



# Shaping Geometry Instruction

to Meet the Learning Needs  
of La Grange Park District 102 Students!

CCC! Video On Demand

Written and developed by: Curriculum Experts at New Dimension Media

## Best Practices in Mathematics Instruction

The following best practices for implementing effective standards-based math lessons should be followed:

- Students' engagement is at a high level
- Tasks are built on students' prior knowledge
- Scaffolding takes place, making connections to concepts, procedures, and understanding
- High-level performance is modeled
- Students are expected to explain thinking and meaning
- Students self-monitor their progress
- Appropriate amount of time is devoted to tasks.

The role of **discovery and practice** and the use of **concrete materials** are two additional topics that must be considered when developing instructional units of study directed at improving mathematics achievement.

Sabean and Bavaria (2005) examined research, which suggested that instruction must be balanced between the practice of skills and methods previously learned and new concept discovery. This discovery of new concepts, they suggest, facilitates a deeper understanding of mathematical connections.

Lesson Focus Request: Geometry | Angles | Advanced Sixth Grade Students | December 2008

Source: for complete white paper entitled, *CLOSING THE ACHIEVEMENT GAP Best Practices In Teaching Mathematics*, visit *The Education Alliance* website: [www.educationalalliance.org/Downloads/Research/TeachingMathematics.pdf](http://www.educationalalliance.org/Downloads/Research/TeachingMathematics.pdf)

## Research Implications:

A set of basic assumptions about teaching practices is implicit in the mathematics, these are:

1. All students must have an opportunity to learn **new** mathematics.
2. All students have the capacity to **learn more** mathematics than we have traditionally assumed.
3. **New applications and changes in technology** have changed the instructional importance of some mathematics concepts.
4. **New instructional environments** can be created through the use of technological tools.
5. **Meaningful mathematics learning is a product of purposeful engagement** and interaction which builds on prior experience

(Romberg, 2000)



**CCC! Technology** can help teachers with their standards-driven instruction. The table to the right reflects the geometry strand of the Illinois Learning Standards in the benchmark areas of late elementary, middle school and early high school, which should be an appropriate span for sixth grade students including those who are advanced in the study of mathematics.

The area highlighted in pink indicates **CCC! VOD** has video resources that can be used to help students master these specific content standards.

Current thinking in standards-based instruction is that the information shown to the right be translated into kid-friendly language. See activity shown below.

**Student Activity:**

Ask advance students to write the geometry standards in kid-friendly language. This integration of writing into the mathematics curriculum is important for learners of all levels. Once completed, the new kid-friendly standards should be posted to help other students be clear on the learning expectations.

**STATE GOAL 9: Use geometric methods to analyze, categorize and draw conclusions about points, lines, planes and space.**

LATE ELEMENTARY	MIDDLE/JUNIOR HIGH SCHOOL	EARLY HIGH SCHOOL
<b>A. Demonstrate and apply geometric concepts involving points, lines, planes and space.</b>		
<b>9.A.2a</b> Build physical models of two- and three-dimensional shapes.	<b>9.A.3a</b> Draw or construct two- and three- dimensional geometric figures including prisms, pyramids, cylinders and cones.	<b>9.A.4a</b> Construct a model of a three-dimensional figure from a two-dimensional pattern.
<b>9.A.2b</b> Identify and describe how geometric figures are used in practical settings (e.g., construction, art, advertising).	<b>9.A.3b</b> Draw transformation images of figures, with and without the use of technology.	<b>9.A.4b</b> Make perspective drawings, tessellations and scale drawings, with and without the use of technology.
<b>9.A.2c</b> Describe and draw representations of geometric relationships, patterns, symmetries, and designs in two- and three-dimensions with and without technology.	<b>9.A.3c</b> Use concepts of symmetry, congruency, similarity, scale, perspective, and angles to describe and analyze two- and three-dimensional shapes found in practical applications (e.g., geodesic domes, A-frame houses, basketball courts, inclined planes, art forms, blueprints).	
<b>B. Identify, describe, classify and compare relationships using points, lines, planes and solids.</b>		
<b>9.B.2</b> Compare geometric figures and determine their properties including parallel, perpendicular, similar, congruent and line symmetry.	<b>9.B.3</b> Identify, describe, classify and compare two- and three-dimensional geometric figures and models according to their properties.	<b>9.B.4</b> Recognize and apply relationships within and among geometric figures.
<b>C. Construct convincing arguments and proofs to solve problems.</b>		
<b>9.C.2</b> Formulate logical arguments about geometric figures and patterns and communicate reasoning.	<b>9.C.3a</b> Construct, develop and communicate logical arguments (informal proofs) about geometric figures and patterns.	<b>9.C.4a</b> Construct and test logical arguments for geometric situations using technology where appropriate.
	<b>9.C.3b</b> Develop and solve problems using geometric relationships and models, with and without the use of technology.	<b>9.C.4b</b> Construct and communicate convincing arguments for geometric
		<b>9.C.4c</b> Develop and communicate mathematical proofs (e.g., two-column, paragraph, indirect) and counter examples for geometric statements.
<b>D. Use trigonometric ratios and circular functions to solve problems.</b>		
	<b>9.D.3</b> Compute distances, lengths and measures of angles using proportions, the Pythagorean theorem and its converse.	<b>9.D.4</b> Analyze and solve problems involving triangles (e.g., distances which cannot be measured directly) using trigonometric ratios.

Source: Illinois Learning Standards for Mathematics, Illinois State Board of Education website: [www.isbe.state.il.us/ILS/math/standards.htm](http://www.isbe.state.il.us/ILS/math/standards.htm)

# Differentiated Learning Options

## Option 1: YOU OUGHTA' BE IN PICTURES!

Students **begin the unit of study by searching in CCC! VOD using the key word:** geometry. From this point, students choose videos and/or video segments to review in order to get ideas for completing the following photography assignment:

For students who are interested in photography, allow them to use a digital camera to capture geometric shapes that they recognize in the world around them. For particular units of study, such as angles, you can assign narrower criteria to the type of photographs each child is to research. Students create a storyboard of their photographs for peer review. Peer reviewers use the following criteria to provide feedback to the student photographers:

Photography Feedback Matrix			
Characteristics	1 Point	2 Points	3 Points
<b>Quality</b> Should answer the question, <i>what more could you do to improve your work?</i>	Picture is recognizable but blurring is apparent in over half of the shot. Student has not resized photographs. Storyboard lacks neatness overall.	Picture is recognizable but some blurring is apparent. Student has resized photographs but sizing differs between pictures. Storyboard is neat overall but lacks a precise layout.	Picture is clear and without blur. Student has resized photographs to a standard size appropriate for the storyboard. Storyboard is neat and precisely layout.
<b>Focal Point</b> Should answer the question, <i>what were you photographing?</i>	There is no focal point in the picture. The background is the dominant focal point.	There is a focal point in the picture. The background is as dominant as the focal point.	There is a purposeful focal point centered in the picture. The background is less dominant than the focal point.
<b>Angle Captured</b> Should answer the question, <i>how did you decide on what to photograph?</i>	Student is able to define the assigned angle but not all pictures reflect the assigned angle to be studied. Student is able to answer 1 follow up question.	Student needs support to explain the storyboard in terms of angle identification in the real world. Student is able to answer 2 to 3 follow up questions.	Student is able to explain the storyboard in terms of angle identification in the real world. Student is able to answer more than 3 follow up questions.
<b>Application Value</b> Should answer the question, <i>which picture or pictures most brilliantly portrays the assigned angle in the real world?</i>	Peer reviewers chose 1 picture that they recommend be made into desktop wallpaper.	Peer reviewers chose 2 to 3 pictures that they recommend be made into desktop wallpaper.	Peer reviewers chose 4 or more pictures that they recommend be made into desktop wallpaper.

## Turn a Photo Into Desktop Wallpaper

The first step to turning a picture into a wallpaper image is to determine the screen resolution that your monitor is running. This way, you can easily make the picture fit the screen properly. This information can be found in the Control Panel – Display - Settings – copy down the pixel size of the display. Close out of the Control Panel since we do not want to change anything.

Open your favorite image editor and load the picture that you want to display on your desktop. To make the picture fit the screen perfectly, you need to do two things: First, crop it to the correct aspect ratio for your monitor; second, size it to fit.

For this to work properly, you should start with a picture with a resolution that's at least as large as your screen's (the number of pixels you wrote down in step 1 above).

Crop the picture so you capture the focal point of the picture. Now resize the picture to be as large as your screen's resolution.

Save your picture with a new file name so you don't lose the original image. Close the image editor.

Go back to your desktop and open the Display Properties dialog box again (right-click the desktop and choose *Properties*). Click the Desktop tab and then click the Browse button at the bottom of the dialog box. Find the picture you just created and click Open, then click OK. You're done.

## Need More?

Try visiting these additional places for more lesson plan ideas:

There are over 1000 lesson plans on angles at LessonPlanet

(<http://www.lessonplanet.com/search?keywords=angles&media=lesson&page=2&rating=3>)

## Have English Language Learners in Your Classroom?

Use the key vocabulary translations below to help you communicate and explain key concepts associated with learning about angles.

Triangle (triangulo)

Angle Measure (la medida del angulo)

Legs (piernas)

Hypotenuse (hipotenusa)

Length (longitud)

Squares (cuadrados)

Area (area)

Conjecture (conjetura)

Relationship (relacion)

## Differentiated Learning Options Continued

### Option 2: Can a Sound Knowledge of Geometry Make a Good Composer Great?

Research the story of composer Dmitri Tymoczko. Create a PowerPoint presentation in response to the question; *can a sound knowledge of geometry make a good composer great?* Reminder: PowerPoint presentations can be used in CCC! Technology)

#### Presentation Criteria:

>Presentation must be coherent in writing style – by the end of the presentation the audience must know the story of the composer as well as how this story fits into the timeline of Western music.

>Presentation must include at least 2 embedded video files found in CCC! VOD that support the main points of the presentation.

>Presentation must reflect citing of at least 3 sources including a magazine, video and a text (book).

>The presentation findings/conclusions must answer the question; *can a sound knowledge of geometry make a good composer great?*

>Presentation quality must reflect overall neatness and balance of design elements.

### Option 3: Student Wikipedia Writers Wanted!

After allowing students to learn about geometry/angles by watching CCC! VOD videos/video segments, have students show what they know by writing/creating simple Wikipedia pages that relate to what they have learned. You can access simple Wikipedia at <http://simple.wikipedia.org>

### Option 4: Student Teachers Can Move Others Forward

Use a webcam and microphone to record students (within a safe school environment) tell about what they know and understand about angles. They should include the following in their webcast: introduction of their study, definitions of terms used, examples that are clear and appropriate to convey meaning, key points and a summary. Use this to help others in class that may need additional teaching or support in mastering the basic geography standards.



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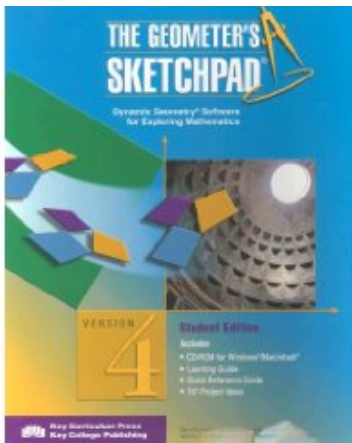
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Recommended by: Curriculum Experts at New Dimension Media

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Need More? Consider:

### The Geometer's Sketchpad: Student Edition (CD-ROM)



If you are not familiar with **The Geometer's SKETCHPAD™**, you might want to look into this exceptional software tool. There are new and used copies available at very reasonable prices on Amazon.com (< \$35.00).

Introduce the art teacher in your school to this resource and collaborate on helping your students apply what they learn in mathematics class to art class as they create beautiful masterpieces worthy of framing and displaying around your school/district community.

Product Information below is from the Key Curriculum Press website  
<http://www.keypress.com/x5521.xml>

### Illuminate Mathematics with Dynamic Visualization

*The Geometer's Sketchpad* is a **dynamic construction, demonstration, and exploration tool** that adds a powerful dimension to the study of mathematics. You and your students can use this software program to build and investigate mathematical models, objects, figures, diagrams, and graphs.

With *Sketchpad™*, you can give your students a **tangible, visual way to explore and understand** core concepts—from numbers and operations, algebraic thinking, and geometry and measurement in elementary and middle school to algebra, geometry, trigonometry, precalculus, and calculus in high school and college. Concepts that students frequently find difficult become very clear when they see visual representations on the screen and interact with them using *Sketchpad*.

### Need More? How About Need Less?

While this unit of study has been created for advanced sixth grade students, you may have a need for varying levels of lessons plans on a variety of subjects including geometry.

The AAA Math website has a wealth of lessons and ideas that are practical and easy to incorporate.

You can visit them at:  
[www.aaaknow.com/geo.htm](http://www.aaaknow.com/geo.htm)

Don't miss out on another great site specifically with geometry games that you can download:

**Jeff Weeks'**  
**Topology and  
Geometry Software**

[www.geometrygames.org/](http://www.geometrygames.org/)

## Additional Values of Sketchpad™

Student Activity Ideas  
found at the Sketchpad™  
Resource Center:

Shape Makers: Developing  
Geometric Reasoning in Middle  
School with The Geometer's  
Sketchpad™

Geometry Activities for Middle  
School Students with The  
Geometer's Sketchpad

Geometry in Action: A Discovery  
Approach Using The Geometer's  
Sketchpad

Thank you for requesting  
this unit of study related to  
geometry, specifically,  
angles. We hope you  
continue to make requests  
for curriculum design and  
development!

Your feedback and  
suggestions for  
improvement are always  
welcome at  
[jkatz@ndmquestar.com](mailto:jkatz@ndmquestar.com)

Sincerely,

**Jo-Ann Kratz,**  
Vice President  
Curriculum and Technology  
New Dimension Media

*Sketchpad* has the **flexibility to help you meet your teaching needs** regardless of your subject matter, technological expertise, grade level, or curriculum. You can take advantage of our subject-specific, ready-to-use activity books and sample activities or create your own activities and demonstrations to differentiate learning for all students.

*Sketchpad* provides you with a **faster, more dynamic and engaging way to demonstrate mathematical concepts** than using transparencies or drawing on the board. *Sketchpad* works easily with your LCD projector, classroom computer, or SMART Board.

*Sketchpad* can help you **quickly explore variables, relationships, and the mathematics of change** with your students. When you construct objects in *Sketchpad*, you can drag points and lines with the mouse. As shapes and positions change, all mathematical relationships are preserved, allowing you and your students to examine an entire set of similar cases in a matter of seconds.

You can use *Sketchpad* **across the mathematics curriculum**, so you don't need different software for each class, concept, or grade level that you teach.

*Sketchpad's* **friendly user interface** allows you and your students to get quickly up to speed so you can spend your time teaching mathematics, not software. You can **quickly and easily generate teaching aids** such as worksheets, tests, reports, and presentations with accurately measured figures by exporting *Sketchpad* files to word-processing programs and spreadsheets, other drawing programs, and the Internet.

**Check out these sites to access more resources and presentations for Sketchpad® software:**

### **The Geometer's Sketchpad® Resource Center**

<http://www.dynamicgeometry.com/>

**The Resource Center supports users of the award-winning Dynamic Geometry® mathematics visualization software, *The Geometer's Sketchpad*.**

### **Report from the 2008 NCTM Annual Meeting**

Salt Lake City, Utah

April 9-12, 2008

*The Geometer's Sketchpad* featured prominently at the National Council of Teachers of Mathematics 86th Annual Meeting in Salt Lake City. Talk abstracts and User Group details are on this site:

[http://www.dynamicgeometry.com/General\\_Resources/User\\_Groups/NCTM\\_2008.html](http://www.dynamicgeometry.com/General_Resources/User_Groups/NCTM_2008.html)