Web Unit Plan

Title: Choreographing Math

Description: Students get out of their seats and move to music while learning about mathematical functions. They explore linear equations using a graphing calculator and choreograph dance moves to communicate these concepts.

At a Glance

Grade Level: 8–10

Subject sort (for Web site index): Mathematics

Subject: Mathematics

Topics: Algebra, Dance

Higher-Order Thinking Skills: Decision Making, Creativity

Key Learnings: Linear Equations, Functions

Time Needed: 2 weeks, 1 hour each day

Background: [Odyssey Story](#) from Alabama, United States

Unit Summary

Students learn to graph linear equations and choreograph dance moves to demonstrate them. For example, students modeling the function $y=x^2$ hold both arms above their head (similar to the way a referee in a football game would indicate a touchdown), and they use a graphing calculator to create corresponding figures and graphs. Each dance is comprised of nine equation poses choreographed to music. Students videotape or photograph their dances, and combine these visual elements with screen shots of the equations and graphs into an electronic presentation.

Curriculum-Framing Questions

- **Essential Question**
  How can we communicate through movement?

- **Unit Questions**
  How do we read equations and graphs?
  How do we represent linear equations in different ways?

- **Content Questions**
  How does a linear function differ from a quadratic function?
  How does changing the y-intercept in an equation change the graph of the equation?

Assessment Processes

View how a variety of student-centered [assessments](#) are used in the Choreographing Math Unit Plan. These assessments help students and teachers set goals; monitor student progress; provide feedback; assess thinking, processes, performances, and products; and reflect on learning throughout the learning cycle.

Instructional Procedures

Introducing the Project

Ask students to discuss what *communicating mathematically* means. Engage students in discussion as they offer their ideas and opinions. Discuss how mathematical communication includes understanding, expressing, and conveying ideas orally, in writing, graphically, and algebraically. Introduce the idea that students will also learn how to communicate their mathematical understanding through movement by creating a dance comprised of nine equation poses.

Pose the Essential Question, *How can we communicate through movement?* Have students record this information in math journals and share ideas with the class.

Set the stage for the project by modeling a variety of functions with your arms. Play a popular song on the radio and move to the beat of the music. Ask students if they can identify the functions you model. For example, stretch your arms out at a diagonal to model the equation y=x. Invite students to join you by getting out of their seats and modeling a few basic functions to the beat of the music. Challenge them to name the equations of the functions they are modeling.

Distribute the student handout and go over basic expectations for the project, including selecting equations, choreographing the dance, choosing music, and collecting visual elements of both the poses and the corresponding graphs and equations. Encourage students to supply props and costumes. Distribute and discuss common lines using the Common Lines Reference, a sheet of common graphs.

Getting to Work

Hand out the project rubric and the group task rubric so students are aware of project expectations. Check for student understanding and answer questions as needed. Students use the group task rubric to self and peer-assess their participation while working in groups. Allow two days for students, working in small groups, to discover families of linear functions by completing the graphing activity on a graphing calculator. After groups complete the activity and discuss their findings with the class, have them complete a four-question investigation so you can assess their understanding thus far. Make necessary adjustments to bring all students to a common point of understanding. Throughout the unit, teach formal lessons to develop students' understanding of linear equations.

Pose the Unit Question, *How do we represent linear equations in different ways?* Discuss ideas as a class. Then, begin a series of lessons to teach students to identify slope and write equations in standard form, point-slope form, and slope-intercept form. Have students document understanding of these concepts in their math journals. Collect journals and provide students with feedback. Use the journal entries to reteach concepts as needed.

Begin the dance choreography part of the project by reviewing the student handout with students. Show part of a sample presentation to demonstrate ways students might represent their functions. Have students reconvene into small groups. Make sure groups have a recording of their music as they choreograph their moves. Ask students to get their songs approved before bringing in music and starting work on their presentations. Graphing calculators will be useful for exploring the various functions they may want to model. Have students choose equations and develop corresponding poses for their dances. Have them experiment with the order of poses and the dance elements between each pose. Instruct students to graph each equation on a separate sheet of graph paper. When all of the groups have their choreography established, ask each group to turn in an outline of their group's dance sequence to you. Review each outline and make necessary recommendations and comments to each group.

When the dances are ready, have students begin developing the multimedia slide presentations. Invite other school personnel to help students work on their projects. The dance instructor, physical education teacher, media center specialist, and video production teacher may be assets.

Give students digital cameras to take pictures of their poses as well as their graph and equation sketches. Have students draft 3- to 5-minute long slideshow presentations. Hand out the slideshow presentation checklist to students and make sure all students understand required expectations. Have students review and refine their presentations, and practice their delivery with one another. The groups can give feedback to each other using the peer assessment sheet.

Performing and Presenting
Plan for students to perform their dances and present their multimedia presentations. Invite other classes, parents, and administrators to watch. If your school has a video production class, allow students to film the dances and broadcast them into the various classrooms.

Revisit the Essential Question, *How can we communicate through movement?* Have students record their ideas in their math journals and make sure they provide concrete examples from the unit. Use these entries in final assessment.

Prerequisite Skills

- Graphing ordered pairs, relations, and equations
- Solving problems by making a table
- Identifying the domain, range, and inverse of a relation
- Determining if a relation is a function
- Writing an equation to represent a function given its table of values
- Analyzing linear equations

Differentiated Instruction

Resource Student

- Modify work requirements if necessary

- Provide extra time to complete assignments (possibly during resource classes)

- Provide additional support from teachers and parents

Gifted Student

- Encourage the student to investigate more advance functions, such as sine and cosine functions

- Require the student to include more advanced technical attributes in the slideshow presentation
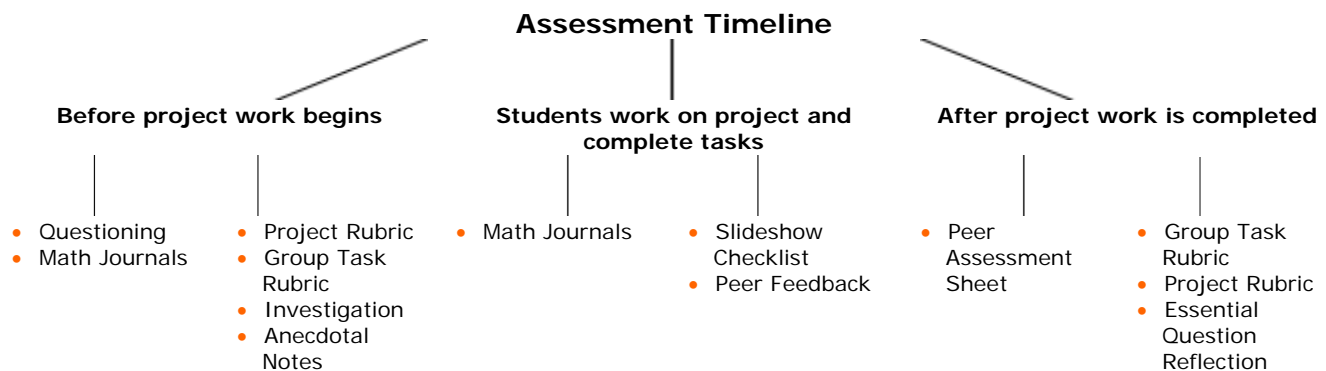
English Language Learner (ELL)

- If possible, have the student work in groups with bilingual students who are more proficient in English

- Use sample projects to provide visual aids

- Provide music suitable to the student's culture

Credits

Brenda Levert teaches mathematics at the Academy for Academics and Arts in Huntsville, Alabama. Levert's classroom was featured in *An Innovation Odyssey*, a collection of stories of technology in the classroom, Story 152: Choreographing Math. A team of teachers expanded the plan into the example you see here.

THINGS YOU NEED (highlight box)

Assessment Plan

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Assessment Timeline

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Before project work begins	Students work on project and complete tasks	After project work is completed
• Questioning • Math Journals	• Project Rubric • Group Task Rubric • Investigation • Anecdotal Notes	• Math Journals	• Slideshow Checklist • Peer Feedback	• Peer Assessment Sheet	• Group Task Rubric • Project Rubric • Essential Question Reflection

Informal questioning is used throughout the unit to assess understanding and promote higher-order thinking. Students use math journals throughout the project to document ideas and answer questions. Use the journals to document student understanding and reteach difficult concepts as needed. Students are given the project rubric and group task rubric before project work begins to set expectations for the quality of work and cooperation within the groups. Students self and peer-assess using the group task rubric. Use the investigation handout to assess student understanding and make necessary adjustments to bring all students to a common point of understanding. Students use the slideshow presentation checklist to guide the creation of their slideshow presentations. Students also receive teacher and peer feedback to make necessary revisions to final products using the peer assessment sheet. The project rubric is used to assess the project as a whole. Students reflect on the Essential Question using examples from the unit. The reflection can also be used as a final assessment.

Targeted Content Standards and Benchmarks

Alabama Content Standards and Benchmarks

- Use computers and graphing calculators to facilitate understanding of coordinate geometry
- Identify and graph functions on the Cartesian plane
- Graph linear functions in the form $y=mx+b$ on the Cartesian plane
- Determine slopes and y-intercepts of lines
- Identify corresponding pairs of equations and graphs

National Council of Teachers of Mathematics (NCTM) Standards
Algebra Standard

- Understand relations and functions, and select, convert flexibly among, and use various representations for them

- Understand and compare the properties of classes of functions, including exponential functions

- Understand the meaning of equivalent forms of expressions, equations, inequalities, and relations

Connections Standard

- Recognize equivalent representation of the same concept

- Recognize and apply mathematics in contexts outside of mathematics

Communication Standard

- Communicate mathematical thinking coherently and clearly to peers, teachers, and others

Student Objectives

Students will be able to:

- Recognize graphs of common relations

- Identify common characteristics in families of lines and other functions

- Understand relations and functions, and select, convert, and showcase them using various representations

- Integrate technology and the arts to showcase visual representations of equivalent forms of common relations

- Recognize how the slope and y-intercepts affect the graph of a function

- Analyze patterns in the graphs and tables of various equations

Resources

Printed Materials

- Bryant, M., Buchanan, P., Carpenter, M., et al. (1999). *Today's students, tomorrow's citizen: pathways for learning.* Montgomery, AL: Alabama High School Graduation Exam Task Force, Alabama Department of Education.

- Rinehart and Winston. (1999). *Mathematics activities for algebra 1, geometry, and algebra 2.* Austin, TX: Holt.

- Collins, W. (1997). *Algebra 1 integration applications connections.* New York: Glencoe-McGraw-Hill.

Supplies

- Graph paper

Technology—Hardware

- CD or tape player to play dance music

- Digital camera to take pictures of choreographed poses and graphs

- Graphing calculator to investigate the various functions

- Graph link to transfer screenshots from calculator to computer (optional)

Technology—Software

- Software for multimedia to create electronic presentations