

Track the Trends Unit Plan

Unit Overview
Unit Title
Track the Trends: Predict the Future?
Unit Summary
Taking on the role of statisticians, students choose a subject of interest (AIDS rate, rise of average baseball salaries, state population growth, and so forth) and collect statistical information about the subject over time. Using a graphing calculator and an exponential regression function or a spreadsheet and regression trendline function, students derive the equation for curve of best fit for the data. The actual data and curve of best fit are graphed, and future predictions are made using the equation. Finally, students evaluate and present the socioeconomic implications of their predictions and the validity of their statistical investigation as a tool for predicting the future.
Subject Area
Algebra, Social Issues
Grade Level
9–12
Higher-Order Thinking Skills
Analysis, Interpretation, Evaluation
Approximate Time Needed
10 class periods (or more) of block schedule, 90–105 minutes per period
Unit Foundation
Targeted Content Standards and Benchmarks
California State Standards Math: Algebra II <ul style="list-style-type: none">• Know the laws of fractional exponents, understand exponential functions, and use these functions in problems involving exponential growth and decay.• Find the general term and sums of arithmetic series and of both finite and infinite geometric series. Math: Probability and Statistics <ul style="list-style-type: none">• Organize and describe distributions of data using a number of different methods, including frequency tables, histograms, standard line and bar graphs, stem and leaf displays, scatter plots, and box and whisker plots.

Student Objectives/Learning Outcomes

Students will be able to:

- Conduct research, using print and electronic resources to collect statistical data on a subject
- Fit an exponential function (with correlation coefficient) to data, using a graphing calculator
- Use a resulting line of best fit to make a prediction for the next five (or more) intervals
- Use a spreadsheet and trendline to create a graph of the actual versus predicted data (curve of best fit)
- Present predictions, implications for the future, and analysis of findings through a presentation and newsletter or wiki

Curriculum-Framing Questions

Essential Question

What does the past tell us about the future?

Unit Questions

- What variables limit or sustain the continuation of a trend?
- How does a trend affect people's choices?
- What will our quality of life be like in the future?

Content Questions

- What is an exponential regression, curve of best fit, and correlation coefficient?
- What are the advantages and limitations of linear regression for analysis of data?

Student Assessment Plan

Assessment Summary

Questioning is used throughout the unit to help students develop their higher-order thinking skills and process content as well as to monitor learning. Students use the slideshow checklist and either the wiki checklist or newsletter checklist, depending on the project they choose, to help them guide their learning, stay on track, and self-assess their progress. Assessment can take place daily, based on daily observations and student products. Individual and group conferences are used to help monitor progress and answer any questions. Ask students to use the project rubric to help them self- and peer-assess work prior to completion. Use this same project rubric to assess and grade final presentations and completed projects.

Assessment Timeline

Before project work begins		Students work on projects and complete tasks		After project work is completed	
<ul style="list-style-type: none"> • Questioning • Project Rubric 	<ul style="list-style-type: none"> • Slideshow Checklist • Wiki Checklist • Newsletter Checklist 	<ul style="list-style-type: none"> • Individual and Group Conferences 	<ul style="list-style-type: none"> • Questioning 	<ul style="list-style-type: none"> • Slideshow Checklist • Wiki Checklist • Newsletter Checklist 	<ul style="list-style-type: none"> • Essay Examination • Project Rubric

Unit Details

Prerequisite Skills

- Experience using graphing calculators
- Experience creating a scatter plot and curve of best fit by hand
- Some experience with creating multimedia presentations, newsletter publications, and wikis
- Familiarity with conducting Internet research

Instructional Procedures

Students present their investigations in slideshow presentations and either newsletters or wikis. Instruction in the development of these pieces should be threaded throughout the daily lessons.

Day 1

Begin the unit by asking the Essential Question, *What does the past tell us about the future?* Ask students to think individually about the question and then discuss their responses with each other. Ask for volunteers to share their responses with the whole class.

Introduce the following Unit Question, *What variables limit or sustain the continuation of a trend?* Explain to students that they will be exploring this question throughout their work on the project.

Begin the project by sharing the project presentation. Brainstorm possible topics that might have appropriate data sets. Discuss and evaluate the ideas students contribute. Ask if statistical analysis using linear regression would be appropriate for the topics suggested. (Note: A *limitation of regression analysis* is that it assumes trends are linear, that is, straight lines without turning points. If turning points occur, they need to be controlled for, and controls introduce other problems. For this reason, regression analysis can lead to erroneous results when dealing with these kinds of data. Careful guidance is necessary to help students pick projects for which linear regression is appropriate.)

Discuss print and electronic resources for collecting data. Possible topics include:

- AIDS deaths
- Crime and crime rates
- Deaths
- Divorces
- Education
- Energy consumption
- Families and households
- Gold reserves of central banks and governments
- Gross national product (GNP)

- Health expenditures
- Housing
- Live births
- Marriages
- Natural disasters
- Pollution
- Sports leaders

Hand out the project rubric and discuss. The rubric provides an overview of the project expectations for the students. Have students use the rubric to help them assess their progress and learning.

Day 2

Ask students to discuss the Unit Questions, *How does a trend affect people's choices?* and *What will our quality of life be like in the future?* Write answers on chart paper and post around the room. Have student teams choose roles that fit with their topic and explore the Unit Questions. Tell students that they will create two projects that incorporate answers to the questions as well as the Unit Question that was introduced on Day 1, *What variables limit or sustain the continuation of a trend?* The projects are:

- A slideshow about the trend and possible implications, using mathematical tools of statistical analysis

AND either

- A newsletter with brief articles and graphs about possible effects and implications of the trend

OR

- A [wiki](#) about the topic, including implications and effects (The wiki should include data or a graphical representation of data to back up any predictions.)

Allow students to choose team members. Membership may be formed based on topic of interest. A different topic should be explored by each team of students. Remind students to use the Unit Questions in their projects.

Pass out the slideshow checklist to all students and either the newsletter checklist or wiki checklist, depending on the publication format each team chooses. Review the checklists and have students use them to monitor their progress while working.

Day 3

Instruct students to begin researching their topics. Conference with students individually and as teams to answer questions, discuss their progress, and assess higher-order thinking.

Day 4

Show students how to do [exponential regression](#) and explain the following mathematical terms:

- Correlation coefficient
- Curve of best fit
- Exponential regression

Have students create equations of curve of best fit using their own data. Allow students to choose either their graphing calculator or a spreadsheet to enter data. If they choose the spreadsheet, have them examine the data graphically and then choose regression trendlines that best fit their data, allowing them to make reliable predictions. For students unfamiliar with spreadsheet use and regression trendlines, provide them with a copy of the adding trendlines document and the spreadsheet sample of the California Population data.

Next, have students calculate future predictions.

Day 5

Have students create graphs of historical data versus curve of best fit and brainstorm the

ramifications of predictions. Provide students with time to complete additional research as needed.

Day 6

Ask students to complete the research on their topic, incorporating their mathematical knowledge.

Days 7 and 8

Have students complete their slideshow presentations and their newsletters or wikis. Remind students to use their checklists to review and finalize their work.

Day 9

Provide time for students to present their final projects to the class. Use the project rubric to assess students' work.

Day 10

Give the class an essay examination by instructing students to respond to the following:

1. Define linear regression and give strengths and weaknesses of using this type of model to predict a future value for your data.
2. *What variables limit or sustain the continuation of a trend?*
3. *How does a trend affect people's choices and quality of life?*

Think of another way to predict a future value for your data (imagine you are asked to do this and you have never heard of linear regression). Describe your approach, and discuss the advantages and disadvantages of your approach.

Accommodations for Differentiated Instruction

Special Needs Student	Reduce assignment or allow more time as needed
Nonnative Speaker	<ul style="list-style-type: none">• Allow the student to access Internet sites in the student's first language• Pair the student with a peer
Gifted/Talented Student	Have the student create a linear function for the same data, compare it to the exponential function, and then answer the question, <i>Which function is more realistic and why?</i>

Materials and Resources Required For Unit	
Technology – Hardware (Click boxes of all equipment needed)	
<input type="checkbox"/> Camera	<input type="checkbox"/> Laser Disk
<input checked="" type="checkbox"/> Computer(s)	<input checked="" type="checkbox"/> Printer
<input type="checkbox"/> Digital Camera	<input checked="" type="checkbox"/> Projection System
<input type="checkbox"/> DVD Player	<input type="checkbox"/> Scanner
<input checked="" type="checkbox"/> Internet Connection	<input type="checkbox"/> Television
<input type="checkbox"/> VCR	<input type="checkbox"/> Video Camera
<input type="checkbox"/> Video Conferencing Equip.	<input checked="" type="checkbox"/> Other graphing calculators
Technology – Software (Click boxes of all software needed.)	
<input checked="" type="checkbox"/> Database/Spreadsheet	<input type="checkbox"/> Image Processing
<input type="checkbox"/> Desktop Publishing	<input checked="" type="checkbox"/> Internet Web Browser
<input type="checkbox"/> E-mail Software	<input checked="" type="checkbox"/> Multimedia
<input checked="" type="checkbox"/> Encyclopedia on CD-ROM	<input type="checkbox"/> Web Page Development
<input checked="" type="checkbox"/> Word Processing	<input checked="" type="checkbox"/> Other wiki site
Printed Materials	
Supplies	Class set of graphing calculators (such as TI-83 Graphing Calculators)
Internet Resources	<ul style="list-style-type: none"> United States Census Bureau www.census.gov* Collection of statistics covering a variety of topics World Health Organization www.who.int/en* Statistics on health issues around the world
Other Resources	

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