

Performance Based Learning and Assessment Task

How Do Facebook Likes Accrue Likes?

I. Assessment Task Overview and Purpose:

Many high school students are addicted to social media. The projects in this performance based learning assessment are aimed at capitalizing on student's daily use of social media.

In this assessment task, students will collect information about the number of Likes received from a post they make to Facebook. Students will use the information they collect to explore how likes accrue over time. They will use regression analysis and correlation to explore how different variables affect how likes are received. This task is designed to help students explore how various statistical methods can be used to analyze a variable on interest. This task is meant to serve as an end-of-unit project

The information collected in this project will probably not lead to making this world a better place, but the hope is that the students will think a little differently about the social media they use every day and maybe they will realize that mathematics are a useful tool to examine the everyday world.

II. Unit Author:

Suzie Warren, Floyd County High School, Floyd County, Virginia

III. Course:

Algebra Functions & Data Analysis (AFDA)

IV. Content Strand:

Curve of best fit, analyzing multiple representations of a function, scatterplots, correlation coefficient

V. Objectives:

Students will:

- Collect data
- Create graphs that represent their data
- Analyze their graphs and data
- Determine the relationship between two variables

- Choose an appropriate regression equation and use the regression equation to make predictions
- Determine the usefulness or validity of their regression models
- Make predictions about the correlation of two variables
- Examine correlation coefficient values and make inferences based on the statistic

VI. Reference/Resource Materials:

- Students will use Microsoft Excel to create graphs
- TI-83 Calculators will be used for regression analyses

VII. Primary Assessment Strategies:

Students will create a poster summarizing their findings, the quality and content of the poster will be assessed by the following:

- Assessment List (Attached)
- Rubric (Attached)

VIII. Evaluation Criteria:

The poster will be evaluated in several categories and awarded 0-5 points in each category.

- Exemplary work – 5 points
- Satisfactory work – 3 points
- Need Improvement – 1 point
- Missing – 0 points
- Benchmarks of exemplary work are attached

IX. Instructional Time:

Data Collection Time: Students should collect data over a weekend prior to the beginning the analyses.

Regression Analysis: One 90-minute class block

Correlation Analysis: One 90-minute class block

Poster Creation: One 90 minute class clock or can be done at home

PROJECT 1: How do Facebook Posts Accrue Likes?

Strand: curve of best fit, analyzing multiple representations of functions, scatterplots, correlation coefficient

Mathematical Objectives: Students will:

- collect data
- create graphs that represents their data
- analyze their data and graphs
- determine relationship between two variables
- choose an appropriate regression equation and use the regression equation make predictions
- determine the usefulness or validity of their regression equation
- make predictions about the correlation of two variables
- examine correlation coefficient values and make inferences based on the statistic

Related Virginia SOLS:

- AFDA.3a – Write an equation for the line of best fit given a set of data points in a table, on a graph, or from a practical situation
- AFDA.3b – Make predictions about unknown outcomes, using the equation of a line of best fit
- AFDA.3d – Investigate scatterplots to determine if patterns exist, and identify the patterns
- AFDA.3e – Find an equation for the curve of best fit for data using a graphing calculator
- AFDA.3f – Make predictions using data, scatterplots, or equation of the curve of best fit
- AFDA.3g – Given a set of data, determine the model that would best describe the data
- AFDA.3h – Describe the errors inherent in extrapolation beyond the range of the data
- AFDA.4b – Make predictions given a table of values, a graph, or an algebraic formula
- AFDA.4c – Determine the relationship between data represented on a table, in a scatterplot, and as elements of a function
- AFDA.4d – Determine the appropriate representation of data derived from real-world situations
- AFDA.4e – Analyze and interpret the data in context of the real-world situation
- A1.11a – Write an equation for a curve of best fit, given a set of no more than 20 data points in a table, graph, or real-world situation

- A1.11b – Make predictions about unknown outcomes using the equation of the curve of best fit
- A1.11c - Design experiments and collect data to address specific real-world questions
- A1.11d – Evaluate the reasonableness of a mathematical model of a real-world situation
- A2.9a – Collect and analyze data
- A2.9b – Investigate scatterplots to determine if patterns exist and then identify the pattern
- A2.9c – Find an equation for the curve of best fit for data, using a graphing calculator
- A2.9d – Make predictions using data, scatterplots, or the equation of the curve of best fit
- A2.9e – Given a set of data, determine the model that would best describe the data

NCTM Standards:

- Data Analysis and Probability
 - Formulate questions that can be addressed with the data and collect, organize, and display relevant data to answer them
 - Understand the differences among various studies and which inferences can legitimately be drawn from each
 - Understand histograms, parallel box plots, and scatterplots and use them to display data
 - Compute basic statistics and understand the distinction between a statistic and parameter
 - Select and use appropriate statistical methods to analyze data
 - For univariate measurement data, be able to display the distribution, describe its shape, and select and calculate summary statistics
 - For bivariate measurement data, be able to display a scatterplot, describe its shape, and determine regression coefficients, regression equations, and correlation coefficients using technological tools
 - Identify trends in bivariate data and find functions that model the data or transform the data so that they can be modeled
 - Develop and evaluate inferences and predictions that are based on the data
 - Understand how sample statistics reflect the values of population parameters and use sampling distributions as a basis for informal inference
- Process Standards
 - Communication

- Organize and consolidate their mathematical thinking through communication
- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others
- Connections
 - Recognize and use connections among mathematical ideas
 - Understand how mathematical ideas interconnect and build on one another to produce a coherent whole
 - Recognize and apply mathematics in contexts outside of mathematics
- Representation
 - Create and use representations to organize, record, and communicate mathematical ideas
 - Use representations to model and interpret physical, social, and mathematical phenomena

Additional Objectives for Student Learning: Scientific method, hypothesis testing, internet safety and use of social media

Materials/Resources:

- Students must have access to a Facebook Account (Instagram also works)
 - If students do not have their own account, then they may collect data through the account of a parent, relative, or friend
- Data Collection Log (attached)
- Letter to Parent/Guardian – this explains the purpose of the activity to parents and makes them aware that their child is collecting data using social media.
 - Printed on the Data Collection Log
- 10-hour block of time (it is suggested that the students collect their data over the weekend)
- Poster Paper
- TI-83/TI-84 PLUS – one for each student
- Microsoft EXCEL – Computer Lab

Assumption of Prior Knowledge

- Students are aware of how to use Facebook (or other social media)
 - Students know how to make a post and monitor the number of Likes of the post
- Students are able to keep track of time in order to take data readings at the appropriate time

- Relevant concepts that have already been explored include;
 - Using the graphing calculator to enter data and create a scatterplot
 - How to determine the curve of best fit from a scatterplot
 - Using the graphing calculator to calculate a regression equation
 - Using the regression equation to make predictions – how to copy the regression equation into the y-editor and use the table feature (and “ask” feature of table)
 - How to determine if predicted values are relevant or believable (relevant range)
 - How to determine the correlation coefficient (using technology)
 - How to interpret the correlation coefficient
- Students may already have ideas about how Facebook posts receive Likes. Encourage them to share their ideas and ask them how they could measure their ideas using the language of the scientific method
 - Ask them to define the term “hypothesis” and determine their hypotheses for this situation
 - Ask them to define “experiment” and how could this activity be an experiment
 - Students have been exposed to hypothesis testing in their science classes (since elementary school) so this activity provides an opportunity to demonstrate one of the many ways that science and mathematics overlap
- Some students may have difficulty calculating the Likes as a rate (Likes per hour). To insure accurate calculations, these students will find these values during class. The students are instructed to only collect the “total number of Likes” on their own.
 - In order to simplify this calculation, the students are instructed to make their data collection at the top of the hour (i.e. 1:00, 2:00, 3:00, etc.)
 - The data collection chart is designed to guide the students’ calculations
 - Advanced students can be instructed to determine a way to describe likes as a rate. They can choose a method and compare measurement techniques with each other

Introduction: Setting up the Mathematical Task: *“Today we will explore the question of how Facebook posts accrue Likes. You are going to begin a project where you analyze the number of Likes received on a Facebook post over time. You may choose any post – a statement or picture – whatever you like (school appropriate of course). You will collect data about your post, analyze the data, determine a model that describes the data, make predictions using your model, and examine how variables are related. You will be using the TI-83 graphing*

calculator for data analysis and Microsoft Excel to create graphs that will be used in your final presentation. You will create a presentation poster that will summarize your findings. Be prepared to share your poster with the class. The poster will be the graded portion of this activity and will be put in the display case in the lobby.”

Student Exploration: Students will make a posting to Facebook and track the number of likes received over the course of a 10 hour period.

- Students will record the number of likes once an hour during the 10 hour span, yielding 11 data points.
 - It is suggested that the data collection be done over a weekend
- Students will use the data sheet provided to record their data.
- Students will create and analyze four scatterplots
 - Regression Analysis/Curve of Best Fit
 - Likes as a Rate (Likes per Hour) and time
 - Total number of Likes and time
 - Correlation Analysis/Correlation Coefficient
 - Maximum Rate of Likes and time
 - Maximum total number of Likes and total number of friends
- Students will summarize their findings in a presentation poster
 - Students will submit individual work

Role of the Teacher: The teacher’s role is that of facilitator. The teacher will not simply give students answers, but guide students and scaffold them in the appropriate direction when they become lost or confused. The teacher will guide students by asking the open-ended questions which are described in the following section. When feasible the teacher will encourage the students to help each other when they encounter difficulty. Care must be taken so that students do not “give” answers out – this, of course, is a challenging endeavor. Here is one suggestion:

Acceptable: “How did you determine the curve of best fit?”

Not-Acceptable: “What is the curve of best fit?”

Monitoring Student Responses

Student Communication

- Students are encouraged to share ideas with each other and with the class as a whole
- Although the project is individual work, the students may openly work with each other and assist one another in the analysis.

Modifications and Extensions

- A reduced project can be given to those with an IEP/504 that specifically calls for reduced work, or those who are struggling significantly with the project
- Some students can be presented with the challenge of collecting information about Facebook Likes and asked to develop a procedure for the data collection process
 - The students can develop a list of questions and methods to utilize to answer the questions
 - Students can formulate hypotheses about Facebook likes and develop an experiment to test their hypotheses using the scientific method

Assessment List

Number	Element	Point Value	Earned Assessment	
			Self	Teacher
1	Description of original post, can be a screenshot	2		
2	Data Sheet included	2		
3	Regression Analysis - Poster includes 2 appropriate graphs <ul style="list-style-type: none"> Includes commentary about the observed relationship between the variables for both analyses 	4		
4	Graphs are appropriately labeled	4		
5	Dependent and independent variables are clearly identified	4		
6	The equation of the curve of best fit is included for both analyses and <i>explained</i>	6		
7	Regression curve is used to predict values at 3 different time periods	6		
8	There is commentary about how well the regression curve fits the data set for both analyses and the usefulness/reliability of the model for making predictions.	6		
9	Correlation Analysis - Poster includes 2 appropriate graphs with interpretation	6		
10	Graphs are appropriately labeled	4		
11	Dependent and independent variables are clearly identified	4		
12	Correlation coefficient for both analyses is included and <i>explained</i>	4		
13	The poster is well organized and easy to follow.	3		
14	The poster is free of mathematical errors	3		
15	The poster is free of grammatical errors	3		
16	All deadlines were met	3		
17	The poster is contains all components, is complete.	3		

Performance Based Learning and Assessment Task

Project 2: Do Facebook Likes have a Normal Distribution?

I. Assessment Task Overview & Purpose:

Many high school students are addicted to social media. The projects in this performance based learning assessment are aimed at capitalizing on student's daily use of social media.

Students will track the number of likes one of their posts receives and examine this data as a rate (likes per hour) and as a total number (maximum number of likes received in a 10 hour span). Students will create a stem-and-leaf plot, determine possible outliers and discuss the effect of outliers, they will calculate z-scores, create a histogram, and determine if the data have a Normal distribution.

The information collected in this project will probably not lead to making this world a better place, but the hope is that the students will think a little differently about the social media they use every day and maybe they will realize that mathematics are a useful tool to examine the everyday world.

II. Unit Author:

Suzie Warren, Floyd County High School, Floyd County, Virginia

III. Course: Algebra Functions & Data Analysis (AFDA)

IV. Content Strand: Normal Distribution

V. Objectives:

The student will:

- collect data
- create graphs that represents their data
- analyze their data and graphs
- determine relationship between two variables
- determine the correlation coefficient using technology
- interpret correlation coefficient (positive/negative relationship; strong/weak relationship; no relationship)
- infer possible reasons that such a relationship exists

VI. Reference/Resource Materials:

- Microsoft Excel
- TI-83 Graphing Calculator

VII. Primary Assessment Strategies:

Students will create a poster summarizing their findings, the quality and content of the poster will be assessed by the following:

- Assessment List (Attached)
- Rubric (Attached)

VIII. Evaluation Criteria:

The poster will be evaluated in several categories and awarded 0-5 points in each category.

- Exemplary work – 5 points
- Satisfactory work – 3 points
- Need Improvement – 1 point
- Missing – 0 points
- Benchmarks of exemplary work are attached

IX. Instructional Time:

- Students should collect data over a weekend
- Normal Distribution Analysis – one 90 minute class block
- Poster Creation – one 90 minute class block or can be done at home

PROJECT 2: Do Facebook Likes have a Normal Distribution?

Strand: Normal Distribution

Mathematical Objectives: Students will:

- collect data
- create graphs that represents their data
- analyze their data and graphs
- determine relationship between two variables
- determine the correlation coefficient using technology
- interpret correlation coefficient (positive/negative relationship; strong/weak relationship; no relationship)
- infer possible reasons that such a relationship exists

Related Virginia SOLS:

- AFDA.3d – Investigate scatterplots to determine if patterns exist, and identify the patterns
- AFDA.3e – Find an equation for the curve of best fit for data using a graphing calculator
- AFDA.3i – Estimate the correlation coefficient when given data and/or scatterplots
- AFDA.4e – Analyze and interpret the data in context of the real-world situation
- AFDA.7a – Interpret mean, mode, range, interquartile range, variance, and standard deviation of a univariate data set in terms of the problem's context
- AFDA.7b – Explain the influence of outliers on a univariate data set
- AFDA.7d – Identify properties of a normal distribution
- A1.9a – Analyze descriptive statistics to determine the implications for the real-world situations from which the data derive
- A1.9d – Given data, including data in a real-world context, calculate and interpret z-scores for a data set
- A2.9a –Collect and analyze data
- A2.9b – Investigate scatterplots to determine if patterns exist and them identify the patterns
- A2.11a – Identify properties of the normal distribution

NCTM Standards:

- Data Analysis and Probability
 - Formulate questions that can be addressed with the data and collect, organize, and display relevant data to answer them
 - Understand the differences among various studies and which inferences can legitimately be drawn from each
 - Understand histograms, parallel box plots, and scatterplots and use them to display data
 - Compute basic statistics and understand the distinction between a statistic and parameter
 - Select and use appropriate statistical methods to analyze data
 - For univariate measurement data, be able to display the distribution, describe its shape, and select and calculate summary statistics
 - For bivariate measurement data, be able to display a scatterplot, describe its shape, and determine regression coefficients, regression equations, and correlation coefficients using technological tools
 - Identify trends in bivariate data and find functions that model the data or transform the data so that they can be modeled
 - Develop and evaluate inferences and predictions that are based on the data
 - Understand how sample statistics reflect the values of population parameters and use sampling distributions as a basis for informal inference
- Process Standards
 - Communication
 - Organize and consolidate their mathematical thinking through communication
 - Communicate their mathematical thinking coherently and clearly to peers, teachers, and others
 - Connections
 - Recognize and use connections among mathematical ideas
 - Understand how mathematical ideas interconnect and build on one another to produce a coherent whole
 - Recognize and apply mathematics in contexts outside of mathematics
 - Representation
 - Create and use representations to organize, record, and communicate mathematical ideas

- Use representations to model and interpret physical, social, and mathematical phenomena

Additional Objectives for Student Learning: Scientific method, hypothesis testing, internet safety and use of social media

Materials/Resources:

- Students must have access to a Facebook Account (Instagram also works)
 - If students do not have their own account, then they may collect data through the account of a parent, relative, or friend
- Data Collection Log (attached)
- Letter to Parent/Guardian – this explains the purpose of the activity to parents and makes them aware that their child is collecting data using social media.
 - Printed on the Data Collection Log
- 10-hour block of time (it is suggested that the students collect their data over the weekend)
- Poster Paper
- TI-83/TI-84 PLUS – one for each student
- Microsoft EXCEL – Computer Lab

Assumption of Prior Knowledge

- Students are aware of how to use Facebook (or other social media)
 - Students know how to make a post and monitor the number of Likes of the post
- Students are able to keep track of time in order to take data readings at the appropriate time
- Relevant concepts that have already been explored include;
 - Using the graphing calculator to enter data and create a scatterplot
 - Definitions and meanings of measures of central tendency
 - Definitions and meanings of measures of variability
 - Characteristics of the normal distribution
- Students may already have ideas about how Facebook posts receive Likes. Encourage them to share their ideas and ask them how they could measure their ideas using the language of the scientific method

- Ask them to define the term “hypothesis” and determine their hypotheses for this situation
- Ask them to define “experiment” and how could this activity be an experiment
- Students have been exposed to hypothesis testing in their science classes (since elementary school) so this activity provides an opportunity to demonstrate one of the many ways that science and mathematics overlap
- Students may have difficulty calculating the Likes as a rate (Likes per hour). To insure accurate calculations, the students will find these values during class. The students are instructed to only collect the “total number of Likes” on their own.
 - In order to make this calculation easier, the students are instructed to make their data collection at the top of the hour (i.e. 1:00, 2:00, 3:00, etc.)
 - The data collection chart is designed to make the calculations simpler
 - Advanced students can be presented with the question of how to determine the rate of likes and asked to formulate possible methods for collecting the data without using the data collection sheet

Introduction: Setting up the Mathematical Task: *“Today we will explore the distribution patterns of Facebook Likes. We will analyze the maximum number of Likes and the maximum rate of Facebook Likes received by students in our class. You will create graphs and determine if the data in each analysis represents a Normal distribution. In addition, you will calculate the z-score for your individual value of maximum likes received and describe how your value compares to the values from the rest of the class. You will also discuss the variables that could influence when the maximum rate of likes occurs and factors that influence the maximum number of likes a person receives from a post.”*

Student Exploration: Students will make a posting to Facebook and track the number of likes received over the course of a 10 hour period.

- Students will record the number of likes once an hour during the 10 hour span, yielding 11 data points.
 - It is suggested that the data collection be done over a weekend
- Students will use the data sheet provided to record their data.
- The students will use their Facebook data to determine if the number of likes received by a post has a Normal distribution.
- Students will calculate single variable summary statistics including measures of central tendency and measures of variability.
- Students will create a stem-and-leaf plot based on the original data and interpret the plot.
- Students will use EXCEL to create a histogram with the normal curve superimposed on it.
- Students will determine whether or not the Facebook likes are normally distributed.
- Each student will calculate the z-score for their individual value of maximum number of likes received and discuss how their individual value compares to the pooled data.
- Each student will create a poster to summarize their analysis.

Role of the Teacher: The teacher's role is that of facilitator. The teacher will not simply give students answers, but guide students and scaffold them in the appropriate direction when they become lost or confused. The teacher will guide students by asking the open-ended questions which are described in the following section. When feasible the teacher will encourage the students to help each other when they encounter difficulty. Care must be taken so that students do not "give" answers out – this, of course, is a challenging endeavor. Here is one suggestion:

Acceptable: "How do you find the correlation coefficient?"

Not-Acceptable: "What is the correlation coefficient?"

Monitoring Student Responses

Student Communication

- Students are encouraged to share ideas with each other and with the class as a whole
- Students are asked to make predictions about the outcomes prior to the analysis

- How do you think the number of friends a person has effects the number of likes a post receives?
- How does time impact the rate of likes received by a post?
- How does the nature of the sample effect the results? Or rather, what would you expect to be different (if anything) if the sample consisted of only adults versus teens?

Modifications and Project Extensions

- A reduced project can be given to those with an IEP/504 that specifically calls for reduced work, or those who are struggling significantly with the project
- Some students can be presented with the idea of collecting information about Facebook Likes and asked to develop a procedure for the data collection process
 - Students can be presented with a list of questions and they will develop the experimental procedure
 - Students can state the hypotheses and develop the means for testing them

Assessment List

			Earned Assessment	
Number	Element	Point Value	Self	Teacher
1	Poster includes appropriate measures of central tendency with explanation	6		
	Poster includes appropriate measures of variability with explanation	6		
3	Poster includes stem-and-leaf plot with interpretation	4		
5	Poster one z-score of maximum number of Likes with an interpretation of its relative standing	6		
6	Poster includes histogram with interpretation of the graph	6		
7	Poster is free of mathematical errors	3		
8	Poster is free of grammatical errors	3		
9	Poster is organized and neat	3		
10	All deadlines were met	3		
11	All components are present	3		

Data Sheet

Name: _____

Describe your post:

How many friends do you have?

Reading	Time	Total number of Likes	Number of New Likes (Likes per Hour)
0 (initial posting)		0	0
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Dear Parent/Guardian,

The students in this class are collecting data using social media as part of a performance based learning assessment. Students are allowed to choose what type of posting to use (picture/comment) and they have been instructed that this post must be school appropriate. Your son/daughter will keep track of the number of “likes” received by a Facebook post over a period of 10 hours. This data will be used to create models and make predictions about the data. If you have any question or concerns about this project please feel free to contact me.

Sincerely,

Suzie Warren, Mathematics Teacher, Floyd County High School