

Chapter 11



Kenneth Freeman: Linear Tables, Graphs, and Equations

Throughout my career, I've operated under the belief that creating *sustainable* success is best achieved through setting goals, executing action plans, and swiftly correcting problems in order to remain on target. During my 15-year career in the Information Technology field at AT&T and Motorola, I've utilized this approach to establish and maintain some of the most sophisticated technology environments within those organizations. As a Mathematics, Science, & Technology Educator in the Chicago Public School (CPS) System, I've continued using a *process-management* approach toward building academic excellence among adolescents in predominantly low-income areas. Since joining CPS in 2002, I've provided instructional leadership, process management, & change control training to individuals and teams in the education field.

Linear Tables, Graphs, and Equations – How Are They Connected?

Grade Level(s): 7th - 8th

Content Area Topic: Mathematics

Content Area Standard(s):

- 7.EE.4: Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.
- F. IF. 4: For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

Learning Objective(s):

- To use prior knowledge + current content learning to construct data table from an algebra problem situation that involve consistent (linear) change in distance and time.
- To use created table and create a graph of problem situation, comparing the information that a table can provide vs. what a graph provides.
- Using table and graph, and the guess-check method, to create a linear equation that can be used to calculate any distance location if he time is known, and vice-versa
- Decide which of the 3 methods is best used under certain conditions.

Suggested Time Allotment:

4 Sixty-Minute Class Periods

Sequence in Learning:

Before this lesson series, students have already had teaching and learning immersion on concepts such as proportional reasoning, elements that makeup data tables (ex. columns and rows), and elements that makeup a linear graph (x/y axis, data marker, coordinate pairs).

Less time in this lesson should be devoted to creation of the table and then graphing its data. Instead, time emphasis should be placed on creation of the linear equations and the important aspects of them, based upon the table and graphs. More time should also be devoted to exploring the relationship between these 3 types of analysis tools.

Looking ahead, students should be ready for more in-depth study around strategies for creating equations from tables/graphs, as well as methods for finding slope (i.e. ratio of how distance and time change in this problem). They should also be given more practice on solving similar problems with different variable values that change consistently. Following this, students should be able to comprehend lessons on the different forms of linear equations - Standard, Point-Slope, and Slope-Intercept (which this lesson covers).

Materials & Resources Needed:

- Math Notebooks/Journals For Note Taking (of new material) and Review (of prior lesson content)
- Graphing Paper
- PowerPoint Presentation
- Copies of Data Recording Sheets From Presentation
- Calculators (optional)

Lesson Activities & Sequence:

Launch: (see accompanying Powerpoint presentation for reference)

- Inquire about students' prior knowledge (whole group)
- Have student write 2 or 3 specific things they already know about the topic (individually)
- Students' share-out unique knowledge they have with entire class. Repeated information from multiple students should be discouraged for the sake for time.
- Teacher guides students through review of each method of analyzing an algebraic situation and the advantages/disadvantages of using Tables/Graphs/Equations. Students take notes in math notebooks as well as complete copies of table-style handouts
- Teacher gives formal definition of a linear algebraic situation, highlighting that for a situation to be linear, there must be 2 related things that change in a consistent manner.

Explore: (see accompanying PowerPoint presentation for reference)

- Teacher presents problem situation about a topic students are very familiar with; include in the problem names/places that majority of class already know about
- Students use notes/handouts to answer math reasoning questions about the problem, and construct a data table supports their answers. (individually)
- Teacher walks through the classroom to monitor table creations; questions any student(s) that misrepresents the changing time data between the two distance-changing data sets.
- Students then use the tables they created to construct 2 straight-

line graphs (in the same coordinate plane) that represents the changing time/distance of the subjects in motion from the problem. (individually)

- Teacher spot-checks table creations, insuring that required elements are being included by students. Afterwards, students are put into groups of 3 or 4 to try and determine the linear equations that mimic the table and graph results.

Summary:

- Student groups are asked to share out the equations they came up with, explain how they got them, and to test their validity by calculating values from their tables or graphs.
- Students are asked to choose the method that worked best for them in this situation.
- Teacher probes to see if students can conclude that using the slope-intercept form equation is the most efficient way of solving algebraic problems of this nature.

Proficiency:

Students will be able to read the algebraic problem statement, determine the changing data relationships (variables), and construct a data table. From this, they will be able to create a graph of this data and using the trial-error method, define an equation that can be used to re-construct the table or the graph.

Evaluation of whether each student has met these objectives would be done via informal review of their work (as teacher walks through the room monitoring progress). Formal assessment of student mastery would be via assignment of the “Extend It” questions from the accompanying PowerPoint presentation.

Feedback

Teachers As Learners:

Group Feedback: Students feel heard and listened to Very interactive lesson. Lots of questions were asked by students seeking help. As a student, I feel I had the opportunity to reflect. Good questioning techniques by the teacher. A lot of review options available to students prior to being given the problem to solve. Connection to prior knowledge and other content/science was present.

Teacher Response: Group had the most trouble creating the starting point for the table for each of the boys leaving the gym. At Time = 30 minutes, group had boys distance recorded based upon their travel rate. They failed to realize that after 30 minutes, Jalen had traveled

some distance but Antonio had not yet moved. Since graphs and equation were based upon the table data, inaccurately recording table results would have lead group (and students) to constructing erroneous artifacts.

Elements of Pretty Good Practice:

Group Feedback

- Access students’ prior knowledge via having them write 1 or 2 things they already know about topic
- Having students work alone on some tasks (used to assess individual understanding), with a partner (to see different ways of solving problem)
- Having students work in groups on some tasks, which some may see as very helpful, and for purposes of creating a “shared thinking” environment for tasks that would take lots of time to do alone.

Modifications and Adaptations:

In what ways can the lesson be changed to accommodate **my** personal teaching and learning contexts and/or learners? (List the feedback from your colleagues)

Group Feedback:

- Math Adaptations - Graphing and then compare in the class the differences.
- L.A. Read for information to go over and underline key words and phrases.
- Extend to real life when you rent movies at rate per hour or membership to gyms, clubs etc..

Questions Arisen:

Use this to raise questions about the content, the pedagogical approach, the use of technology, or any other questions the group has about the design and delivery of the lesson.

Group Feedback: How do you differentiate this assignment based upon student’s prior knowledge?