HOW TO ACHIEVE Common Core With Tech:

{THE MATH STRAND}

[9] Grades [114] Standards

[20] Projects

ASK A TECH TEACHER

How to Achieve Common Core Standards with Tech

The Math Strand

9 Grades
114 Standards
20 Projects

By Ask a Tech Teacher©

2013

Visit the companion website at http://askatechteacher.com for more resources to teach K-12 technology

To receive free technology tips and websites, [click here](#)

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Introduction

Technology has become synonymous with education reform. Like starter on a barbeque, squirt around enough iPads and digital tools and classes start to sizzle.

Everyone agrees it's a transformative tool, but there's little consensus on how to integrate it into a curriculum. Endless conversation. Spirited debate. An impressive number of pilot programs and great ideas all with decidedly mixed results.

That is, until Common Core State Standards arrived in classrooms across the country. Its rigorous approach to preparing students for college and career treats tech-in-ed as decided science. Of course teachers use it in classrooms, as one of many tools to deliver quality content to eager students.

Consider these tech-centric Standards spread throughout K-8 Common Core strands (truncated for brevity):

- *Expect students to demonstrate sufficient command of **keyboarding** to type a minimum of one page [two by fifth grade] in a single sitting*
- *Expect students to **evaluate different media** (e.g., print or digital …)*
- *Expect students to **gather relevant information** from print and digital sources*
- *Expect students to integrate and evaluate **information presented in diverse media** and formats*
- *Expect students to **interpret information** presented visually, orally, or quantitatively (e.g., … interactive elements on Web pages)*
- *Expect students to make **strategic use of digital media***
- *Expect students to use **glossaries or dictionaries, both print and digital** …*
- *Expect students to use information from **illustrations and words in print or digital** text*
- *Expect students to use a **variety of media** in communicating ideas*
- *Expect students to **use technology** and digital media strategically and capably*
- *Expect students to **use text features and search tools** (e.g., key words, sidebars, **hyperlinks**) to locate information*

> *Use of technology differentiates for student learning styles by providing an alternative method of achieving conceptual understanding, procedural skill and fluency, and applying this knowledge to authentic circumstances.*
>
> *—Common Core*

…and this Common Core note:

> ***New technologies** have broadened and expanded the role that speaking and listening play in acquiring and sharing knowledge and have tightened their link to other forms of communication. **Digital texts** confront students with the potential for continually updated content and dynamically changing combinations of words, graphics, images, **hyperlinks**, **and embedded** video and audio.*

The underlying theme can't be ignored: A 21st Century learner requires technologic proficiency. Proof enough is that Common Core summative assessments will be completed online—only possible if students use technology as comfortably as paper and pencil to demonstrate knowledge.

What's in the Common Core Tech Series?

OK. You're convinced, but how do you get tech into your classes? You don't have time for another subject in your already bloated curriculum?

You'll love this series—*How to Achieve Common Core With Tech*. Here, we show you easy-to-understand tech that can be used as a tool to accomplish the standards. The technology is always grade-appropriate, often intuitive, no more complicated to use than any other educational tool, like iPads or manipulatives.

Each volume addresses a separate Common Core strand:

- *Language*
- ***Math***
- *Reading*
- *Speaking-listening*
- *Writing*

You see how to use computers, websites, iPads, graphic art, infographics, web widgets and other tech tools to scaffold what you already teach, using tech to deliver Common Core's big ideas:

- *Provide practical strategies for students and teachers to publish and share*
- *Provide flexible learning paths*
- *Differentiate for varied student learning styles*
- *Share scalable projects that suit many classroom demands*
- *Increase rigor*
- *Make students accountable for their own learning*

> *Digital materials that are smaller than a course can be useful... adapted for clusters of standards or progressions within a cluster.*
>
> *—Common Core*

In this volume—*Math*—you'll find effective strategies to prepare students for rigorous math while covering 100+ **Common Core Standards in Literacy and Math.**

Big Idea of This Book

Common Core has refocused the teaching of math. No longer do you rush to present all material every year. Now, each grade focuses of specific topics, as part of a coherent strategy, with the application of rigor--

Focus
Coherence
Rigor

A triumvirate. Each year scaffolds on prior years with students expected to remember and use what they learn as math is linked to major topics within the grade level—less a stand-alone subject than a tool. The goal: Conceptual understanding, procedural skill and fluency, and application.

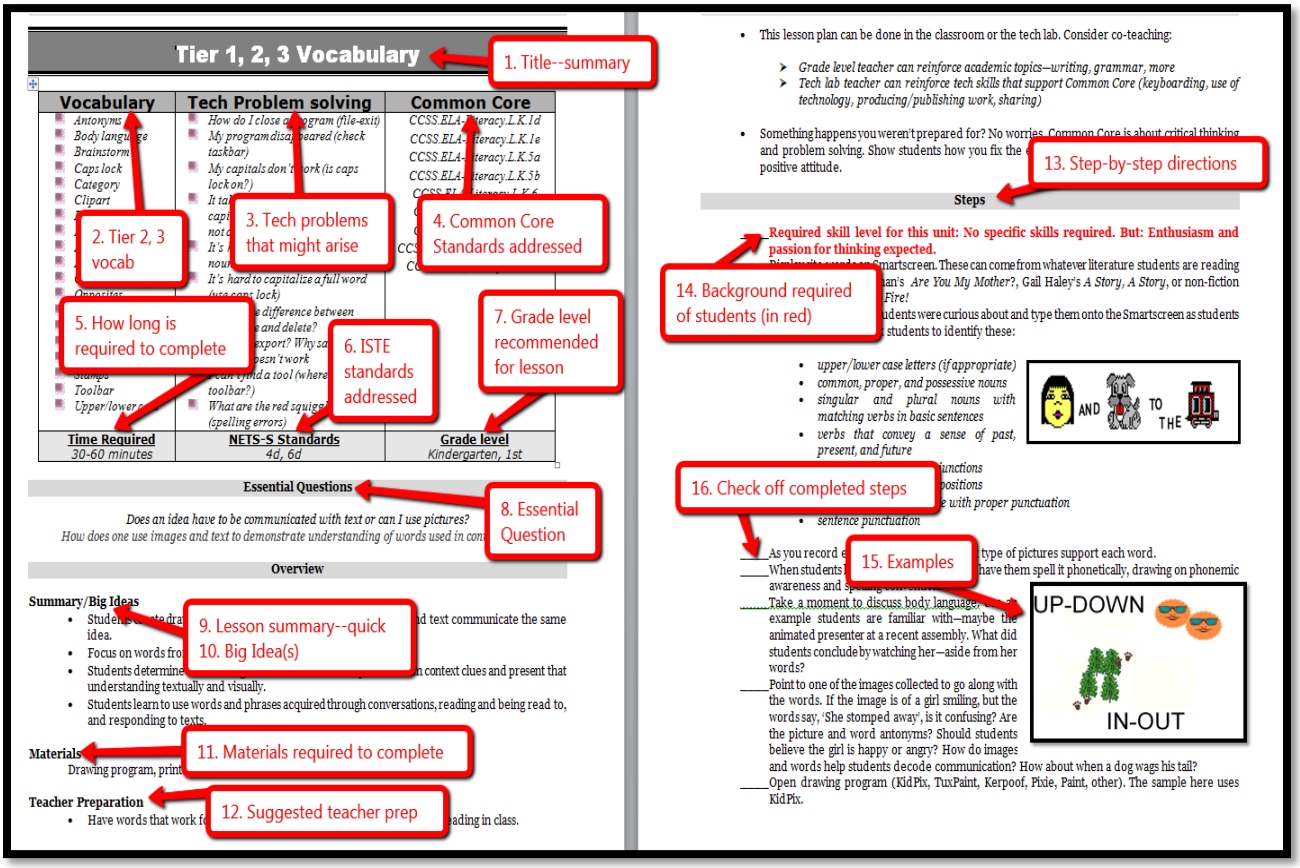
Use the twenty projects in this book to make that happen.

How the Book is Organized

Each lesson shows how to use technology to achieve Common Core Math Standards (*Figure 1)* as follows:

1. *Title—overview of what the project addresses*
2. *Vocabulary-academic/domain-specific used*
3. *Tech Problem solving—common tech problems faced when teaching lesson—and solutions*
4. *Common Core—standards addressed*
5. *Time Required—how long lesson will take to complete*
6. *NETS-S Standards—ISTE standards addressed*
7. *Grade level—recommended grades*
8. *Essential Question—what should student leave lesson understanding*
9. *Summary—what is accomplished*
10. *Big Idea—what student gets from time spent on this topic*
11. *Materials—software, hardware, equipment teacher should have available to complete lesson*
12. *Teacher preparation—how should teacher be prepared*
13. *Steps—step-by-step directions*
14. *Required skill level—what tech background should students have to accomplish stated goals*
15. *Examples—where relevant*
16. *Check off—track what's accomplished. Why? Some lessons take more than a class session*

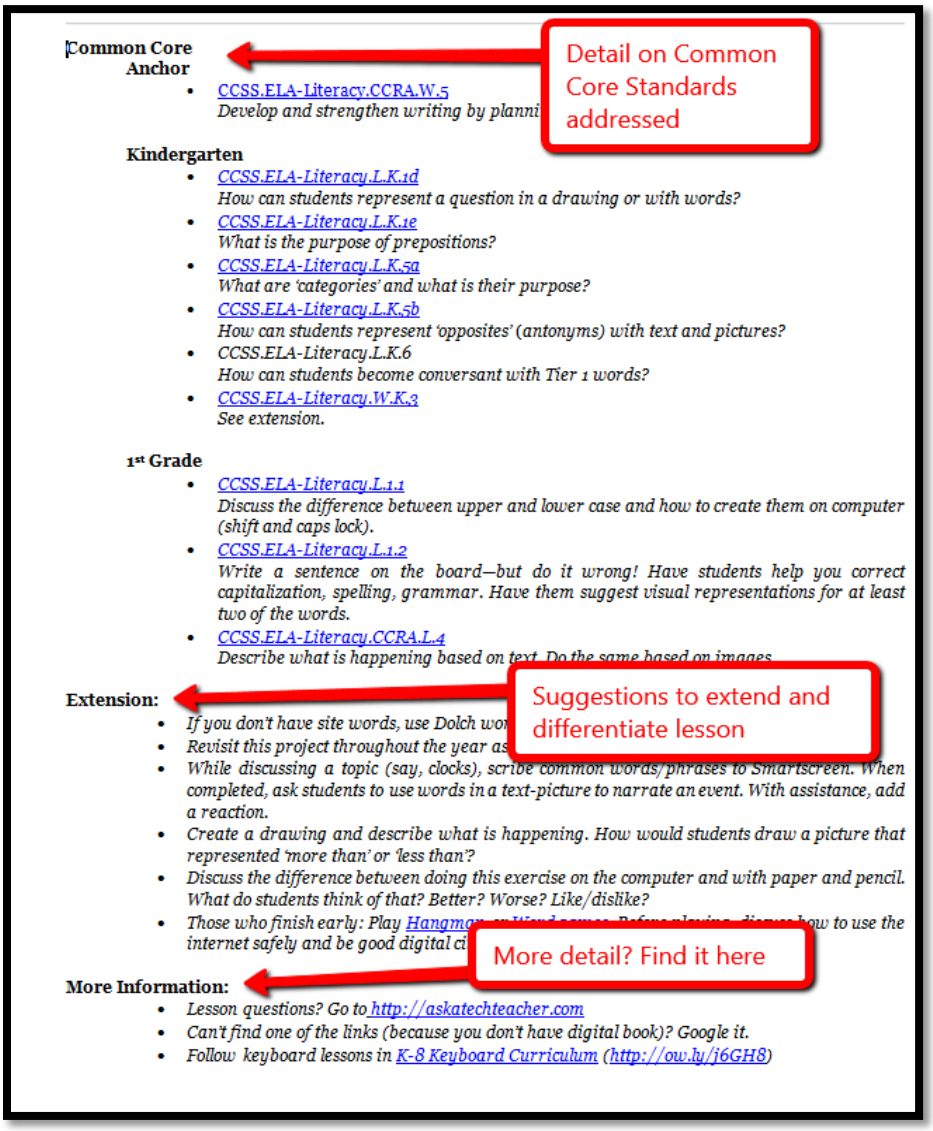
Figure 1



The next three are found at the end of each lesson (see *Figure 2*):

- *Common Core—detail of standards addressed*
- *Extension—suggestions on how to extend and differentiate lesson*
- *More information—where to go for additional help*

Figure 2



Who Needs This Book

You are the Tech Specialist, Coordinator for Instructional Technology, IT Coordinator, Technology Facilitator, Curriculum Specialist, Technology Director, or tech teacher—tasked with finding the right project for a classroom, an idea, a Standard. You have a limited budget, less digital tools, and the drive to do it right no matter the roadblocks.

Or you are the classroom teacher, a tech enthusiast with a goal—and this time you mean it—to integrate the wonders of technology into lessons. You've seen it work. Others in your PLN do it. And especially now, you want

technology to help meet standards like those listed earlier *(…use technology strategically and capably… …use digital resources…*). But too often, technology seems like a puzzle box added to your already overflowing educational toolbox.

How do you do it? With these projects, where tech meets Common Core.

Tips for Using This Book

When you unpack this tome, you likely will find many familiar strategies—but presented in Common Core ways. This means you aren't learning new programs, but new ways to scaffold comprehension and optimize learning.

Here are tips for using this ebook:

- Lessons are device-neutral. It doesn't matter if you're a Mac or PC school, with laptops or Chromebooks or desktops. The Big Ideas and Essential Questions are valid on any platform. Yes, you might have to make a few adjustments—but, you're a techie. No worries.
- Lessons can be done in the classroom or lab. Consider co-teaching:
    - *Grade level teacher reinforces academic topics*
    - *Tech teacher reinforces tech skills*
- Use 'Vocabulary' in each lesson as you teach. It supports Standards and students learn by your example.
- 'Tech Problem Solving' shares common geeky show-stoppers. Don't rush in to solve problems. Help students determine strategies that worked in the past. Focus on listed problems, but embrace all that come your way.
- All teachers share responsibility for student literacy. Use strategies to demystify math no matter where it appears—math, science, literature, other.
- Throughout lessons are instructions to '*pick which program works best*' and '*devise a plan to accomplish goals*'. It means exactly that: Differentiate instruction for your unique group. Be flexible, open-minded, and adventurous with choices.
- Common Core standards are a cumulative progression designed to enable students to meet college and career expectations. They build year-to-year, scaffolding on prior knowledge, developing depth:

> ***Standards for Mathematical Practice***
>
> *Mathematically proficient students consider available tools when solving a mathematical problem. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.*
>
> *—Common Core*

Students advancing through the grades are expected to meet each year's grade-specific standards, retain or further develop skills and understandings mastered in preceding grades… (from Common Core)

- Most lessons in this book are for multiple grade levels. Pay attention to that as you implement the lesson.
- Lessons use free software and web-based tools where possible. If you can't access one, email us (info@structuredlearning.net) and a curriculum specialist will help you develop a work-around.
- Assessment isn't limited to traditional approaches (see Introductory section on 'Assessment'). Be creative. Materials in this book allow flexibility in meeting the needs of a range of students. The wide variety of assessments included in each lesson reflect that. Adjust as needed (maintaining core teaching principals), refine content and methodology, and pick the assessment approach suited to your needs. Remember why you assess: 1) to measure understanding, 2) to help students prepare for college and/or career.
- Consider a BYOD approach so students can use the device they are most comfortable with (if your IT folks and infrastructure support this approach). Because lessons cross content boundaries, learning is optimized by encouraging students to complete projects when convenient for their schedule.
- At every opportunity, use technology—to schedule projects, take a poll, read, time an activity. Expect students to devise tech alternatives to common activities.
- Questions? Don't know how to perform a required skill? Get answers from the companion website, AskaTechTeacher.com where you always find a teacher familiar with Structured Learning books. Let them know where you need help and they'll figure it out with you.

> *Digital materials offer substantial promise for conveying mathematics in new and vivid ways and customizing learning. In a digital or online format, diving deeper and reaching back and forth across the grades is easy and often useful.*
>
> *—Common Core*

Equipment Needs

Tech infrastructure and equipment needs vary tremendously from school-to-school. We've kept this list as basic as possible, with options to assist in meeting Common Core demands:

- *Digital camera (optional)*
- *Digital portfolios (online, GAFE, server)*
- *Headphones, speakers*
- *Internet access*
- *Microphone (optional)*
- *Permissions for online ed tools, student use*
- *Printer*
- *Productivity program (Office, GAFE, OO)*
- *Projector, optional Smartscreen, printer*
- *Student response system (Today's Meet, Socrative, Twitter, Padlet)*
- *Students computers*
- *Video camera (optional)*
- *Writing forums (blogs, wikis, websites, more)*

Assessment

Assessment is always challenging, isn't it? Finding evidence that students have learned what you taught, that they can apply knowledge to complex problems—how do you do this? Rubrics? Group projects? Posters? None sound worthy of the Common Core educational environ. You need authentic assessments that are measurable and student-centered, promote risk-taking by student and teacher alike, are inquiry-driven, and encourage students to take responsibility for his/her own learning.

Here's a general list included in this ebook with options that are scalable, age-appropriate and effective:

- **Anecdotal**
  Observe how students show learning. Are they engaged, making their best effort? Do they remember/apply skills taught prior weeks? Do they self-assess and make corrections as needed?
- **Transfer knowledge**
  Can students transfer learning to life? Do you hear fun stories from parents and teachers about how students used tech? Do students share how they 'helped mom use Google Maps …"
- **Teach others**
  There's a hierarchy of learning that goes like this:

  - ✓ *Student listens*
  - ✓ *Student believes*
  - ✓ *Student tries it*
  - ✓ *Student remembers it*
  - ✓ *Student shows others*
  - ✓ *Student teaches others*

  Authentic learning. That's rigor.

> *Digital materials that are smaller than a course can be useful. … adapted for clusters of standards or progressions within a cluster.*
>
> *—Common Core*

- **Verbalize**
  Can students use the right words? No umms, hand motions, giggles. Can they share knowledge in succinct, pithy sentences?
- **Portfolio**
  Do students collect work to a digital portfolio? Is it in the cloud where stakeholders can access it, never wondering what grade has been earned because they know?
- **Summarize knowledge**
  Can students use knowledge to create a magazine, a video, a how-to audio or screencast? 'Use' is important. Or does it sit in a mental file folder?
- **Oral presentations**
  This can be summative, formative, informational, formal, or informal. It can be a quick answer to classroom questions, solving a problem on the Smartscreen, teaching classmates to solve a problem during class, or preparing a multimedia presentation to share. It's more than assessment of learning. It judges speaking and listening skills—which, of course, are fundamental life skills.

In the end, choice of assessment depends upon teaching goals—and which works best for you.

Companion Website

Books are static. The challenge is to keep them current—especially in a field like technology where nothing remains the same for more than ten minutes. Common Core recognizes this:

Digital texts confront students with the potential for continually updated content…

To address this reality, we provide a companion website—Ask a Tech Teacher.com—that is always up-to-date, staffed by tech teachers using Structured Learning materials, and ready to answer your questions on lesson plans, tools, strategies, pedagogy. Drop by for a visit and find:

- *Free lesson plans*
- *Targeted websites*
- *Free Newsletters on tech tips and weekly websites*
- *Teacher resources*

- *Free training videos on tools used in lesson plans*
- *Great apps to include on iPads, digital devices*

Find not just help with projects, but your questions about technology in education. When should you start teaching keyboarding? How do you introduce computers to kindergarteners? What do you do when students know more than parents (or teachers)?

And more.

License

About the Publisher

Structured Learning IT Team *is the premier provider of technology instruction books and ebooks to education professionals including curricula, how-to guides, theme-based books, and one-of-a-kind online help—all to fulfill the tech demands of the 21st century classroom. Materials are classroom-tested, teacher-approved with easy-to-understand directions supported by online materials, websites, blogs, and wikis. Whether you are a new teacher wanting to do it right or a veteran educator looking for updated materials,* ***Structured Learning*** *and its team of technology teachers is here to assist*

About the Author

Ask a Tech Teacher *is a group of technology teachers who run an award-winning resource* ***blog*** *where they provide free materials, advice, lesson plans, pedagogic conversation, website reviews, and more to all who drop by. The free newsletters and website articles help thousands of teachers, homeschoolers, and those serious about finding the best way to maneuver the minefields of technology in education.*

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Standards for Mathematical Practice

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CCSS Math/ Content 6-7.SP.B.4

_____Did student worked well with partner?

_____Did student provide backchannel feedback?

8…Excel—Certification

Vocabulary	Tech Problem solving	Common Core
• *Calculation* • *Count* • *Data* • *Doc* • *Excel* • *Formula* • *Four-function* • *Function* • *Geek* • *Hyperlink* • *Model* • *Precision* • *Quantitative* • *Read only* • *Structure* • *Workbook* • *Worksheet*	• *Spreadsheet's gone (check taskbar)* • *What's today's date (Ctrl+; in Excel)* • *My cell says **** (widen column)* • *Can't find hyperlink tool (Ctrl+K)* • *Data entered didn't work (push enter)* • *Assessment takes too long? Adjust requirements and grading.* • *Student computers don't work? Help them solve problems—don't do for them.* • *Can't save assessment—says 'read only' (save under a different name)* • *What's the difference between save and save-as?* • *Chart embeds into worksheet (highlight data; click F11)* • *Formula won't work (did you start with =? Did you try Help?)*	*CCSS.ELA-Literacy.RST.6-8.3* *CCSS.ELA-Literacy.RST.6-8.4* *CCSS.ELA-Literacy.RST.6-8.7*
Time Required *6 hours*	**NETS-S Standards** *2b, 6a*	**Grade** *Middle School*

Essential Question

Why is a spreadsheet the appropriate tool? How do I use it strategically?

Overview

Summary

Students work independently to prepare for and take a nationally-recognized MS Excel certification.

By the end of this unit, middle school students will review seven of the Standards for Mathematical Procedures and 3 RST Math Standards, as well as solidify use of spreadsheet for conveying rigorous mathematical information.

Big Idea

Know how to use technology to evaluate quantitative information and ideas efficiently.

Materials

Internet Excel Certification information (websites, practice tests)

Teacher Preparation

- If you have access to a backchannel device (like Today's Meet, Socrative, Padlet, or Twitter), have that available. Twitter enables student collaboration in problem solving.
- This lesson plan can be done in the classroom or tech lab. Consider co-teaching:

- *Grade level teacher can reinforce academic topics*
- *Tech lab teacher can reinforce tech skills*

- Something happen you weren't prepared for? No worries. Common Core is about critical thinking and problem solving. Show students how you fix the emergency without a meltdown and with a positive attitude.

Steps

_____**Required skill level: Intermediate Excel and self-starter attitude.**

_____Spreadsheets are a proven approach to understanding problems and modeling data—and 'modeling' is one of Common Core's Standards for Mathematical Practice that describe expertise educators seek in students. Spreadsheets are one of a student's strategic tools.

_____Excel Certification is self-directed. Test is scheduled when student is ready. Here are examples of skills students should know:

1. *Add/ remove cell borders*
2. *Add digital signatures*
3. *AVERAGEIF*
4. *Axis information*
5. *Change Chart types*
6. *Change row function*
7. *Change row/column size*
8. *Change orientation*
9. *Change view*
10. *Chart trend over time*
11. *Chart elements*
12. *Color scales*
13. *Conditional formatting*
14. *Conditional Logic*
15. *Convert text to columns*
16. *COUNTA*
17. *COUNTIF*
18. *Create custom cell format*
19. *Create drop-down list*
20. *Custom AutoFilter*
21. *Cut, copy, paste data*
22. *Data bars*
23. *Define print area*
24. *Display and print formulas*
25. *Document Inspector*
26. *Enable multiple users*
27. *Ensure Data integrity*
28. *Fill a series*
29. *Filter data*
30. *Format cells*
31. *Format decimal places*
32. *Format rows and columns,*
33. *Format text*
34. *Format date*
35. *Format worksheet*
36. *Format Data and Content*
37. *Formulas*
38. *Freeze panes*
39. *Headers and footers*
40. *Hide a row or column*
41. *Hide/unhide worksheets*
42. *Hide Ribbon*
43. *HLOOKUP*
44. *Icon sets*
45. *Insert and modify shapes*
46. *Insert comments*
47. *Keywords to properties*
48. *Mark workbooks as final*
49. *MAX*
50. *Merge and split cells*
51. *MIN*
52. *Mixed references*
53. *Modify a range*
54. *Modify/save a theme*
55. *Move a page break*
56. *Move embedded chart*
57. *Open/arrange windows*
58. *Paste Special*
59. *Paste without borders*
60. *Protect workbooks*
61. *Quick Styles*
62. *Remove duplicate rows*
63. *Remove private data*
64. *Restrict data*
65. *Save as template*
66. *Save as macro-enabled*
67. *Scale worksheet to fit*
68. *Secure Data*
69. *Set margins*
70. *Set print options*
71. *Show/hide gridlines*
72. *SmartArt graphics*
73. *Sort/filter data*
74. *Subtotal data*
75. *SUMIF*
76. *Track Changes*
77. *Troubleshoot formula*
78. *VLOOKUP*

_____Here are test-taking hints:

- *Most procedures are multi-step, but less than five. Do them right and they work.*
- *Tests are skills-based and take place in a simulated application environment.*
- *Exam is assessed on outcome and clicks.*
- *Users should be able to locate and utilize key features.*
- *Questions are not worded to be tricky or misleading.*

- *Be well versed in software, persistent.*
- *Takes about 90 minutes. Keep track of time.*
- *Skip questions you are not sure of. Return to them at end of test.*
- *If you think you clicked too many places looking for answer, reset question.*
- *Do not over-think questions. Stick to the literal.*

_____Before beginning, put backchannel device onto Smartscreen to track student comments as they work. Students access it on their devices. If using Twitter, encourage students to respond to classmate problems (if they know solution).

_____Students will use class and homework time to prepare using an MS approved prep website. Training takes approx. five hours. Students can study in groups. Remind them to use time wisely.

_____Part of prep will be creating an assessment in Flubaroo, Test creator, or Tests—whichever works for your group. These will be uploaded to a central location, such as:

- *Shared through Google Apps*
- *Class blog*
- *Class wiki*

...for use of all students. When students think they're ready, take one as practice. These can be assessed or not—your option.

_____Official test can be taken through an online location like Certiport or at your school if school has arranged to be a certified MS Office testing location.

_____During class, check for understanding. Expect students to make decisions that follow class rules.

_____*A note: Every chance you get, use technology to facilitate teaching. Lead by example. Students will see you use tech quickly and facilely and follow your good example. They want to use tech. Don't discourage them!*

Common Core (truncated for brevity; refer to original Standards for exact wording)

Standards for Mathematical Practice

- CCSS.Math.Practice.MP2
  Reason abstractly and quantitatively
- CCSS.Math.Practice.MP3
  Construct viable arguments
- CCSS.Math.Practice.MP4
  Model with mathematics
- CCSS.Math.Practice.MP5
  Use appropriate tools strategically
- CCSS.Math.Practice.MP6
  Attend to precision
- CCSS.Math.Practice.MP7
  Look for and make use of structure
- CCSS.Math.Practice.MP8
  Look for and express regularity in repeated reasoning

Middle School

- CCSS.ELA-Literacy.RST.6-8.3
  Follow precisely a multistep procedure when performing technical tasks.
- CCSS.ELA-Literacy.RST.6-8.4
  Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context
- CCSS.ELA-Literacy.RST.6-8.7
  Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., a table).

Extension:

- *If available, have local business folk explain importance of MS Certification in business. Help students understand how time spent preparing contributes directly to college and career.*
- *Students can work in groups.*
- *Use Evernote or OneNote (if available) to collect and share notes on prep materials.*
- *Access free online Excel training.*
- *Use StudyBlue to create and share flash cards for Certification.*
- *Practice on MS 365 if available so students get used to taking tests online.*
- *Reflect in blog on achieving Certification. Was it important? Did student learn a lot? If they didn't pass, what happened? Student is graded NOT on achieving certification, but the process in pursuing it.*
- *This is an excellent KWL formative assessment or a summative assessment for end of a unit.*

More Information:

- *Get prep course at Lynda.com.*
- *Certification classes: Comma.*
- *Certification classes: Certiport.*
- *Lesson questions? Go to Ask a Tech Teacher.*
- *If using this for an assessment, see the full list of assessment items by grade level at end of unit.*

Assessment
Middle School

_____Did student join class discussion? With backchannel device?

_____Did student share study materials with classmates (via Google Apps, DropBox, other)?

_____Did student transfer knowledge from prior spreadsheet lessons to this one and use it appropriately?

_____Did student troubleshoot problems (if any)?

_____Was student able to follow multi-step videos and written directions in preparing Excel skills?

_____Was student able to decode domain-specific language in test preparation materials?

_____Did student work tenaciously throughout preparation?

_____Did student complete preparation working independently and tenaciously?

_____Did student take a student-created pre-test?

_____Did student take certification test?

_____Did student pass certification test?

_____Did student use academic and domain-specific language in class conversation and blog posts?

_____Did student think critically when investigating Excel problems?

_____Could student provide supporting evidence for how s/he arrived at solutions?

_____Did student blog on certification and comment on other posts? Did student use evidence when discussing topic?

_____Did student understand why spreadsheets are a strategic tool important to their academic career?

_____Other_____

_____

_____

9...Arrays

Vocabulary	Tech Problem Solving	Common Core
• *Addends* • *Arrays* • *Attribute* • *Autistic* • *Column* • *Context* • *Equation* • *Grid* • *Matrix* • *Pairing* • *Pi* • *Product* • *Row* • *Spreadsheet* • *Workbook* • *Worksheet*	• *Computer doesn't work (check common problems)* • *Cells aren't square (click between A/1)* • *Where's Excel embed code (only in Google Spreadsheet)* • *I don't understand directions (read, interpret, do your best, edit, revise, collaborate with neighbor)* • *Got wrong fill (try again with correct color)* • *Why must my name be in file name?* • *My spreadsheet disappeared (did you save-early-save-often?)* • *It's easier for me to do the multiplication (or addition) without arrays (That's OK. Understand how arrays work and then use approach that works best for you)*	*CCSS.ELA-Literacy.CCRA.SL.5* *CCSS.ELA-Literacy.CCRA.SL.2* *CCSS.Math.Content.2.MD.B.5* *CCSS.Math.Content.2.OA.C.4* *CCSS.Math.Content.3.NBT.A.3* *CCSS.Math.Content.3.OA.A.1* *CCSS.Math.Content.3.OA.A.3* *CCSS.Math.Content.3.MD.C.6* *CCSS.Math.Content.3.MD.C.7* *CCSS.Math.Content.3.G.A.2* *CCSS.Math.Content.4.NBT.B.5* *CCSS.Math.Content.4.OA.A.2* *CCSS.Math.Content.4.OA.B.4* *CCSS.Math.Content.5.MD.C.3* *CCSS.Math.Content.5.MD.C.5*
Time Required *25-45 minutes*	**NETS-S Standards** *3c, 6a*	**Grade** *2nd - 5th*

Essential Questions

How can I draw a picture of numbers?
How are patterns related to multiplication?

Overview

Summary

Use spreadsheet tools to visually represent arrays. Compare answers derived from array with those based on mental math, traditional math processes, and/or a four-function calculator.

This lesson contributes to coherence between math skills and strategic use of technology to deliver those.

Additionally, this lesson contributes to the rigor of your school's math program.

By the end of this unit, 2nd - 5th grade students will review two Anchor Standards in Language Arts, all eight Standards for Mathematical Procedures, up to 2 MD standards, up to 2 OA standards, up to 1 NBT standard, and 1 G standard, as well as review use of arrays in math concepts.

Big Idea

Mathematical concepts are often clearer when visualized.

Materials

Spreadsheet program, internet, four-function calculator (if appropriate to your school)

Teacher Preparation

- Have access to a screenshot program like Windows Snipping Tool or Jing.
- If students have blogs, have these set up.
- If you have access to a backchannel device (like Today's Meet, Socrative, Padlet), have that available.
- Have sample math problems to solve with arrays.
- Differentiate where possible for student learning styles.
- This lesson can be done in the classroom or tech lab. Consider co-teaching:

  - *Grade level teacher can reinforce academic topics*
  - *Tech lab teacher can reinforce tech skills*

- Something happen you weren't prepared for? No worries. Common Core is about critical thinking and problem solving. Show students how you fix emergencies without a meltdown and with a positive attitude.

Steps

_____**Required skill level: One spreadsheet project.**

_____Let's talk about models. What's a model? Anyone make plane models? Use Legos to create a building? Those are tangible. What about something intangible—can you 'model' a concept, idea? What tools are used to model? Have students read comics? What are those a 'model' for? How did the play they did earlier this year (or last year) 'model' an idea? Discuss how important it is in modeling to do it carefully, with precision. Each tool used must be exact and structured. In this way, anyone who sees the 'model' gets the message.

_____Common Core references arrays at every elementary grade level. Arrays are used for counting, organizing, measuring, multiplication, and fractions. How can they be considered 'models'?

_____Introduce arrays with a discussion of the amazing Daniel Tammet, author of *Born on a Blue Day*. He is an autistic savant who perceives words and numbers as shapes and colors. He can recite *pi* to several thousand places by visualizing the number as a landscape. See *More Resources* for links to Tammet's work.

Figure 4

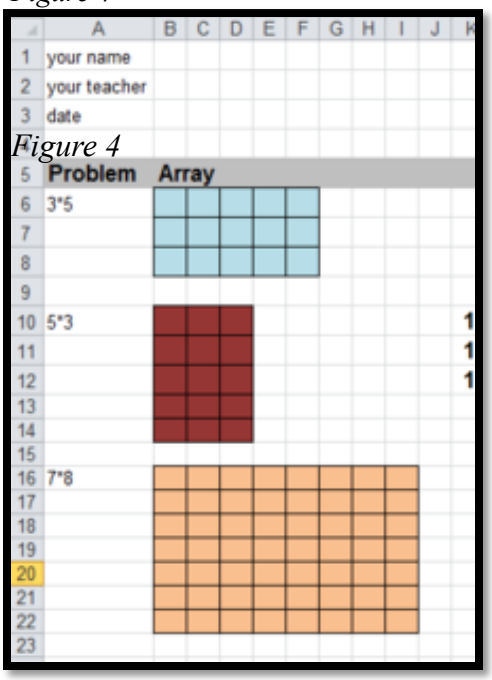


Figure 4

_____An array is a display of objects put into equal rows and columns (see *Figure 18*). In math, that means a grid-like arrangement of rows and columns enabling visualization of math. This is helpful to students who comprehend math best as an image rather than number (like Daniel Tammet).

_____Arrays offer an alternative model for multiplication problems. When some students see rows down and columns across and the tiny cells in between, they suddenly understand the logic and soon can answer without the array. This is differentiation.

_____Before beginning, put backchannel device onto Smartscreen to track student comments. Show students how to access it on their devices. As you demonstrate, address student comments.

_____Review spreadsheet—better yet, ask a student to review for class. Include rows, columns, numbers, letters, toolbars, how to format with color and text.

_____**2nd graders**: Postulate several addition problems in an array format. Have students verify sum is the same whether rows or columns are added. Have students click in each square and type a sequenced number as they add squares—one, two, three, and so forth until they run out of squares. On spreadsheet, to right of array, type equation that represents what is being added. Verify that whatever method student selects gives the same answer.

_____**Olders**: Postulate a problem, say three times five. In array syntax, this means a matrix (does this relate to the movie, *Matrix*?) 'three rows of five'. The delineated number of squares answers the function. What fraction of the whole would that be?

_____**All ages:** Give a word problem and ask students to work with a partner to solve it using an array.

_____Have students open spreadsheet program. For simplicity, use same workbook for all spreadsheet projects. In this case, name new tab 'Arrays'.

_____Set column width so sheet looks like graph paper (excepting column A where multiplication sentence is loaded). Discuss whether these squares equal centimeters, inches, millimeters, or another measure. What would the difference be? Should there be a legend to clarify?

> *Students develop an understanding of meanings of multiplication and division of whole numbers through activities and problems involving … arrays.*
>
> *—Common Core*

_____Add column titles 'Problem' and 'Array'. See *Figure 18* for example.

_____Working in groups, have students come up with three problems, say: *3*5, 5*3, 7*9*. Be sure to include a legend defining scale used to measure.

_____Color cells with paint bucket. Add cell borders to delineate.

_____With a partner, answer the following questions. Place answers to the right of arrays or in a separate section. Let students arrange as it suits them. Remind them: Make layout clear to viewer. Treat this like a problem (*How do I answer these questions so viewer can see what I'm talking about*?):

> *3. Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent problem. (3rd grade)*
>
> *—Common Core*

- *What counting pattern is shown by array? Why does pattern find total number of items in array?*
- *What objects in classroom or school are arranged as an array?*
- *Write an addition or multiplication sentence to go with array. Describe how columns and rows are used to find parts of a multiplication sentence.*
- *What part of the whole is each square? Measured as a width or as part of the area? How can student determine answer? For example, one square might be ½ of the total width. It also might be 1/6th of the total area.*

_____Now, student partners create five of their own problems and solve in the same manner. Create problems representative of math being learned in class. Include fractions if appropriate. For example, a third grader will multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9 × 80, 5 × 60). A fourth grader will create a word problem.

_____Next: Show how a rectangle with an area of ten can be represented by different arrays—such as 1 x 10 and a 2 x ?.

_____What about volume? How is that represented with arrays? What portion would one square represent? Let students use problem solving strategies—see what they come up with. After the right amount of time, have students work in groups with Legos to solve the problem, then transfer that knowledge to spreadsheet array. Share that thinking in a blog post.

_____Have student groups create as many arrays as possible with area of 24 (1 by 24; 2 by 12; 3 by 8). As they work:

- *Discuss thinking with each other; revise as needed.*
- *Understand arrays are a model, much as a graphic organizer.*
- *Consider how an array's visual display is different from a mathematical sentence?*

> *5. Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. (4th Grade)*
>
> *—Common Core*

_____Save to student digital portfolios, including last name in file name. Why? Embed page into student blog if using GAFE/Google Spreadsheet. If not using GAFE, save a screenshot of page and add to student blog with a reflection on how this visual arrangement enhanced understanding—or didn't. Compare and contrast to a numeric sentence.

_____Occasionally when students have difficulty doing what you are teaching, ask why. And listen. You may be surprised by the answer.

_____Tech Problems listed at beginning of lesson are the most common students will face. Expect students to solve these. Additionally, expect students to solve hardware problems as independently as possible, to persevere in solving them no matter how difficult they seem, and to use appropriate tools for finding solution. Consider:

- *Monitor problems—is power on*
- *Mouse problems—is light on underside (means it's getting power)?*
- *Sound problems—are headphones plugged in? Is student using correct headphones? Is sound on?*
- *Computer problems—is power on? Is student logged in correctly?*

> *6. Find quotients … Illustrate … by equations, rectangular arrays, and/or area models. (5th grade)*
>
> *—Common Core*

_____Throughout class, expect students to make decisions that follow class rules.

_____As you teach, incorporate domain-specific vocabulary and expect students to do the same.

_____Remind students to transfer knowledge to class or home.

_____As students leave classroom, have them line up in arrays.

_____*A note: Every chance you get, use technology to facilitate teaching. Lead by example. Students will see you use tech quickly and facilely and follow your good example. They want to use tech. Don't discourage them!*

Common Core (truncated for brevity; refer to original Standards for exact wording)

Anchor Standards

- CCSS.ELA-Literacy.CCRA.SL.5
  Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.
- CCSS.ELA-Literacy.CCRA.SL.2
  Integrate and evaluate information presented in diverse media and formats

Standards for Mathematical Practice

- CCSS.Math.Practice.MP1
  Make sense of problems and persevere in solving them
- CCSS.Math.Practice.MP2
  Reason abstractly and quantitatively
- CCSS.Math.Practice.MP3
  Construct viable arguments
- CCSS.Math.Practice.MP4
  Model with mathematics
- CCSS.Math.Practice.MP5
  Use appropriate tools strategically
- CCSS.Math.Practice.MP6
  Attend to precision
- CCSS.Math.Practice.MP7
  Look for and make use of structure
- CCSS.Math.Practice.MP8
  Look for and express regularity in repeated reasoning

2nd Grade

- CCSS.Math.Content.2.MD.B.5
  Use addition and subtraction within 100 to solve word problems …
- CCSS.Math.Content.2.OA.C.4
  Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends

3rd Grade

- CCSS.Math.Content.3.NBT.A.3
  Multiply one-digit whole numbers by multiples of 10 in the range using place value and properties of operations
- CCSS.Math.Content.3.OA.A.1
  Interpret products of whole numbers
- CCSS.Math.Content.3.OA.A.3
  Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities
- CCSS.Math.Content.3.MD.C.6
  Measure areas by counting unit squares
- CCSS.Math.Content.3.MD.C.7
  Relate area to the operations of multiplication and addition
- CCSS.Math.Content.3.G.A.2
  Partition shapes into parts with equal areas. Express area as a unit fraction of whole

4th Grade

- CCSS.Math.Content.4.NBT.B.5
  Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations
- CCSS.Math.Content.4.OA.A.2
  Multiply or divide to solve word problems involving multiplicative comparison
- CCSS.Math.Content.4.OA.B.4
  Find all factor pairs for a whole number in the range 1–100

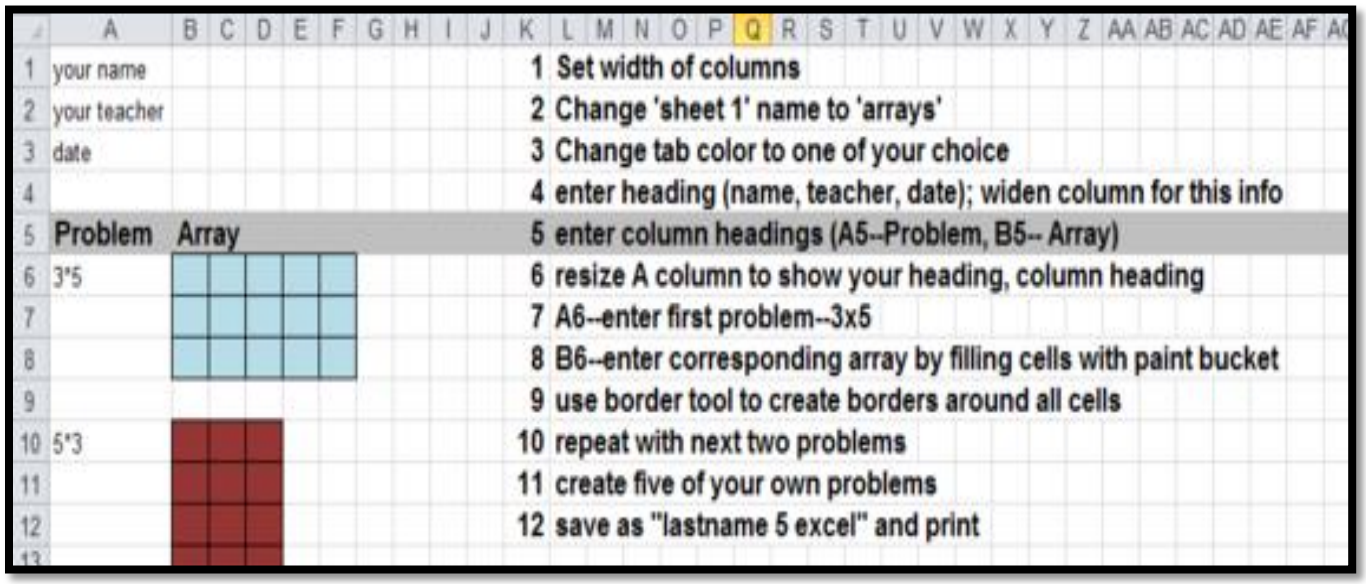
5th Grade

- CCSS.Math.Content.5.MD.C.3
  Recognize volume as an attribute of solid figures
- CCSS.Math.Content.5.MD.C.5
  Find volume of a prism with whole-number side lengths by packing it with unit cubes; show volume matches that found by multiplying edge lengths

Extension:

- *If using this for assessment, see full list of assessment items by grade level at end of unit.*
- *Students can work in groups.*
- *Use arrays to determine how many arrangements of rows and columns give the same multiplicative answer (factor a number). Do as a group on Smartscreen and then in groups.*
- *Show 5th graders how to determine volume of right rectangular prisms by viewing them decomposed into layers of cubes. Have them solve another problem the same way.*
- *Using Google Docs (with some adaptations), assign student groups to build arrays on shared spreadsheet. Display spreadsheet on Smartscreen as students work so they learn together.*
- *Have a student explain how s/he embedded Google Spreadsheet into a blog/website.*
- *Follow directions on right side Figure 19 as independent work.*

Figure 5



More Information:

- *See Daniel Tammet's Pi Landscape here.*
- *Click here for background on Tammet. Click here for TED talk.*
- *Lesson questions? Go to Ask a Tech Teacher.*

Assessment
2nd Grade

_____Did student join class discussion?

_____Did student locate and open workbook started on prior project if any)?

_____Did student format spreadsheet as required?

_____Did student follow directions when presented to group? Could student transfer information from Smartscreen to their digital device?

_____Did student work well with partner?

_____Was student able to take/make helpful suggestions from/to peers?

_____Did student use domain-specific language in class conversation?

_____Did student correctly build arrays to represent addition and multiplication problems?

_____Did student understand relationship between arrays and functions?

_____Did student critically think when analyzing data?

_____Did student understand how arrays contributed to their understanding of math? Did they connect the patterns created in arrays to math functions?

_____Did student come up with additional correctly-formed arrays?

_____Could student build an array to represent a word problem?

_____Did anecdotal observations show student working tenaciously on project?

_____Did student complete project?

_____Did student save/export to his/her digital portfolio?

_____Did student troubleshoot problems (if any)?

_____Other_____

_____

_____

Assessment
3rd Grade

_____Did student join class discussion?

_____Did student locate and open workbook started on prior project?

_____Did student format spreadsheet as required?

_____Did student follow directions when presented to group?

_____Did student work well with partner?

_____Was student able to take/make helpful suggestions from/to peers?

_____Did student use domain-specific language in class conversation?

_____Did anecdotal observations show student working tenaciously on project?

_____Did student correctly build arrays to represent addition and multiplication problems? Could student build an array to represent a word problem? Did student understand relationship between arrays and functions?

_____Did student critically think when analyzing data?

_____Did student understand how arrays and spreadsheets contributed to their understanding of math? Did they connect patterns created in arrays to math functions?

_____Did student understand how arrays connect area?

_____Did student find all factors of a number and represent that on spreadsheet?

_____Did students understand how each array was the composite of smaller equal parts, and as such, each part was $1/4^{th}$ or $1/3^{rd}$ (or similar) of the whole?

_____Did student come up with additional correctly-formed arrays?

_____Did student troubleshoot hardware problems (if any)?

_____Did student complete project?

_____Did student save/export to his/her digital portfolio?

Assessment
4th Grade

_____Did student join class discussion?

_____Did student locate and open workbook started on prior project (if any)?

_____Did student troubleshoot problems (if any)?

_____Did student format spreadsheet as required?

_____Did student work well with partner?

_____Was student able to take/make helpful suggestions from/to peers?

_____Did student follow directions presented to group and work independently when following a multi-step series of instructions?

_____Did student use backchannel device to get/give help?

_____Did student use domain-specific language in class conversation?

_____Did anecdotal observations show student working tenaciously?

_____Did student correctly build arrays to represent math problems? Could student build an array to represent a word problem? Did student understand relationship between arrays and functions?

_____Could student explain calculations using arrays to model answers?

_____Did student find all factors of a number and represent that on spreadsheet?

_____Did student understand how arrays and spreadsheets contribute to understanding math? Did they connect the patterns created in arrays to math functions?

_____Did student understand how arrays connect area, volume, multiplication, and addition?

_____Did student understand how each array was the composite of smaller equal parts, and as such, each part was $1/4^{th}$ or $1/3^{rd}$ (or similar) of whole?

_____Did student come up with additional correctly-formed arrays?

_____Did student complete project?

_____Did student save/export to his/her digital portfolio?

Assessment
5th Grade

_____Did student join class discussion?

_____Did student locate and open workbook started on prior project?

_____Did student troubleshoot problems (if any)?

_____Did student format spreadsheet as required?

_____Did student work well in a group—take/make suggestions from/to peers?

_____Did student follow directions presented to group and/or work independently when following a multi-step series of instructions?

_____Did student use backchannel device to get/give help?

_____Did student use domain-specific language in class conversation?

_____Did anecdotal observations show student working tenaciously?

_____Did student correctly build arrays to represent math problems? Could student build an array to represent a word problem?

_____Could student explain calculations using arrays to model answers?

_____Did student find all factors of a number and represent that on spreadsheet?

_____Did student see how arrays and spreadsheets contribute to understanding math, and relationship between arrays and functions?

_____Did student understand how arrays are connected to area, volume?

_____Did student understand how each array was the composite of smaller equal parts, and as such, each part was $1/4^{th}$ or $1/3^{rd}$ (or similar) of whole?

_____Did student come up with additional correctly-formed arrays?

_____Did student complete project?

_____Did student save/export to his/her digital portfolio?

12…Problem Solving

Vocabulary	Tech Problem solving	Common Core
• *Authentic problems* • *Compare/contrast* • *Conjecture* • *Context* • *Deductive reasoning* • *Democratic society* • *Evidence* • *Gamification* • *Inductive reasoning* • *Life skill* • *Logical thinking* • *Mathematical language* • *Pattern* • *Problem solving* • *Proportional reasoning* • *Responsible citizen* • *Shortkeys* • *Strategies* • *Troubleshoot* • *Visual learner*	• *What's the difference between 'save' and 'save-as'?* • *Why 'save early save often'?* • *Which tool do I use (what works?)* • *It's confusing (ask a friend to explain)* • *I couldn't get on keyboarding website (try other one)* • *I don't know answer (Did you use all resources?)* • *I don't care about shortkeys (they are another solution to a problem)* • *I'm frustrated (but doesn't it feel great to solve a problem)* • *I can't do it (take a deep breath; try again)* • *Student computers don't work (help—don't do for them)* • *Students afraid to fail? Remind them success is based on effort, not crossing a finish line*	*CCSS.ELA-Literacy.SL.3.1a-d* *CCSS.ELA-Literacy.SL.3.3-6* *CCSS.ELA-Literacy.SL.4.2* *CCSS.ELA-Literacy.SL.4.4-5* *CCSS.ELA-Literacy.SL.5.4-5* *CCSS.ELA-Literacy.RST.6-8.3* *CCSS.ELA-Literacy.RST.6-8.4* *CCSS.ELA-Literacy.RST.6-8.7* *CCSS.ELA-Literacy.SL.6.2* *CCSS.ELA-Literacy.SL.6.4-5* *CCSS.ELA-Literacy.SL.7.2* *CCSS.ELA-Literacy.SL.7.4-5* *CCSS.ELA-Literacy.SL.8.4-5*
Time Required *180 minutes*	**NETS-S Standards** *4a, 4c*	**Grade** *3-Middle School*

Essential Question

How does technology help problem solving skills?

Overview

Summary

Students select one common tech problem and teach classmates how to solve it in a presentation format.

By the end of this unit, 3rd-middle school students will review four of the eight Standards for Mathematical Procedures, up to 8 SL and 3 RST standards, as well as review practical strategies for problem solving.

Big Ideas

Make things as simple as possible, but not simpler (Albert Einstein).

Materials

Problem Solving Board rubrics, SignUp Genius account (if using this), Google Calendar (if using this)

Teacher Preparation

- Have Problem-Solving Board sign-up sheets posted
- This lesson plan can be done in the classroom or tech lab. Consider co-teaching:

  - *Grade level teacher can reinforce academic topics*
  - *Tech lab teacher can reinforce tech skills*

- Something happen you weren't prepared for? No worries. Common Core is about critical thinking and problem solving. Show students how you fix the emergency without a meltdown and with a positive attitude.

Steps

_____**Required skill level: Enthusiasm for thinking.**

_____Discuss quote under 'Big Idea'. Who said that? What's it mean? Discuss quotes at end of unit. Take ten minutes for students to blog about one (if your students use blogs).

> *Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution*
>
> *—Common Core*

_____Discuss what it means to be a 'problem solver'. Who do students go to when they need a problem solved? Do students believe that person gets it right more often than others? Would they believe most people are wrong half the time? Relate 'problem solving' to literature being discussed in class (i.e., Louisa May Alcott's *Little Women*).

_____Wait—can learning problem solving in math help with life's problems? Have a discussion with students on that topic before moving on.

_____Discuss what Common Core notes as the difference between 'problems' and 'exercises'. Problems: Students work through what they haven't yet learned, figuring out how to solve. Exercises: Students apply what they have already learned to build mastery. Both are valuable, but here, we share strategies to resolve the unknown.

_____In school, students won't always know the difference. What starts as an exercise can quickly turn into problem solving as a sequence of activities leads from prior knowledge to new knowledge, or a new understanding. This is 'regularity in repeated reasoning'.

_____Problem solving is closely aligned with logical thinking, critical thinking, reasoning, and thought habits. Discuss why students should become problem solvers (hint: refer to prior point—most people are wrong half the time). Discuss characteristics of a 'problem solver' (from Common Core):

- *Use appropriate tools strategically*
- *Attend to precision*
- *Make sense of problems and persevere in solving them*
- *Value evidence*
- *Comprehend as well as critique*
- *Understand other perspectives and cultures*
- *Demonstrate independence*

_____Additionally, problem solvers:

- *Identify/define authentic problems/questions*
- *Accept responsibility for solving problems*
- *Troubleshoot*
- *Learn new skills by reflecting on past knowledge*

- *Know which tool is right for what task*

_____Finally, being a problem solver:

- *Is fundamental to an educated person*
- *Is required of a responsible citizen in a democratic society*
- *Is critical for a wide range of jobs*

> *…devise a strategy… lay out solution as a sequence of well justified steps. …the solution to a problem takes the form of a cogent argument that can be verified and critiqued…*
>
> *—Common Core*

_____Discuss strategies for problem solving:

- *Use teacher as a guide, not an oracle*
- *Use tools available*
- *Observe and collect data*
- *Be aware of surroundings*
- *Notice the forest and the trees*
- *Think logically*
- *Never say 'can't'*
- *Act out a problem*
- *Apply inductive reasoning*
- *Break a problem into simpler parts*
- *Distinguish between relevant and irrelevant information*
- *Draw a diagram*
- *Guess and check*
- *See patterns*
- *Translate data into mathematical language.*
- *Try, fail, try again*
- *Use conjecture and evidence to develop valid rules and procedures.*
- *Use proportional reasoning*
- *Use what has worked in the past*
- *Work backwards*
- *Embrace change*
- *Question 'the way it's always been done'*
- *Identify authentic problems; ask clarifying questions; trust yourself*
- *Do not fear risk-taking*

> *Proficient students are sufficiently familiar with tools appropriate for their grade to make sound decisions about when each of these tools might be helpful…*
>
> *—Common Core*

_____Introduce Problem Solving Board. This is a life skill that transcends a subject. Expect students to transfer knowledge to all parts of life.

_____Three parts to this project:

1. *Class presentation*
2. *Create a how-to in an online presentation/publishing tool*
3. *Submit a storyboard that shares organization (optional)*

_____Discuss common problems students face when using tech (see list at end of lesson). Students should own these by end of class (Throughout year, keep a list of problems for next year's Board).

_____Student presentations will open class, a warm-up like a Responsive Classroom activity. Add start date to class online calendar.

_____Presentation requires 1) independent investigation, 2) risk-taking for cautious students who feel a Right Answer lives out there somewhere, and 3) presentation skills discussed in Common Core 'Speaking and Listening':

- *Students will show classmates how to solve a problem using an online tool.*
- *Student presentation will be professional, clear, edited, and reworked where necessary.*
- *If information is technical, student will include a visual (Middle School only).*
- *Presentation will use appropriate eye contact, adequate volume, clear pronunciation.*
- *Speech style will fit audience.*
- *Students will take questions from audience that relate to subject.*
- *Students will have storyboard available for teacher.*
- *Problem solving presentation will provide answers, but also arguments, explanations, diagrams, mathematical models, and whatever else aids understanding.*

_____Students can work in groups. Sign up for a problem and presentation date via a program like Sign up Genius or Google Apps.

_____**First:** Student group selects a tool to show how to solve problem they selected. Here are suggestions, but students may come up with their own if teacher approves:

- *Animoto*
- *Comic builder ZimmerTwins)*
- *Widgets*
- *Flipboard*
- *online slideshow (Kizoa. Slideboom)*
- *Photocube (6 how-to pictures)*
- *Prezi*
- *Scratch*
- *Screencast-o-matic or Jing*
- *SketchUp*
- *video published to YouTube (class private channel), SchoolTube, Pupiltube, other*

> *Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning.*
>
> *—Common Core*

_____**Second (Optional):** Students create a storyboard using online tool showing how to solve problem. This will be turned in with final project. What is a storyboard? What is its purpose? Have students used one before?

_____**Third:** Using selected tool, students show clear understanding of how to solve problem. Students self-teach tool, using resources like online videos, friends, online instructions. Teaching themselves to use this tool is an authentic example of their personal problem solving skills.

_____**Fourth:** Students show classmates how to solve problem on agreed-upon date. Audience will follow agreed-upon rules for listening, ask questions to check understanding, stay on topic, and link comments to remarks of others.

_____**Fifth:** Students save project to digital portfolios and embed in blog to share with classmates.

_____Students get three class periods to prepare, one for presentation. Pay attention to these considerations while working:

- *determine target audience, goal, and purpose of presentation*
- *introduce presentation with a problem solving quote (see list at end of lesson)*
- *convey information, offer insights and analysis*
- *organize content so solution is evident*
- *show care in downloading and using public domain clipart*
- *use headings, illustrations, multimedia, and text*

_____Review grading (see assessment options at end of lesson).

_____As you teach, incorporate domain-specific vocabulary and expect students to do the same.

_____Throughout class, expect students to make decisions that follow class rules.
_____Moderate expectations depending upon grade level of students.
_____*A note: Every chance you get, use technology to facilitate teaching. Students will see you use tech quickly and facilely and follow your example. They want to use tech. Don't discourage them!*

Common Core (truncated for brevity; refer to original Standards for exact wording)

Standards for Mathematical Practice

- CCSS.Math.Practice.MP1
  Make sense of problems and persevere in solving them.
- CCSS.Math.Practice.MP3
  Construct viable arguments; critique reasoning of others.
- CCSS.Math.Practice.MP5
  Use appropriate tools strategically.
- CCSS.Math.Practice.MP6
  Attend to precision

3rd Grade

- CCSS.ELA-Literacy.SL.3.1a
  Come to discussions prepared, having studied required material; explicitly draw on that preparation to explore ideas under discussion
- CCSS.ELA-Literacy.SL.3.1b
  Follow agreed-upon rules for discussions
- CCSS.ELA-Literacy.SL.3.1c
  Ask questions to check understanding, stay on topic, and link comments to remarks of others
- CCSS.ELA-Literacy.SL.3.1d
  Explain their own ideas and understanding in light of the discussion
- *CCSS.ELA-Literacy.SL.3.3*
  Ask and answer questions about information from a speaker, offering appropriate detail
- CCSS.ELA-Literacy.SL.3.4
  Report with appropriate facts, speaking clearly at an understandable pace
- CCSS.ELA-Literacy.SL.3.5
  Create engaging audio recordings that demonstrate fluid reading at an understandable pace; add visual displays when appropriate to enhance facts or details
- CCSS.ELA-Literacy.SL.3.6
  Speak in complete sentences to provide requested detail or clarification

4th Grade

- CCSS.ELA-Literacy.SL.4.2
  Paraphrase information
- CCSS.ELA-Literacy.SL.4.4
  Report on a topic in an organized manner, using appropriate facts to support main ideas; speak clearly at an understandable pace
- CCSS.ELA-Literacy.SL.4.5
  Add audio and visual displays to presentations when appropriate to enhance main ideas

5th Grade

- CCSS.ELA-Literacy.SL.5.4
  Report on a topic, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas; speak clearly at an understandable pace
- CCSS.ELA-Literacy.SL.5.5
  Include multimedia components in presentations to enhance development of main ideas

Middle School

- CCSS.ELA-Literacy.RST.6-8.3
  Follow precisely a multistep procedure when performing technical tasks
- CCSS.ELA-Literacy.RST.6-8.4
  Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context
- CCSS.ELA-Literacy.RST.6-8.7
  Integrate quantitative or technical information with a version expressed visually
- CCSS.ELA-Literacy.SL.6.2
  Interpret information presented in diverse media and formats and explain how it contributes to a topic, text, or issue under study
- CCSS.ELA-Literacy.SL.6.4
  Present findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas; use appropriate eye contact, adequate volume, clear pronunciation
- CCSS.ELA-Literacy.SL.6.5
  Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information
- CCSS.ELA-Literacy.SL.7.2
  Analyze the main ideas and supporting details presented in diverse media and formats
- CCSS.ELA-Literacy.SL.7.4
  Present claims and findings, emphasizing salient points in a focused, coherent manner
- CCSS.ELA-Literacy.SL.7.5
  Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points
- CCSS.ELA-Literacy.SL.8.4
  Present claims and findings, emphasizing salient points in a focused, coherent manner
- CCSS.ELA-Literacy.SL.8.5
  Integrate multimedia into presentations to clarify information, strengthen claims, add interest

Extension:

- *Add problem solving presentations to school server for benefit of all students.*

More Information:

- *Make sure students are good digital citizens as they research and create online projects*
- *If using this for an assessment, see full list by grade level at end of unit.*
- *Lesson questions? Go to Ask a Tech Teacher.*

Sample Problems	
When do I save and when 'save as'	What does 'BCC' mean in an email
What if the monitor doesn't work	How do I exit a screen I'm stuck in
What if the volume doesn't work	How do I use Discussion in the wiki
What if the computer doesn't work	I don't have Word at home. What do I do
What if the mouse doesn't work	My file's 'read only'. What do I do
When do I backspace and when delete	How do I make a macro in Word
What are 5 useful shortkeys	What's the difference between *format* and *edit*
What's 'see the forest for the trees' mean	How do I add a hyperlink in Word
What does 'select-do' mean	Why use Word? Why use Excel? PowerPoint?
I can't find a tool I need	How do I embed a widget
What if I can't find the tool I need	How do I save a blog post
What if the document disappears	How do I edit a Google Earth placemark
My doc is too large to email	What are three ways to communicate something
How do I search for a file	Is it better to communicate with words or images
How do I rename a folder	What is brainstorming? Mind mapping?
What if program freezes	How do I protect my digital footprint
What's a Mulligan? In this class?	What are 3 ways to keep info private on the internet
My internet toolbar disappeared	How do I share/collaborate on Google Apps
When must I use proper grammar on internet	What are 3 digital rights? Responsibilities?

Great Quotes About Problem Solving

Success consists of going from failure to failure without loss of enthusiasm.

—Winston Churchill

In times like these, it is good to remember that there have always been times like these.

— Paul Harvey *Broadcaster*

Never try to solve all the problems at once — make them line up for you one-by-one.

— Richard Sloma

Some problems are so complex that you have to be highly intelligent and well-informed just to be undecided about them.

— Laurence J. Peter

Life is a crisis - so what!

— Malcolm Bradbury

You don't drown by falling in the water; you drown by staying there.

— Edwin Louis Cole

The significant problems we face cannot be solved at the same level of thinking we were at when we created them.

— Albert Einstein

It is not stress that kills us. It is effective adaptation to stress that allows us to live.

— George Vaillant

The most serious mistakes are not being made as a result of wrong answers. The truly dangerous thing is asking the wrong questions.

— Peter Drucker *Men, Ideas & Politics*

Eighty percent of success is showing up.

—Woody Allen

The problem is not that there are problems. The problem is expecting otherwise and thinking that having problems is a problem.

—Theodore Rubin

On the infrequent occasions when I have been called upon ... to play the bongo drums, the introducer never seems to find it necessary to mention that I also do theoretical physics.

—Richard Feynman

Do not keep saying to yourself, if you can possibly avoid it, "But how can it be like that?" because you will get "down the drain," into a blind alley from which nobody has yet escaped. Nobody knows how it can be like that.

—Richard Feynman

The problem is not that there are problems. The problem is expecting otherwise and thinking that having problems is a problem.

— Theodore Rubin

It's not that I'm so smart, it's just that I stay with problems longer.

—Albert Einstein

There is a great difference between worry and concern. A worried person sees a problem, and a concerned person solves a problem.

—Harold Stephens

While average people are thinking negatively about problems, successful people view their problems positively. They love problems. They eat them for breakfast.

Why? Because problems create value; the more problems you can solve, the more valuable you will be, the more money you will make, the more responsibility you will have.

—Brian Klemmer

No problem can stand the assault of sustained thinking.

—Voltaire

Problems are only opportunities with thorns on them.

—Hugh Miller

Assessment
3rd Grade

_____Did student join class discussion?

_____Did anecdotal observations show student working tenaciously on project? Did s/he persevere in solving problem and creating how-to?

_____Did student follow guidelines for the use of online media when creating their project?

_____Did student demonstrate problem solving strategies in the use of his/her chosen presentation tool?

_____Was student able to independently solve his/her own problems when they arose?

_____Was student able to take/make helpful suggestions from/to peers?

_____Did student work well with partner? Did s/he come to work sessions prepared, ready to contribute?

_____Did student presentation explain how to solve the problem--with appropriate multi-media tools to contribute to explanation? Did student show a clear understanding of problem, how to solve it, and how to use selected tool in sharing information with audience?

_____Did student make presentation as simple as possible, using visuals where necessary to enhance information—but not oversimplify?

_____Did chosen technology add to presentation or detract?

_____Was student able to answer classmate questions about presentation?

_____Did both presenter and audience follow agreed-upon rules for discussions?

_____Did student use domain-specific language in class conversation, presentation, and prepared tool?

_____Did student ask appropriate questions of classmates after their presentations?

Assessment

4th Grade

_____Did student join class discussion?

_____Did anecdotal observations show student working tenaciously on project? Did s/he persevere in solving problem and creating how-to?

_____Did student follow guidelines for use of online media when creating project?

_____Did student demonstrate problem solving strategies in use of his/her chosen presentation tool?

_____Was student able to independently solve his/her own tech and hardware problems when they arose?

_____Was student able to take/make helpful suggestions from/to peers?

_____Did student work well with partner? Did s/he come to work sessions prepared, ready to contribute?

_____Did student presentation explain how to solve the problem--with appropriate multi-media tools to contribute to the explanation? Did student show a clear understanding of problem, how to solve it, and how to use selected tool in sharing information with audience?

_____Did student make presentation as simple as possible, using visuals where necessary to enhance information—but not oversimplify?

_____Did chosen technology add to presentation or detract?

_____Was student able to answer classmate questions about presentation?

_____Did both presenter and audience follow agreed-upon rules for discussions?

_____Did student use academic and domain-specific language in class conversation, presentation, and prepared tool?

_____Did student ask appropriate questions of classmates after their presentations?

_____Did student complete all parts of project?

Assessment

5th Grade

_____Did student join class discussion?

_____Did student work well with partner? Did s/he come to work sessions prepared, ready to contribute?

_____Did student demonstrate problem solving strategies in the use of his/her chosen presentation tool?

_____Did presenter and audience follow agreed-upon rules for discussions?

_____Did student follow guidelines for the use of online media in project?

_____Did student use academic and domain-specific language in class conversation, presentation, and prepared tool?

_____Did student independently solve own problems when they arose?

_____Did student presentation explain how to solve problem--with appropriate multi-media tools to contribute to explanation? Did student show a clear understanding of problem and how to solve it?

_____Did student presentation sequence ideas logically with appropriate facts and descriptive detail?

_____Did student use visuals where necessary to enhance information?

_____Did chosen technology add to presentation or detract?

_____Could student answer classmate questions about presentation?

_____Did student complete all parts of project?

_____Did student save/export to his/her digital portfolio and embed project in blog, website or class wiki?

Assessment

Middle School

_____Did student join class discussion?

_____Did student work well with partner? Did s/he come to work sessions prepared, ready to contribute?

_____Did student demonstrate problem solving strategies in the use of his/her chosen presentation tool?

_____Did presenter and audience follow agreed-upon rules for discussions?

_____Did student follow guidelines for the use of online media in project?

_____Did student use domain-specific language in class conversation, presentation, and prepared tool?

_____Did student independently solve own tech and hardware problems when they arose?

_____Did student presentation explain how to solve the problem--with appropriate multi-media tools that contributed to explanation? Did student show a clear understanding of problem and how to solve it?

_____Did student presentation sequencing ideas logically, with appropriate facts and descriptive detail?

_____Were steps precise, using correct technical terms where necessary?

_____Did student use visuals where necessary to enhance information?

_____Did chosen technology add to presentation or detract?

_____Could student answer classmate questions about presentation?

_____Did student complete all parts of project?

_____Did student save/export to his/her digital portfolio and embed project in blog or use screenshot where required?

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