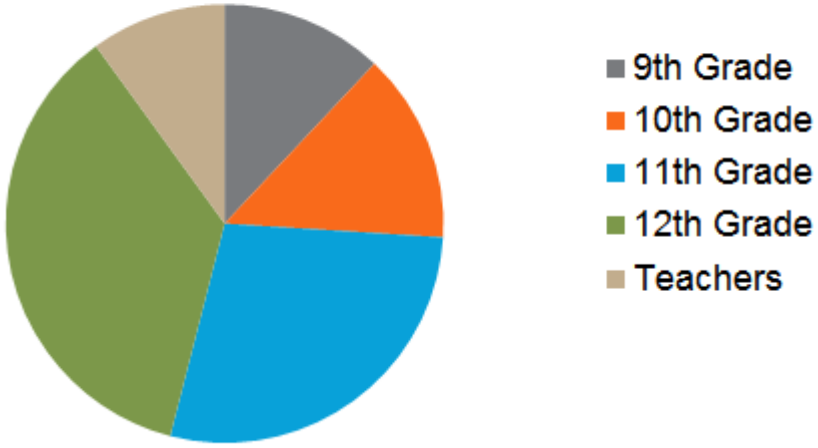
FREQUENCY DISTRIBUTION TABLE

Classes	Frequency	Relative Freq.	Cumulative Freq.
0-2	5	.1	.1
3-6	14	.28	.38
7-9	12	.24	.62
10-12	14	.28	.9
13-15	5	.1	.1

FREQUENCY DISTRIBUTION GRAPH



Corn Hole Participants



MEAN, MEDIAN, AND MODE

Mean: 7.34

Median: 8

Mode: 8 & 10

PBA Rubric

Self-Evaluation

Number	Element	Point Value	Self-Graded	Teacher Grade
1	The Template is complete	8	8	
2	All materials and answer keys for the task are included	12	12	
3	The Template and materials are organized and structured	8	8	
4	The task is inquiry based	4	8	
5	The task is connected to the real world	6	6	
6	The task requires higher order thinking skills/levels of cognitive demand	4	4	
7	The task is based on the SOL's and NCTM Standards	6	6	
8	The assessment is provided and is followed both by students and teacher	12	12	
9	The benchmark of exemplary student work is included	6	6	
10	The document is professionally presented	6	6	
	Total	**72**	72	