

READING with PICTURES

COMICS
THAT MAKE
KIDS
SMARTER!

G-MAN,
CAN I
READ
THAT
NEXT?



COMICS THAT TEACH CORE CONCEPTS IN SCIENCE,
MATH, SOCIAL STUDIES & LANGUAGE ARTS!

TEACHER GUIDE



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ABOUT THE LESSON PLANS

Educators at all levels are discovering the teaching and learning power of the comics format. There is emerging research that shows that comics and graphic novels:

- motivate kids to read
- support struggling readers
- enrich the skills of accomplished readers
- effectively teach math, science, history, and other subjects

Reading With Pictures and this accompanying teachers' guide are designed to provide instruction in language arts, mathematics, social studies, and science that engages both students and their teachers. The instructional plans in this guide are educationally sound, using techniques and standards that can be found in classrooms across the country, but also fun and will create high levels of student engagement.

Each lesson includes:

- standards: Common Core State Standards, McRel Compendium, National Council of Teachers of Mathematics Standards (NCTM), and Next Generation Science Standards
- objectives
- vocabulary
- materials needed to teach the lesson
- assessment suggestions
- extended learning activities

All lessons provide activities for before, during, and after reading the comics, and many include hands-on activities and reproducible student pages.

All lessons are written for students in three through six. We realize there is a great deal of difference between a third grader and a sixth grader, but we also know that all students in these grades can learn from *Reading With Pictures*. Comics provide a form of built-in differentiation: the images provide scaffolding to help lower-level readers decode text, and the interplay of text and images creates a complex, high-level reading experience for accomplished readers. Teachers can easily differentiate the instruction in the lesson plans by making some activities teacher-guided and some independent, varying the sizes of student groups, having students work together, and re-teaching whenever necessary. In addition, the Extended Learning section of each lesson provides activities to take students deeper into the content of each comic.

If you are new to comics, please take a look at "How to Read a Comic" on the following page to learn more about the conventions of this visual medium. "Why Comics?" (page 14) details current research and rationale for using comics in education. Throughout this guide you will also find some great comics about education and the history of the medium.

This guide has been a labor of love by educators who believe in the power of comics to teach and engage students. We hope that once you teach these lessons, you will become a believer as well!

Tracy Edmunds, M.A. Ed.
Curriculum Development Manager
Reading With Pictures

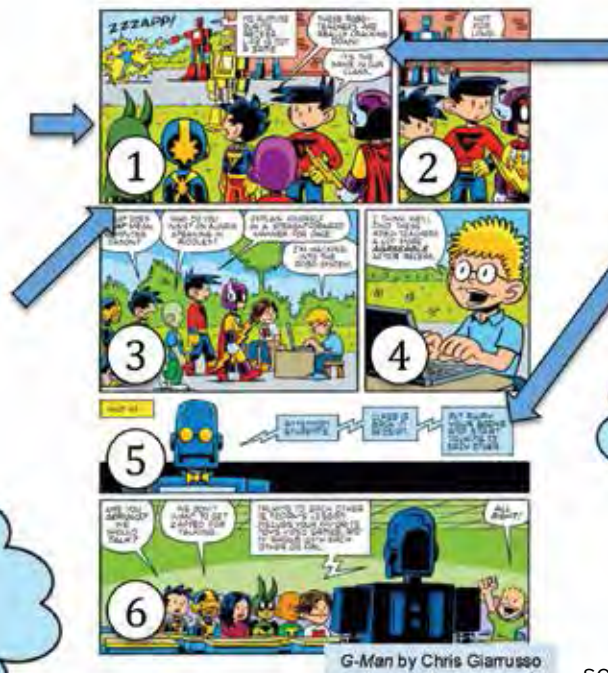
HOW TO READ A COMIC

by Tracy Edmunds, M.A. Ed.

Panels are frames that each contain one segment of the action. Panels can be any shape or size. Read the panels from left to right, top to bottom.

Gutters are the spaces between panels. This is where the reader must imagine the action from panel to panel.

Slow down!
Read both the text
and the pictures.
Think about what is
happening between
the panels.



Word balloons contain character dialogue. The tail of the bubble points to the speaker. Sometimes different colors, shapes, or fonts are used to show the personality of a character.

A cloud-like thought bubble means a character is thinking, not speaking.

Captions usually contain narration but sometimes dialogue or other text information.

Doctor Sputnik: Man of Science by Roger Langridge



Sound effects are usually drawn to visually represent the volume and feeling of the sound.

Splash panels are large images that take up most or all of a page. They are often used to establish location or mood.

Bleed is when an image goes all the way to the edge of a page.

What action takes place between these panels?



COMICS & EDUCATION

Fifteen years ago, I began teaching high school and self-publishing comics at around the same time.



On the first day of class, I made sure to tell my students that I drew comics. I thought it'd make me the "cool teacher."

I'm a cartoonist!

Are you telling us this cuz you think it makes you cool or something?



I was wrong. I learned to keep my two jobs, teaching and cartooning, separate.

A similar separation occurred in the world at large. Back in the 1940s, when comic books first became a mass medium, educators enthusiastically researched ways to teach with them.



Journal of Educational Sociology, Vol. 18, No. 4, published in 1944, was completely devoted to comics!

Then came the *Wertham trials* of the 1950s. Comics got blamed for everything from illiteracy to juvenile delinquency.



Academia spent the next several decades effectively ignoring comics.

But then graphic novels like *Maus*, *Watchmen*, and *Persepolis* began to appear, demonstrating just how powerful a communication medium comics can be.



Now, forward-thinking teachers, librarians, and academics are bringing comics back into the classroom!

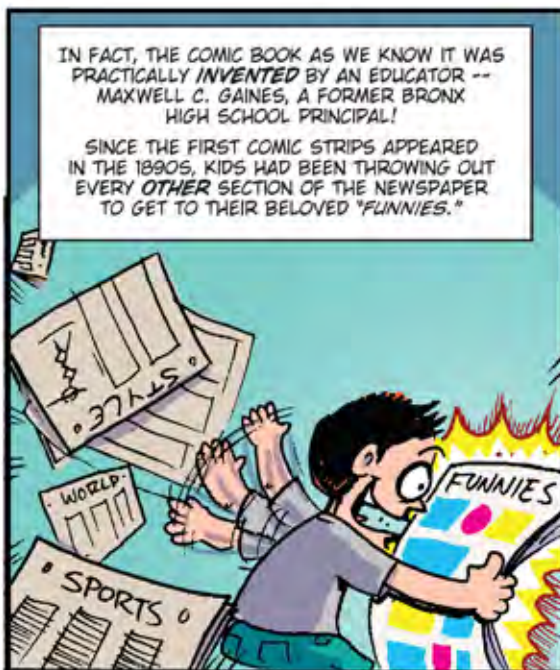
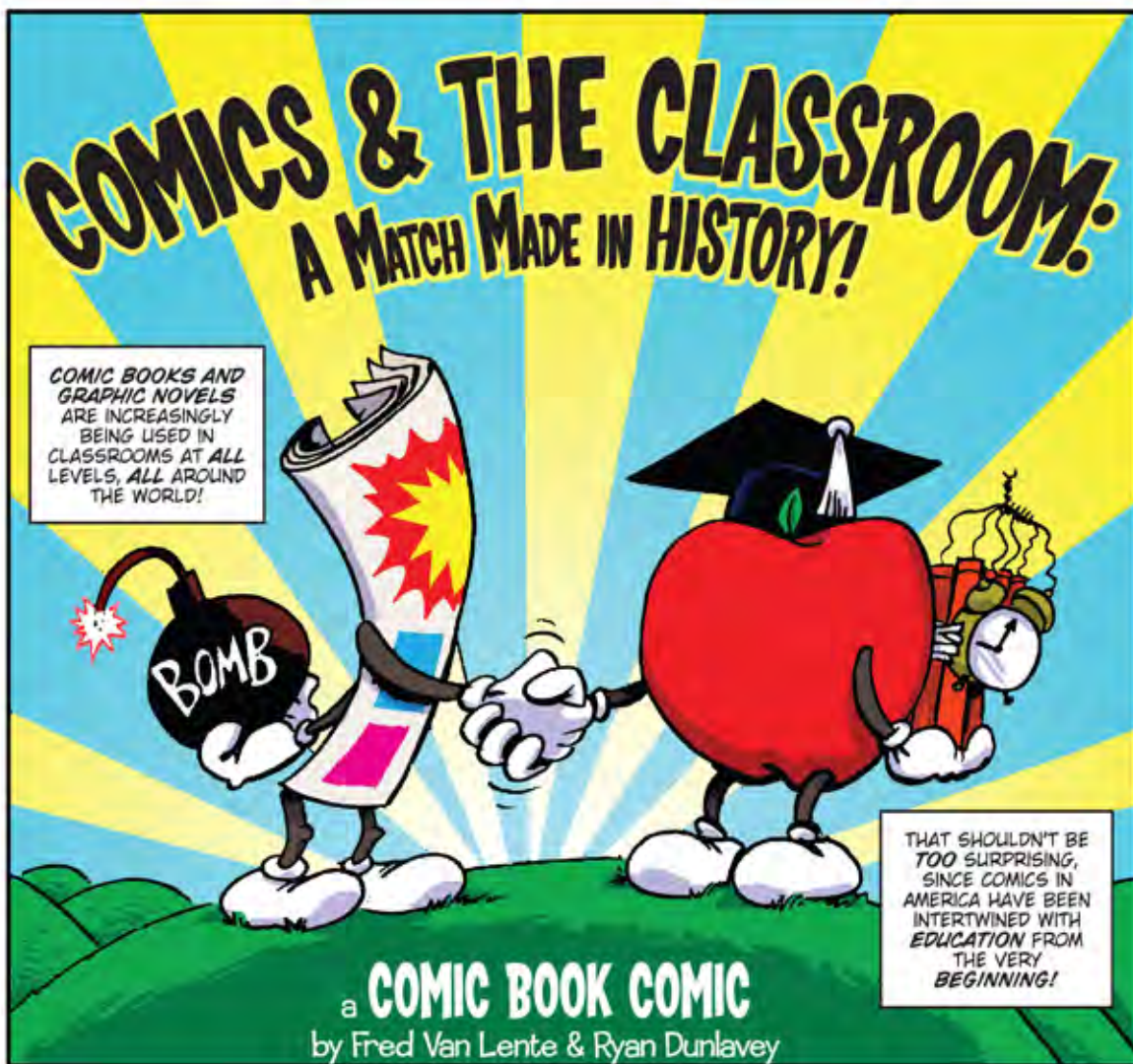
My two jobs are finally coming together! And this book you hold in your hands is a part of that!



Mr. Yang! I heard you're a cartoonist! That's so cool!



Gene Luen Yang, September 2013



...AND WAS STUNNED TO DISCOVER
THEY **SOLD OUT BY MONDAY!**



GAINES REMAINED A **TEACHER** AT HEART, THOUGH.
USING THE MONEY HE MADE IN THE SUPER HERO
FIELD HE FOUNDED A NEW PUBLISHER IN 1946,
EDUCATIONAL COMICS, OR EC.

GAINES SOON BEGAN PRODUCING **ORIGINAL** COMIC BOOK
MATERIAL.. A STRIP HE BOUGHT FROM TWO RECENT HIGH
SCHOOL GRADUATES IN CLEVELAND, "**SUPERMAN**"
BY JERRY SIEGEL AND JERRY SHUSTER, PROVED TO BE
THE MEGA-HIT THAT PUT COMICS ON THE MAP
COMMERCIALLY IN 1938!



"I DON'T CARE
HOW LONG IT TOOK
MOSES TO CROSS
THE DESERT!

"I WANT
IT IN **THREE
PANELS!**"*



* **ACTUAL
QUOTE!**

EC'S FIRST TITLES INCLUDED **PICTURE
STORIES FROM AMERICAN HISTORY** AND
PICTURE STORIES FROM THE BIBLE, ALL
PRODUCED TO MAX'S NOTORIOUSLY (COUGH)
COST-CONSCIOUS STANDARDS...

PICTURE STORIES FROM WORLD HISTORY AND
PICTURE STORIES FROM SCIENCE SOON FOLLOWED,
BUT, ALAS, NONE SOLD VERY WELL.

THEN, TRAGICALLY, MAX AND A FRIEND
WERE KILLED IN A **BOAT COLLISION** ON
NEW YORK'S LAKE PLACID IN 1947.



MAX'S TWENTY-FIVE YEAR OLD SON **BILL** --
ABOUT TO BECOME A **CHEMISTRY TEACHER** HIMSELF --
INHERITED HIS DAD'S BUSINESS.

HE WANTED TO STAY IN **EDUCATION**, BUT HIS MOTHER
BEGGED HIM TO TRY AND KEEP THE COMPANY AFLOAT,
FOR IT WAS ALL THEY HAD LEFT OF HIS FATHER.



BILL GAINES TURNED EC AROUND BY CHANGING ITS NAME TO **ENTERTAINING COMICS** AND CRANKING OUT GORY HORROR TITLES LIKE **TALES FROM THE CRYPT** THAT SOON MADE IT FAMOUS!

UNFORTUNATELY, **TOC** AND THE OTHER EC SMASH-HIT, **MAD MAGAZINE**, DID NOTHING TO DISPEL GAINES' FELLOW TEACHERS' **SUSPICIONS** ABOUT COMICS.



AS EARLY AS 1942 HORRIFIED ARTICLES LIKE "**THE PLAGUE OF THE COMICS**" BEGAN APPEARING IN **ELEMENTARY ENGLISH REVIEW** AND OTHER **TEACHERS' JOURNALS**.

BY 1948, **BOTH** THE NATIONAL CONGRESS OF PARENTS AND THE NATIONAL EDUCATION ASSOCIATION WERE CALLING FOR **FEDERAL REGULATION** OF THE INDUSTRY!

THE HYSTERIA WAS **UNDERSTANDABLE** IN THE SENSE THAT COMIC BOOKS WERE AMONG THE FIRST MASS MEDIA TO BE MARKETED DIRECTLY TO CHILDREN, AS OPPOSED TO **PARENTS** TO BUY FOR THEIR KIDS.

AT A **DIME** A POP, KIDS COULD BUY COMICS WITH THEIR OWN MONEY AND ENJOY THEM WITHOUT A **TRACE** OF ADULT SUPERVISION.



PUBLIC ENEMY NUMBER ONE ON TEACHERS' **FOUR-COLOR HATE LIST** WAS THE COMICS SERIES THAT SWORE UP AND DOWN IT WAS THE **MOST EDUCATIONAL**...

I'D LIKE TO REGALE THE CLASS, MRS. HODGKISS, WITH MY BOOK REPORT ON REMEMBRANCE OF THINGS PAST...

WAIT A...

...DID YOU READ THE **BOOK**, OR THE **CLASSICS ILLUSTRATED** VERSION?!



CLASSICS ILLUSTRATED WAS FOUNDED IN 1941* BY ALBERT LEWIS KANTER, A RUSSIAN IMMIGRANT WHO HAD PREVIOUSLY CREATED A **TOY TELEGRAPH**.

HMMM...MY **THREE MUSKETEERS** IN **MORSE CODE** ISN'T REALLY COMING ACROSS...

I KNOW! I'LL TRY **COMICS**!



ORIGINALLY **CLASSICS COMICS**; THE NAME CHANGED IN 1947, PROBABLY TO AVOID ADULTS' GROWING OUTCRY AGAINST ALL THINGS COMICS-Y.

...THAT THEY WENT THROUGH MULTIPLE **REPRINTINGS** (UNHEARD OF FOR COMICS IN THOSE DAYS) AND ALLOWED KIDS IN **TWO DOZEN COUNTRIES** TO CHEAT ON BOOK REPORTS IN **NINE LANGUAGES!**

ME GUSTA REGALAR A SU CLASE, SRA. HODGKISS, CON MI REPORTE DE LIBRE ACERCA DE EN BUSCA DEL TIEMPO PERDIDO...

ESPERA UN...



"IN A WORLD OF **BAD COMICS**, WE WERE THE **BEST**," SNIFFED **CLASSICS** EDITOR AND WRITER MEYER KAPLIN.

"WE WERE THE **CLEANEST**, WE WERE THE MOST **RESEARCHED**, AND, WITHIN THE LIMITATIONS OF OUR PAGE LENGTH, AS **FAITHFUL** TO THE ORIGINAL AS HUMANLY POSSIBLE."

THOUGH REDUCING 400- AND 500-PAGE PROSE NOVELS TO, ON AVERAGE, **48 PAGES** OF COMIC BOOK MEANT A CERTAIN AMOUNT OF MATERIAL HAD TO BE... **TRUNCATED...**

WHEN THE OUTCRY FROM PARENTS AND TEACHERS FORCED THE INDUSTRY TO REGULATE ITSELF WITH THE 1955 **COMICS CODE AUTHORITY**, **CLASSICS** ILLUSTRATED **REFUSED** TO CARRY THE CCA SEAL, CLAIMING THEY HELD THEMSELVES TO HIGHER LITERARY STANDARDS THAN THE CODE DEMANDED ANYWAY!

YOU WOULDN'T DARE **CENSOR** THE BARD OF AVON, WOULD YOU?

NAW, SO LONG AS YOU DON'T HAVE THE **MURDER**, **INCEST**, **TORTURE** AND **WITCHCRAFT** THE CODE PROHIBITS!



UM... NO, OF COURSE NOT, DON'T BE SILLY... -HEH!-



ALL KIDDING ASIDE, **CLASSICS ILLUSTRATED** CAN BE CREDITED WITH AWAKENING A LOVE OF LITERATURE IN **MILLIONS** OF KIDS.

CIRCULATION PEAKED IN 1960, WHEN THE AVERAGE ADAPTATION ENJOYED A PRINT RUN OF **262,000 COPIES**.

BUT NEW TITLES STOPPED APPEARING IN 1962, DONE IN LARGELY BY COMPETITION FROM **CLIFF'S NOTES**, WHICH DEBUTED IN 1958.

THE ODYSSEY (IN ONE PANEL)

HONEY, I'M HOME!

WELL THAT WAS QUICK...



I'M SO MUCH MORE "LITERARCILY" THAN THOSE STUPID COMICS, RIGHT?

THAT IS HOW YOU SAY THAT, RIGHT...?

NOOOOOOO!!



THE U.S. MILITARY FIRST PIONEERED THE USE OF COMICS AS AN ACTUAL **TEACHING TOOL**, THANKS PRIMARILY TO CARTOONIST **WILL EISNER**, WHO WOUND UP AT THE ORDNANCE DEPARTMENT'S **ABERDEEN PROVING GROUND** IN MARYLAND AFTER HE WAS DRAFTED INTO WORLD WAR TWO.

EISNER'S WEEKLY NEWSPAPER COMIC BOOK **THE SPIRIT** WAS A POPULAR FEATURE IN THE NEARBY **BALTIMORE SUN**; THE BRASS QUICKLY RECOGNIZED WILL AND MADE HIM ART DIRECTOR OF THE SERVICE MAGAZINE **ARMY MOTORS**.



ARMY MOTORS WAS A KEY PART OF ORDNANCE'S ON-GOING EFFORTS TO INURE THE CONCEPT OF **PREVENTIVE MAINTENANCE** INTO THE G.I. -- THE IDEA THAT KEEPING ONE'S WEAPONS AND EQUIPMENT IN **GOOD CONDITION BEFORE** THEY BROKE WAS MOST **EFFICIENT AND SAFEST**.

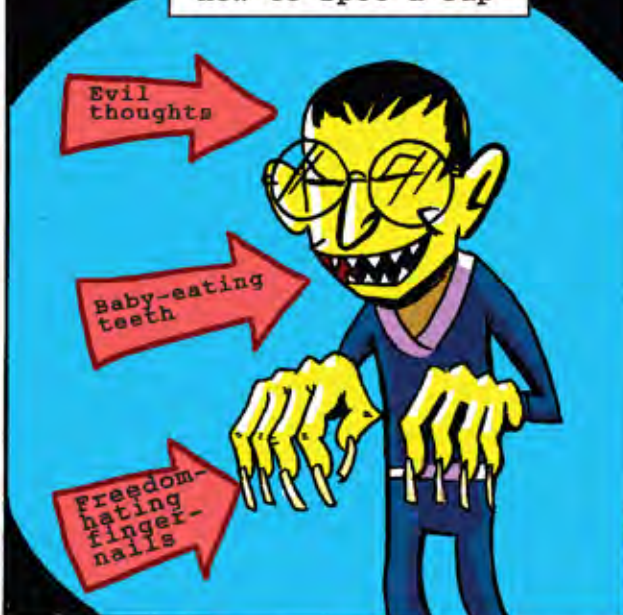


BUT, **PRE-EISNER**, IT WAS, LIKE MOST ARMY PUBLICATIONS, **ANTISEPTIC, JARGON-RIDDEN AND BORING**.

EISNER CONVINCED HIS SUPERIORS TO LET HIM USE **COMICS** TO TEACH **PREVENTIVE MAINTENANCE** WITH **HUMOR AND PLAIN LANGUAGE**, THEREBY IMPROVING SOLDIERS' **COMPREHENSION AND RETENTION**.

UP UNTIL THIS POINT, THE MILITARY HAD DEEMED COMICS FIT ONLY FOR **PROPAGANDA**-- SUCH AS "**HOW TO SPOT A JAP**" WHICH THE ARMY COMMISSIONED FROM **TERRY** AND THE **PIRATES** CARTOONIST **MILTON CANIFF**.

"How to Spot a Jap"



PREDICTABLY, EISNER RAN UP AGAINST THE HIGHER-UPS' RESISTANCE TO **ANYTHING** THAT DEVIATED FROM PREVIOUSLY ESTABLISHED PROCEDURE.

WHAT IS THIS **POPPYCOCK**? ACCIDENT PREVENTION IS **SERIOUS BUSINESS**! YOU CAN'T USE **SILLY DRAWINGS** TO PROMOTE IT!

AND EVEN **WORSE** -- IN YOUR STRIPS YOU **MOCK** SUPERIOR OFFICERS BY INSINUATING **WE DON'T KNOW WHAT WE'RE TALKING ABOUT!!!**



AS IF VOLUNTEERING TO PROVE WILL'S POINT, THE ADJUTANT GENERAL IN CHARGE OF PRODUCING *TECHNICAL MATERIALS* ARRANGED FOR THE UNIVERSITY OF CHICAGO TO RUN AN *EFFICIENCY TEST* PITTING STANDARD MANUALS AGAINST EISNER'S *COMICS*...AND THE *COMICS* WON *HANDILY!*



AS HIS BIOGRAPHER BOB ANDELMAN WRITES,
"THE RESULTS *REINFORCED* WHAT EISNER BELIEVED TO BE *CHARACTERISTIC* OF THE COMIC STRIP:
"THE *EASE* WITH WHICH *IMAGES* DEMONSTRATED *PROCESS*."
THE SAME SEQUENTIAL PROCESS THAT COULD EXPERTLY RENDER THE BACK-AND-FORTH OF A *VAUDEVILLE COMEDY ROUTINE* IN THE *NEWSPAPER FUNNIES* ALLOWED EISNER TO DEMONSTRATE A TECHNICALLY COMPLEX TASK -- SUCH AS REMOVING *VOLUTE SPRINGS* FROM A *TANK* -- FROM THE POINT OF VIEW OF THE *REPAIRMAN*.
COMIC ART DRAWS THE READER *INTO* THE SEQUENCE, MAKES HER A *PART* OF IT, STEP BY STEP!
ARMY MOTORS AND ITS SUCCESSOR, *P'S: THE PREVENTIVE MAINTENANCE MONTHLY*, PROVED *SO* SUCCESSFUL AT EDUCATING SOLDIERS AND OFFICERS THAT EISNER REMAINED ITS ART DIRECTOR LONG AFTER HE MUSTERED OUT!



SO HE COULD KEEP UP-TO-DATE ON THE LATEST EQUIPMENT AND TECHNIQUES, THE MILITARY SENT EISNER ON TOURS OF ARMY POSTINGS AROUND THE WORLD -- INCLUDING HOTSPOTS LIKE THE KOREAN DMZ AND SAIGON, WHERE HE GOT **GLOWING REVIEWS** FROM THE SOLDIERS THEMSELVES!



WHEN EISNER FINALLY GAVE UP HIS LUCRATIVE ARMY CONTRACT IN 1971, HIS WIFE ANN ENCOURAGED HIM TO TAKE THE NEXT BIG LEAP AND CREATE A COMIC AIMED AT **ADULTS**, WITH ADULT THEMES.

HIS INSPIRATION CAME IN THE FORM OF DARKEST **TRAGEDY**.

IN 1969, EISNER'S BELOVED TEENAGE DAUGHTER ALICE HAD SUCCEEDED TO **LEUKEMIA**.

THE ARTIST POURED HIS GRIEF AND RAGE INTO A SHORT COMICS STORY, "A CONTRACT WITH GOD," ABOUT A DEPRESSION-ERA HASSIDIC JEW WHO REJECTS HIS FAITH WHEN HIS DAUGHTER DIES UNEXPECTEDLY.



EISNER COMBINED THAT TALE WITH THREE OTHERS ABOUT 1930'S JEWS IN HIS NATIVE BRONX, CALLING THE COLLECTION **A CONTRACT WITH GOD AND OTHER TENEMENT STORIES**.

HE FELT WEIGHTY MATERIAL SUCH AS THIS DEMANDED TO BE PUBLISHED AND DISTRIBUTED BY A MAINSTREAM (I.E., **NON-COMICS**) PUBLISHER, BUT STRUGGLED OVER A WAY TO **MARKET** THE UNIQUE PROJECT.



THOUGH EISNER DIDN'T ORIGINATE THE TERM "**GRAPHIC NOVEL**," ITS APPEARANCE ON THE TRADE PAPERBACK COVER OF **A CONTRACT WITH GOD** (1978) BROUGHT IT INTO **POPULAR USAGE** FOR THE FIRST TIME.

THROUGH RACKED IN **BOOKSTORES** AS ITS AUTHOR INTENDED, BAFFLED CLERKS DIDN'T KNOW WHETHER TO SHELVE **CONTRACT** IN THE "RELIGION" OR "HUMOR" SECTIONS... AS OPPOSED TO "**FICTION**," WHERE IT RIGHTLY BELONGED!



SINCE EISNER'S BOLD EXPERIMENT, IT'S THE MORE SOPHISTICATED LITERARY ASPIRATIONS OF "GRAPHIC NOVELS" (REALLY JUST A SYNONYM FOR "LONG COMIC BOOK") THAT HAVE LED THEM TO BE USED IN THE CLASSROOM AT EVERY LEVEL!



WHY COMICS?

Comics Go Mainstream

Comics are all grown up. Legitimate, even! They are the subject of research studies at major universities. They win prestigious literary awards: the Pulitzer (*Maus*), the Printz (*American Born Chinese*) and the Geisel (*Benny and Penny in the Big No-No!*), with a few National Book Award finalists for good measure (*Stitches*, and *American Born Chinese* . . . again). They form the centerpiece of an entire pavilion at the American Library Association's annual conference. They even rate their very own *New York Times* Best Seller List. Most importantly, the Common Core Standards now explicitly recommend their use in the classroom.

Comics are coming to your classroom and library, and this guide will help you make the most of them!

Comic Books, Graphic Novels and Illustrated Texts. . . Oh, my!

Let's begin by defining our terms. Comic books, graphic novels, and illustrated texts all belong to the larger medium of "sequential art" or just plain "comics." The term sequential art originated with pioneering cartoonist and father of the graphic novel, Will Eisner, and has been described as a series of images arranged in a sequence to convey information, wherein the reader controls the flow/pace of that information. This expansive definition encompasses an enormous variety of storytelling techniques, going all the way back to hieroglyphics and cave drawings.

Now, you're probably not going to be teaching with hieroglyphics or cave drawings, but you may well be teaching with these:

Comic Strips—Short form sequential art, often humorous and typically found in newspapers or online webcomics.

Comic Books—Sequential art in pamphlet or magazine format.

Graphic Novels—Long-form sequential art, akin to a novel in length and narrative complexity. The term is applied to works of both fiction and nonfiction.

Illustrated Texts—A hybrid of sequential art and prose. Differs from a picture book in that the images and text are wholly interdependent rather than merely complementary.



Kids Like Them! They Really, REALLY Like Them!

When given a choice, kids—especially boys and reluctant readers—are increasingly gravitating toward the comic format over traditional text. Illustrated texts such as *Diary of a Wimpy Kid* and *Big Nate* and graphic novels such as *Geronimo Stilton* and *Drama* are blowing up the bestseller lists in both print and digital formats

This is true in libraries as well as bookstores. Librarians have found that once a graphic novel collection reaches a certain critical mass, it often becomes the highest circulating collection in the entire library, with the average graphic novel out-circulating all but the most popular YA prose titles. “As a librarian, you cannot get more bang for your buck than graphic novels,” opines Christian Zabriskie, NYC librarian and founder of Urban Librarians Unite. “They circulate like mad, reach across generations, and drive circulation wherever they go.”

And reading comic books can lead to more reading overall. According to a study by reading expert Stephen Krashen, kids who read more comic books, “did more pleasure reading, liked to read more, and tended to read more books. These results show that comic book reading certainly does not inhibit other kinds of reading, and is consistent with the hypothesis that comic book reading facilitates heavier reading.”

Science Says: “Comics Are Great!”

Kids may love comics, but is that necessarily a good thing? The answer, according to a relatively new but rapidly growing body of clinical research, is: “You better believe it, pal!”

A 2011 engagement/efficacy study by professors Jay Hosler (Biology, Juniata College) and K.B. Boomer (Mathematics, Bucknell University) found a statistically significant improvement in students’ content knowledge regarding evolution and their attitudes toward biology in general after the science graphic novel *Optical Allusions* was introduced into their classroom.

In 2012, Jeremy Short and Aaron McKenny of the University of Oklahoma found that the comic format improves content retention rates compared to traditional textbook materials. The researchers gave two groups of students two books—one a graphic novel and the other a traditional textbook—on the same subject. The students using the graphic novel showed a significant improvement in content retention over the students using the traditional textbook. According to Professor Short: “Not only do we find that graphic novels are on par with traditional textbooks in regard to key learning outcomes—they are actually superior in some cases!”

And while comics are often mistakenly seen as low-level reading material, they actually have a higher average-vocabulary level than other types of books. According to the University of Oregon Center on Teaching and Learning, “Comic books average 53.5 rare words per thousand, while children’s books average 30.9, adult books average 52.7, expert witness testimony averages 28.4, and the conversations of college graduates with friends average 17.3.”



Reaching Reluctant Readers, or Hooked on Comics Worked for Me!

While comics can improve educational outcomes for all students, the format has proven especially effective in meeting the needs of struggling readers, special-needs students and English-language learners. Because these students rely largely on visual literacies to build their schema for print-text reading and writing, comics are the ideal tool for making the students better and more enthusiastic readers. The format plays to their strengths, thereby helping level the classroom playing field in a meaningful way.

Comics have also been proven effective in teaching English Language Learners. In a study using comic strips to teach text comprehension, Jun Liu at the University of Arizona found that, “. . . the low-level students receiving the high-level text with the comic strip scored significantly higher than their counterparts receiving the high-level text only.” And a study by Jason Ranker at Portland State University found that, “students, primarily English-language learners, were able to make use of [comics] in order to learn new reading practices.”

Challenging High-Achieving Readers with Graphic Novels

Comics are a powerful tool to enrich the high-level literacy skills of strong readers as well. As readers explore the interplay of visual and text information, they exercise high-level thinking skills such as inference and synthesis. According to AP teacher Lisa Cohen, “Incorporating visual rhetoric into your curriculum will also require students to practice higher-learning critical thinking and analytical skills emphasized in an AP curriculum.” And Nick Sousanis of Columbia University Teachers College states, “More than a gateway to literacy, the spatial interplay of visual and verbal that defines comics makes for a powerful tool for inquiry. . . .”

Comics Can Save Your Life

Stepping outside the classroom, we find that educational comics are all around us. From furniture assembly instructions to airplane safety manuals, they play a largely invisible but utterly essential role in our everyday lives, especially in cases of (literal) life and death. Case in point: The aforementioned Will Eisner spent a substantial portion of his career working for the U.S. Army developing comic-format maintenance and safety manuals. Military efficiency studies found that Eisner’s comics outperformed traditional manuals while countless GIs personally credited Eisner and his comics for helping them make it back home alive and in one piece from warzones around the world.

And while the stakes weren’t quite as high, it’s still highly telling that when Google wanted to tell the world how (and why) to use its new Chrome web browser, the company turned to cartoonist and visual learning expert Scott McCloud.



Making Comics Work in Your Classroom – Comics and the Common Core

The Common Core Standards are purposefully designed to be format/medium agnostic. All classroom materials, including comics, are referred to simply as “texts,” an explicit admission that all formats, when used properly, have their place in the twenty-first-century classroom. And graphic novels are mentioned specifically in the Standards as a text type for instruction.

“In my early years of teaching middle school, comic books were on the back reading shelf for the kids who had finished their ‘real reading,’” reminisces pedagogical expert and author Lynette Brent. “Though with a wide variety of topics from classic literature to standards-based content, today’s graphic novels aren’t ‘extra reading,’ but are instead a powerful core to best-practices teaching.”

Writing With Pictures

Literacy scholars are already calling our era “the greatest communication revolution of all-time,” surpassing even the fifteenth-century invention of the printing press. Modern technology enables images to be integrated with text in unprecedented ways, including everything from emoticons to PowerPoint. Thus, modern writers must be fluent in both words and images in order to effectively communicate. Working with the comic format enables students to develop visual and textual literacies at the same time.

Content Area Education with Comics

Comics have been shown to improve reader engagement while enhancing both comprehension and retention. This holds true no matter the content area: math, science, social studies, or language arts. That’s why Reading With Pictures has chosen to focus the Graphic Textbook not only on literacy instruction but also on content-area instruction.

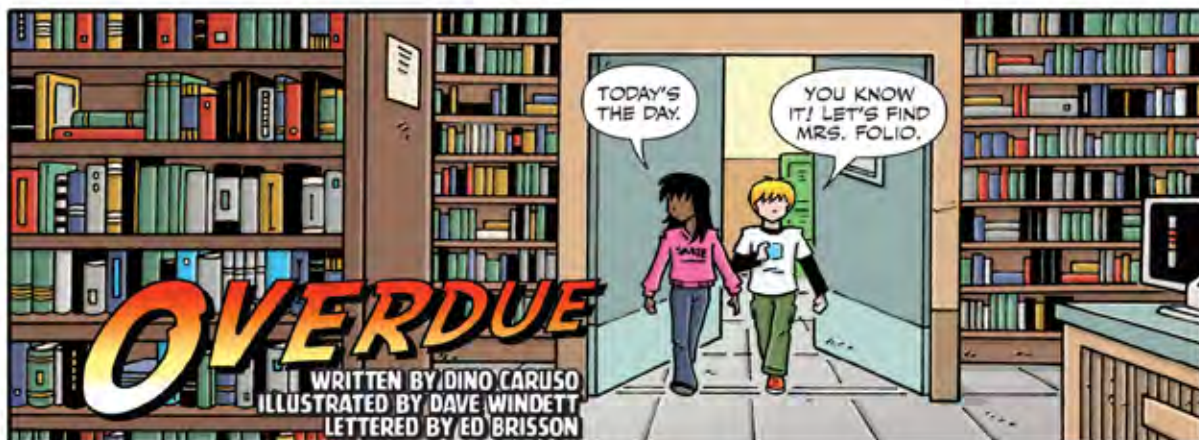


Why Comics?

The bottom line: Comics are effective teaching tools because they require readers to not only passively receive information but also interact with the text and images to construct meaning, and that is the key to the magic. Words and pictures work together!

Comics have incredible potential as a learning multiplier for students everywhere. But that potential will only be realized with the help of parents, teachers, and librarians who understand the value of the comic format and know how to use it to its fullest potential. We hope that this book will provide a running start toward that goal.

Text prepared by Dr. Katie Monnin, associate professor of literacy at the University of North Florida, Tracy Edmunds, M.A. Ed., Curriculum Consultant, and Josh Elder, president and founder of Reading With Pictures.







READING WITH PICTURES **LANGUAGE ARTS**



G-Man: Reign of the Robo-Teachers

Comic by Chris Giarrusso – Lesson Plan by Tracy Edmunds

The Power of Print

Comic by Katie Cook – Lesson Plan by Dr. Katie Monnin

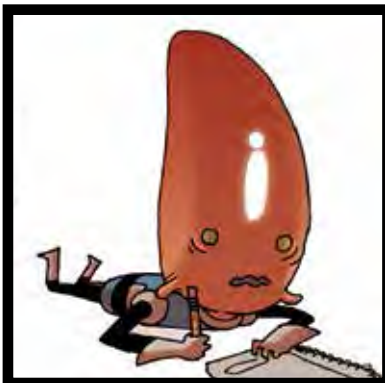
Albert the Alien in “It’s a Figure of Speech”

Comic by Trevor Mueller & Gabriel Bautista

Lesson Plan by Dr. Katie Monnin

Special Delivery to Shangri-La

Comic by Mike & Janet Lee – Lesson Plan by Dr. Katie Monnin



Lesson Plan for
G-Man: Reign of the Robo-Teachers by Chris Giarrusso
By Tracy Edmunds, M.A. Ed., Curriculum Consultant

Overview: Students will read the story “G-Man: Reign of the Robo-Teachers” as a group and analyze several characters’ points of view. Students will then retell the story, taking on the point of view of a chosen character.

Subject: Language Arts—Point of View

Grade Level: Grades 3–6

Content Standards: Reading, Speaking, and Listening

Common Core State Standards: www.corestandards.org

- Assess how point of view or purpose shapes the content and style of a text.
[CCSS.ELA-LITERACY.CCRA.R.6]
- **Grade 3:** Describe characters in a story (e.g., their traits, motivations, or feelings) and explain how their actions contribute to the sequence of events [CCSS.ELA-LITERACY.RL.3.3]
- **Grade 4:** Describe in depth a character, setting, or event in a story or drama, drawing on specific details in the text (e.g., a character’s thoughts, words, or actions).
[CCSS.ELA-LITERACY.RL.4.3]
- **Grade 5:** Describe how a narrator’s or speaker’s point of view influences how events are described. [CCSS.ELA-LITERACY.RL.5.6]

Objectives

- Students will assess how point of view shapes the content and style of the text.
- Students will create their own interpretation of the story from the point of view of a chosen character.

Vocabulary

- **prediction:** a statement about what will happen or might happen in the future
- **point of view:** the narrator’s position in relation to the story being told
- **word balloon:** a balloon-like icon with a tail that points to the mouth of the character that is speaking. In the balloon are the words that the character is speaking so that the reader can differentiate who is saying what. (Also called word bubble or speech bubble)

Materials

- “G-Man: Reign of the Robo-Teachers” comic by Chris Giarrusso
- student worksheets:
 - Point of View
 - Point of View Example
- pencils

Time Frame: one to three class periods

Procedure

Before Reading

1. Either project the comic "G-Man: Reign of the Robo-Teachers" so the entire class can see it (using a document camera or computer connected to a projector) or distribute copies to students. Allow a few minutes for students to look through the comic without reading the text.
2. Ask students to predict what they think the comic will be about. Remind them that in comics, information comes from pictures as well as words (and they way they work together).
3. Ask students to point out who they think the main characters are in the comic, then describe them and make predictions about the characters' feelings and actions based on visual cues. Have students generate a few questions about the characters and record them for the class to answer later.

During Reading

4. Read through the story together and discuss using the information and questions below.

Page 1:

- Look at the different styles of word balloon used for the humans and for the robo-teacher. Why do you think the artist made them different shapes? Why do you think he used different fonts (styles of text)? How do these choices influence the way you think the voices sound?
- In the third panel, there is a dark scribble in Mr. Gavin's thought bubble. What do you think it means? Would he be making a sound?

Page 2:

- Close your eyes while I read the text on this page out loud. Now, look at the pictures without reading the words. What do the pictures tell you that the text does not? What does the text tell you that the pictures do not?
- Do you think this could happen in real life? Why or why not? Cite specific evidence from the text to support your opinion.

Page 3:

- What do you think Computer Jason is up to? Can you predict what will happen?

Page 4:

- If your teacher told you to talk about anything you like, what would you talk about? How do you think the kids feel about getting to discuss whatever they want?
- Why is the robo-teacher acting differently? Look at the last panel. What does the picture tell you about what happened and how the kids feel about it?

Page 5:

- Have you ever told your family something, but they didn't believe you? What problems did this cause for you? For your parents? How did you try to convince them?

Page 6:

- What do you think bio-scanning is? What information do the words give you about bio-scanning? What information do the pictures give you? Do you think bio-scanning is real or did the writer make it up?
- What happened to Jason's computer? How do you know? Is it the words or the pictures that tell you what happened? Why is this important to the story?

Page 7:

- Close your eyes while I read the text on this page out loud. Now, look at the pictures without reading the words. What do the pictures tell you that the text does not? What does the text tell you that the pictures do not?
- What superpowers does G-Man appear to have? What would you have done in this situation if you were G-Man?



Page 8:

- Do you think Mr. Gavin treats G-Man fairly? Why or why not?
 - Why does G-Man's word balloon in the last panel look different from the others?
7. Create a two-column chart on the board and have students list the pros and cons of having a robo-teacher.

After Reading

8. Revisit the questions that students posed before reading, then answer them as a class.
9. Ask students to identify the point of view from which the story is told. (Third person) Have students turn and talk to a partner about the story's point of view. Ask students to cite specific evidence from the text to support their reasoning. Make a list on the board of evidence from the text that shows that the story is told in the third person.
10. Tell students that they will now think about the story from the point of view of different characters in the story. As a model, show students the Point of View Example about Mr. Gavin and review it with the class, then have students find the stated evidence from the model in the comic.
11. Divide students into pairs or small groups and assign or have groups choose a character from the story. (Suggested characters: G-Man, a robo-teacher, G-Man's mother, Computer Jason, any of the students in the story.) Distribute copies of Point of View worksheet to students and have them complete the chart in pairs or small groups. Be sure students can view the comic for reference.
12. Tell students they will each create a new version of the story from the point of view of their chosen character. They should include all of the events from the story that their chosen character would have been involved in or witnessed. Let students know that they can also use their imaginations for this assignment by making up new events related to the story. For example, if they chose Mr. Gavin as their main character, they should include the scenes from the story that he is present for, but they can also write about where he went and what he did while the robo-teachers were running the school. You could have students write their stories in prose, create comics, or make audio recordings or videos.
13. Have students share their completed stories with the class. Challenge the class to identify from whose point of view each reimagined story is told.

Assessment

Assess students' completed Point of View charts and retellings of the story to determine their level of understanding of point of view.

Extended Learning

- Have students write a script for a radio play of the story featuring their chosen character as the main character and told from his or her point of view. Have students record their radio plays, adding sound effects to enhance their stories. You can have students use online tools such as VoiceThread or podcasts, or use a digital voice recorder.
[\[CCSS.ELA-LITERACY.CCRA.SL.5\]](#)
- Have students create comics to tell familiar stories, or stories read in class, from alternate points of view. Remind students to use both pictures and words together to tell their stories.

Point of View Example

Character: Mr. Gavin

What happens to this character?	How does the character feel about what happens?	Cite evidence from the text to support your ideas.
<i>He is dismissed by the robo-teacher and leaves.</i>	<i>He is not happy about being replaced by a robo-teacher.</i>	<i>He says he will miss the students. There is a black cloud over his head as he leaves and his body language shows that he is unhappy.</i>
<i>He returns to the classroom after the robo-teachers are gone.</i>	<i>He is happy to be back.</i>	<i>He says, "I'm so happy to see you all again!" and he is smiling.</i>
<i>He rewards Computer Jason.</i>	<i>He is proud of Computer Jason because he thinks he got rid of the robo-teachers.</i>	<i>He gives Jason a gold star sticker and says he's proud to teach such a bright student.</i>
<i>He suspends G-Man from school for being a dangerous threat.</i>	<i>He thinks G-Man is dangerous and is afraid of him.</i>	<i>He says, "Get out of here before you hospitalize us!" and sends G-Man away.</i>

Point of View

Name _____ Date _____

Directions: Choose a character from the story. As you read the story, make a list of things that happen to your chosen character. Then, write about how your character feels about what happens and list evidence from the text (both words and pictures) that show how the character feels.

Character _____

What happens to this character?	How does the character feel about what happens?	Cite evidence from the text to support your ideas.

Lesson Plan for **The Power of Print by Katie Cook**

By Dr. Katie Monnin, Associate Professor of Literacy, University of North Florida

Overview: “The Power of Print” introduces students to the history of human communications. As they read the literary comic, students will identify and trace the key ideas and details as they develop over the course of the text.

Subject: Language Arts—Key Ideas and Details

Grade Level: Grades 3–6

Content Standards: Reading and History

Common Core State Standards: www.corestandards.org

- **Grades 3–6:** Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text. [[CCSS.ELA-Literacy.CCRA.R.1](#)]
- **Grades 3–6:** Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas. [[CCSS.ELA-Literacy.CCRA.R.2](#)]
- **Grades 3–6:** Analyze how and why individuals, events, and ideas develop and interact over the course of a text. [[CCSS.ELA-Literacy.CCRA.R.3](#)]
- **Grade 3:** Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. [[CCSS.ELA-Literacy.RI.3.3](#)]

McREL Compendium: www2.mcrel.org/compendium

- **Grades 3–4:** Understands the significance of the printing press, the computer, and electronic developments in communication and their impact on the spread of ideas. [[Grades K–4 History, Standard 8, Benchmark 12](#)]

Objectives

- Students will be able to identify key ideas and details in the literary comic and document how those ideas and details evolve over the course of the story.

Vocabulary

- **the telephone game:** a game played by passing oral information from one person the next person
- **the written word:** the use of letters and words to convey information and communicate with others
- **cave drawings:** early communication, mostly through the use of symbols, drawn on cave walls 40,000 years ago
- **hieroglyphics:** communication symbols used by the Egyptians around 3300 BCE



- **woodblock:** a communication practice first used in India and China on fabric and later used on paper
- **Johannes Gutenberg:** 15th-century inventor of the printing press
- **telegraph:** 19th-century invention that used a code system to speedily communicate information from one location to another
- **propaganda:** information—sometimes bias—conveyed through various print-text inventions in order to inform or influence readers
- **American Library Association:** the oldest and largest library association in the world, formed in 1876 to enhance learning and ensure access to information for all
- **Internet:** a modern, 21st century literacy and technology advancement that allows today's readers and writers to communicate and find information instantaneously

Materials

- “The Power of Print” comic by Katie Cook
- student worksheet: “The Power of Print” Timeline
- large timeline for students to write on (on whiteboard, overhead, or document camera) and markers
- pencils

Time Frame: one to three class periods

Procedure

Before Reading

1. Either project the comic “The Power of Print” so the entire class can see it (using a document camera or computer connected to a projector) or distribute copies. Have students look through the comic without reading the text. What do they think the comic will be about? What makes them think so? Remind them that in comics, information comes from pictures as well as words (and the way they work together). Have students make predictions based on visual cues.
2. To help students build schema for comprehension, ask the following questions and record student answers on the board:
 - What does it mean to read?
 - What kind of books do you read or like?
 - How do you think authors and publishers are able to get their books into libraries and schools?

During Reading

3. Give students a few minutes to read “The Power of Print” comic to themselves.
4. Distribute copies of “The Power of Print” Timeline to students. As you read through the comic together, have students record the words from the word bank on their timelines.



After Reading

5. After reading "The Power of Print" and completing the worksheet, display a large timeline on a whiteboard, overhead, or document camera. Encourage students to come up and add key characters, ideas, or events they recorded on their own timelines. Further, ask students to write brief details about the significance of each item on the timeline, explaining why that particular event, term, person, or moment on the timeline is so significant or influential.

Assessment

In order to ensure student comprehension, ask students to share "The Power of Print" and their finished timeline worksheet with a younger reader, creating a mentor/mentee reading friendship. With an extra, blank timeline for the younger readers to work from, the mentor readers can then assist younger readers not only as they read the story, but also as they create their own timeline. Collect and pair all student work and post it around the room. Finally, ask the mentors and mentees to share their timelines and decision-making processes.

Extended Learning

- For homework, ask students to find some traditional books and some new literacy texts that call on them to read and write with both images and words. Let students know that they will be sharing their findings during the next class meeting. As a class, build/extend the class timeline from the story to include the various new and traditional literacies students find at home.
- Place students in small groups and have each group research a print or communication format or technology, such as cave paintings, hieroglyphics, the telegraph, the printing press, or the Internet. Have each group present their findings, including an example of the technology they researched. For example, students who research the telegraph should create a message in Morse code, and students who research the printing press can create printed messages using rubber alphabet stamps. Students who research the Internet can present their findings as a blog or podcast.



"The Power of Print" Timeline

Name _____ Date _____

Directions: As you read "The Power of Print," use the word bank to identify the key ideas and details as they occur historically in the story. Start on the left end of the timeline and move to the right. When you find a word, term, or historical person from the word bank in the story, make a dot on the timeline and write the word bank item. When possible, try to list the date and a brief explanation for each significant find. You can write some items above the timeline arrow and some items below.

the telephone game	Johannes Gutenberg	woodblock
the written word	telegraph	Internet
cave drawings	propaganda	
hieroglyphics	American Library Association	



Lesson Plan for
**Albert the Alien in “It’s a Figure of Speech”
by Trevor Mueller and Gabriel Bautista**

By Dr. Katie Monnin, Associate Professor of Literacy, University of North Florida

Overview: As they read “Albert the Alien in ‘It’s a Figure of Speech’” students will be introduced to the literary term *figure of speech*. One of the most challenging concepts in Language Arts is figurative speech. That’s why this comic is so brilliant! Using words and images, the authors have doubly-emphasized what it means to be literal or to be figurative in one’s speech. At the end of the lesson, students will be able to identify, explain, and discuss the use and purpose of figures of speech.

Subject: Language Arts—Figures of Speech

Grade Level: Grades 3–6

Content Standards: Reading

Common Core State Standards: www.corestandards.org

- **Grade 3:** Determine the meaning of words and phrases as they are used in a text, distinguishing literal from nonliteral language [CCSS.ELA-Literacy.RL.3.4]
- **Grade 5:** Determine the meaning of words and phrases as they are used in a text, including figurative language such as metaphors and similes. [CCSS.ELA-Literacy.RL.5.4]
- **Grade 6:** Determine the meaning of words and phrases as they are used in a text, including figurative and connotative meanings; analyze the impact of a specific word choice on meaning and tone [CCSS.ELA-Literacy.RL.6.4]

Objectives

- Students will understand and interpret various figures of speech as they are used in a literary text.

Vocabulary

- **rack your brain:** think very deeply about a specific topic
- **brainstorming:** coming up with ideas
- **drive the kids bananas:** cause the kids to go crazy
- **butterfingers:** a person who tends to drop things
- **falling in love:** feeling deeply connected with another person
- **my life is an open book:** being transparent about one’s life and doings
- **my dogs are barking:** my feet hurt; tired or worn out
- **we’re in a real pickle:** involved in a dilemma or unsure situation
- **butterflies in my stomach:** feeling nervous or unsure
- **raining cats and dogs:** a severe or intense storm

Materials

- “Albert the Alien in ‘It’s a Figure of Speech’” comic by Trevor Mueller and Gabriel Bautista
- student worksheet: Figures of Speech
- index cards, 10 per student group
- pencils

Time Frame: one to three class periods

Procedure

Before Reading

1. Either project the comic “Albert the Alien in ‘It’s a Figure of Speech’” so the entire class can see it (using a document camera or computer connected to a projector) or distribute copies. Allow a few minutes for students to look through the comic without reading the text.
2. Ask students to predict what they think the comic will be about and who the characters are. Remind them that in comics, information comes from pictures as well as words (and they way they work together). Have students make predictions based on visual cues.
3. Build schema by introducing students to the main characters: Albert, Mr. Gavin, Mr. Paret, Gerty Greyson, Draven Darkmoon, Miranda Tam, Wally, Mr. Jack Greyson, Becky Conzett. Point out the characters in the comic and ask students to describe them.
4. Have students generate a few questions about the comic and record them for the class to answer later.

During Reading

5. Read through the comic together as a class. Each time Albert misunderstands a figure of speech, discuss with students his literal interpretation and the common meaning of the phrase.

Page 2: rack your brain

Page 3: brainstorm

Page 4: butterfingers; drive the kids bananas

Page 5: falling in love; my life is like an open book

Page 6: my dogs are barking; we’re in a real pickle; butterflies in my stomach

Page 7: raining cats and dogs

Page 8: All the world’s a stage and all the men and women merely players

After Reading

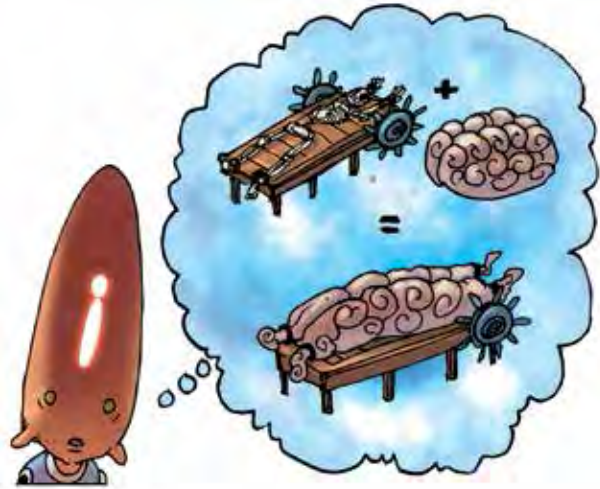
6. Revisit the questions that students posed before reading and answer them as a class.
7. Distribute copies of the Figures of Speech worksheet to students. Have students complete the worksheet individually or in small groups. Let students know that they can use both writing and drawing to record their ideas on the chart.
8. After students have completed the chart, discuss with the class each figure of speech as understood by Albert the Alien and as understood by his classmates and friends. Allow students to add to or change their answers on the worksheet as the class shares ideas.

9. Write the following three terms on the board: figure of speech, metaphor, simile. To build comprehension, ask students to work with you to brainstorm definitions for each term. Ask students to pinpoint where in the comic they see examples of each term.

Assessment

Place students in small groups and create a set of ten index cards for each group. On one side of each index card, write one of the ten figures of speech found in the story (and listed below). Leave the other side of the index cards blank. In their groups, have students review each of the seven index cards/figures of speech and develop their own images to help define the terms. Have students draw their images on the backs of the cards. Encourage students to be creative and to stray away from the style of cartooning shown in the comic story. This assessment relies on how well students can generate authentic and synonymous interpretations of the various figures of speech.

- rack your brain
- brainstorm
- butterfingers
- drive the kids bananas
- falling in love
- my life is like an open book
- my dogs are barking
- we're in a real pickle
- butterflies in my stomach
- raining cats and dogs



Extended Learning

- Encourage students to speak with their family, friends, and community neighbors about their new knowledge on figures of speech, offering definitions and some examples. After they finish introducing the topic to loved ones, students should invite their listeners to share any of their own familiar figures of speech. Have students take brief notes on what is shared by others and bring these notes and newly learned figures of speech to the next class meeting. Allow students to share the new figures of speech they found so the entire class can grow and build on their expanding knowledge of figures of speech.
- Have students work in small groups to create posters illustrating their favorite figures of speech. They should include an illustration of the figurative meaning as well as the literal meaning. For older students, have them indicate on the poster whether their chosen figure of speech is an idiom, metaphor, or simile.

Figures of Speech

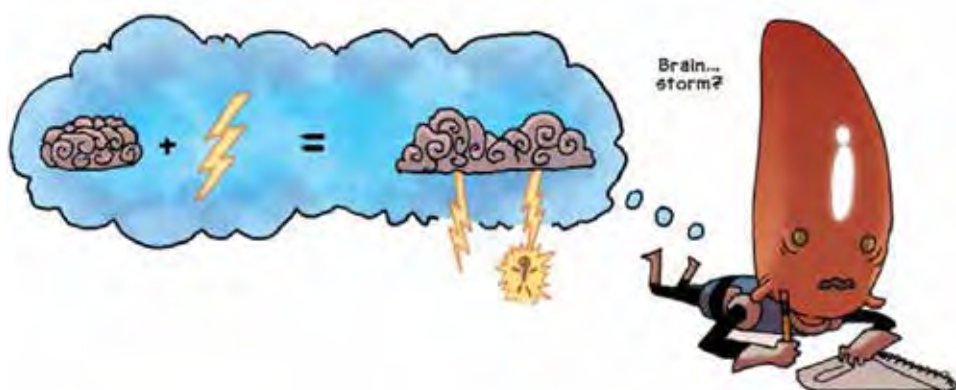
Name _____ Date _____

Directions: Explain, with words and with images, how Albert the Alien interprets each statement, and how his friends and classmates interpret each statement.

Figure of Speech	Albert the Alien	Teachers, Classmates, and Friends
Racking your brain		
Brainstorm		
Butterfingers		
Drive the kids bananas		
Falling in love		

Figures of Speech (cont.)

Quotation	Albert the Alien	Teachers, Classmates, and Friends
My life is like an open book		
My dogs are barking		
We're in a real pickle		
I have butterflies in my stomach		
It's raining cats and dogs		



Lesson Plan for

Special Delivery to Shangri-La by Mike Lee and Janet Lee

By Dr. Katie Monnin, Associate Professor of Literacy, University of North Florida

Overview: While reading the engaging comic “Special Delivery to Shangri-La,” students identify and define vocabulary using context clues. Then, students develop their writing abilities by creating a new adventure for the characters in comic format using at least five of their new vocabulary words.

Subject: Language Arts—Word Choice and Vocabulary; Writing

Grade Level: Grades 3–6

Content Standards: Writing

Common Core State Standards: www.corestandards.org

- **Grades 3–6:** Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone. [CCSS.ELA-Literacy.CCRA.R.4]
- **Grades 3–6:** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. [CCSS.ELA-Literacy.CCRA.W.4]
- **Grades 3–6:** Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach. [CCSS.ELA-Literacy.CCRA.W.5]

Objectives

- Students will demonstrate comprehension of “Special Delivery to Shangri-La” and its key vocabulary terms by producing and developing a written alternative ending to the story.

Vocabulary

- **dirigible:** a lighter-than-air craft that is powered and steerable; airship or blimp
- **heading:** the direction in which a ship or aircraft points
- **summit:** a mountainous peak
- **piton:** a pointed piece of metal used in rock climbing that is hammered into a crack in the rock in order to hold the rope which is attached to a climber
- **rappel:** to move down a steep cliff, rock, etc., by pushing your feet against its surface and sliding down a rope
- **parcel:** a box or large envelope that is usually given, sent, or delivered to a person
- **pilfering:** stealing things that are not very valuable or stealing a small amount of something
- **primate:** a monkey, ape, human, or other similar mammal
- **passage:** a long, narrow space that connects one place to another
- **gaining:** increasing or getting closer
- **ambush:** to hide and then attack by surprise
- **emerged:** arose or appeared

- **destination:** end point of a journey
- **decreed:** announced or commanded
- **celebration:** a festivity or party
- **grand-mère:** French for grandmother

Materials

- “Special Delivery to Shangri-La” comic by Mike Lee and Janet Lee
- student worksheets:
 - Treasure Map
 - Treasure Map Answer Key
 - Story Plan
 - Make Your Comic!
- pencils and drawing utensils
- various blank comic panel pages (optional)



Time Frame: one to three class periods

Procedure

Before Reading

1. Activate students’ schema by asking them the following question: Have you ever delivered a special package, gift, or delivery to anyone? As students volunteer responses, record their thoughts and explanations on the board.
2. Share the title of the comic story students will read, “Special Delivery to Shangri-La.” Using the title and their schema brainstorming session on special deliveries, have students predict what they think the “special delivery” might be in the comic story they are about to read. Take notes on the board.

During Reading

3. Distribute the Treasure Map worksheet to students. You may want students to complete this graphic organizer individually, with a partner, or in small groups. Read the directions together and make sure students understand that they are to find the vocabulary words and write their own definitions using context clues. Remind them that in comics, information comes from pictures as well as words (and they way they work together).
4. Either project the comic “Special Delivery to Shangri-La” so the entire class can see it (using a document camera or computer connected to a projector) or distribute copies to students. You may choose to read through the story together as a class or allow time for students to read it on their own. As students read, have them complete the graphic organizer.

After Reading

5. When finished reading, display the Treasure Map Answer Key. Have students switch papers with a partner and add up their points to see how much treasure they earned.
6. Display a blank version of Treasure Map. Complete it together and discuss.

Assessment

Tell students they are to choose at least five key vocabulary words from the comic and use them to create the next chapter in the comic. Distribute copies of the Story Plan worksheet to students and have them fill it out to plan their comic story. You may want to provide feedback and approve students' story plans before giving them the Make Your Comic! worksheet to draw and write their comic. Assess how well students understand key vocabulary by analyzing how they used the words in their comics.

If some students are hesitant to draw, let them know that they can use any drawing style, even stick figures, as long as the reader can understand the story.

If you would like to provide students with alternative blank comic book pages with panels, gutters, and balloons, simply conduct an Internet search for "blank comic book pages."

Extended Learning

















- Read through "Special Delivery to Shangri-La" again with students and have them identify all of the onomatopoetic words (*crash*, *thump*, *whoooooosh*, etc.) in the sound effects. Point out how the color, shape, size, and font of the sound effects tell the reader how they sound. Then, have students add onomatopoetic sound effects to their own comics.
- Ask students to think about someone they would like to send a special delivery to. Once students have a special person in mind, they can write a letter to that special someone. If they would like to include a small, simple special surprise in their package, feel free to encourage them to do so. If needed, teachers may want to ask parents or administrators for help in funding postage for the students' special deliveries.



















Treasure Map

Name _____ Date _____

Directions: As you read "Special Delivery Shangri-La," pretend you are a treasure hunter. You are looking for vocabulary words in order to win points. You win points not only by finding each word but also by correctly defining each word using context clues from the story. Use both the words and the pictures! Each word is worth 5 points.

Vocabulary Word	Definition	Points
 dirigible		
 heading		
 summit		
 piton		
 rappel		
 parcel		
 pilfering		
 primate		
 passage		
 gaining		
 ambushed		
 emerged		
 destination		
 decreed		
 celebration		
 grand-mère		
	Total Points:	

Answer Key

Vocabulary Word	Definition
 dirigible	a lighter-than-air craft that is powered and steerable; airship or blimp
 heading	the direction in which a ship or aircraft points
 summit	a mountainous peak
 piton	a pointed piece of metal used in rock climbing that is hammered into a crack in the rock in order to hold the rope which is attached to a climber
 rappel	to move down a steep cliff, rock, etc., by pushing your feet against its surface and sliding down a rope
 parcel	a box or large envelope that is usually given, sent, or delivered to a person
 pilfering	stealing things that are not very valuable or stealing a small amount of something
 primate	a monkey, ape, human, or other similar mammal
 passage	a long, narrow space that connects one place to another
 gaining	increasing or getting closer
 ambushed	to hide and then attack by surprise
 emerged	arose or appeared
 destination	end point of a journey
 decreed	announced or commanded
 celebration	a festivity or party
 grand-mère	French for grandmother

Story Plan

Name _____ Date _____

Directions: After finding your treasure of vocabulary words while reading, select five or more of your favorites and use them to write the next chapter in this comic book story. Keeping with the characters and their storylines, think about what their next adventurous special delivery may be. Use this page to plan your story about the adventurers' next special delivery.

Characters: _____

What are they delivering? _____

Where are they delivering it? _____

Why are they delivering it? _____

Who will receive it? _____

The five (or more) vocabulary words you will use in your story:



Make Your Own Comic!

Name _____ Date _____

Directions: Draw and write in the panels to tell the story you created about the adventurers' next special delivery. Don't forget to use at least five vocabulary words from your Treasure Map worksheet in the dialogue or narration! You can use the comic panels on this page or create your own.

The comic strip template consists of seven panels arranged in three rows. The first row has one large rectangular panel. The second row also has one large rectangular panel. The third row is divided into four smaller rectangular panels. The fourth row is divided into three rectangular panels of varying widths.



COMICS FOR TEACHING SCIENCE

Dr. Sputnik: Man of Science in “Force and Motion!”

Comic by Roger Langridge – Lesson Plan by Tracy Edmunds

Like Galileo . . .

Comic by James Peaty & Tintin Pantoja – Lesson Plan by Tracy Edmunds

Mail Order Ninja and the Silverback Horde

Comic by Josh Elder, Tim Smith III, and Chris Beckett

Lesson Plan by Tracy Edmunds



Lesson Plan for

The Adventures of Doctor Sputnik: Man of Science! in “Force and Motion” by Roger Langridge

By Tracy Edmunds, M.A. Ed., Curriculum Consultant

Overview: In “The Adventures of Doctor Sputnik: Man of Science! in ‘Force and Motion’” Dr. Sputnik and his faithful sidekick, Spud, blast off into space as they explore Newton’s three laws of motion. Students will read and discuss the comic as a group, and observe and identify each of Newton’s three laws of motion in the real world.

Subject: Science—Newton’s three laws of motion

Grade Level: Grades 3–6

Content Standards: Science

Next Generation Science Standards: www.nextgenscience.org

- **Grade 3:** Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. [3-PS2-1]
- **Grade 6:** Apply Newton’s Third Law to design a solution to a problem involving the motion of two colliding objects. [MS-PS2-1]

McREL Compendium: www2.mcrel.org/compendium

- **Grades 3–5:** Knows that the Earth’s gravity pulls any object toward it without touching it [Physical Sciences, 10.II.2]
- **Grades 3–5:** Knows that when a force is applied to an object, the object either speeds up, slows down, or goes in a different direction [Physical Sciences, 10.II.5]
- **Grades 3–5:** Knows the relationship between the strength of a force and its effect on an object (e.g., the greater the force, the greater the change in motion; the more massive the object, the smaller the effect of a given force) [Physical Sciences, 10.II.6]
- **Grade 6:** Knows that an object that is not being subjected to a force will continue to move at a constant speed and in a straight line [Physical Sciences, 10.III.5]

Objectives

Students will gain a basic understanding of Newton’s three laws of motion:

- **First law:** an object at rest tends to stay at rest, and an object in motion tends to stay in motion, with the same direction and speed.
- **Second law:** The acceleration of an object produced by a total applied force is directly related to the magnitude of the force, the same direction as the force, and inversely related to the mass of the object ($F = ma$).
- **Third law:** For every action there is an equal and opposite reaction.

Vocabulary

- **acceleration:** increase of speed or velocity
- **friction:** surface resistance to relative motion
- **force:** a push or pull acting on an object
- **gravity:** the force that attracts objects with mass toward one another
- **mass:** a measure of the amount of matter in an object

Materials

- “The Adventures of Doctor Sputnik: Man of Science!” in ‘Force and Motion’ comic by Roger Langridge
- a small, smooth, lightweight ball for each group, such as a ping-pong ball
- a small, smooth, heavy ball for each group, such as a large marble (it should be of similar size but significantly heavier than the other ball)
- student worksheet: Newton’s Laws of Motion Activity
- pencils

Time Frame: one to two class periods

Procedure

Before Reading

1. Either project the comic “The Adventures of Doctor Sputnik: Man of Science!” in ‘Force and Motion’ so the entire class can see it (using a document camera or computer connected to a projector) or distribute copies. Allow a few minutes for students to look through the comic without reading the text.
2. Ask students to predict what they think the comic will be about and who the characters are. Remind them that in comics, information comes from pictures as well as words (and they way they work together). Have students make predictions based on visual cues.
3. Have students generate a few questions about the comic and record them for the class to answer later.

During Reading

4. Read through the story together and discuss using the information and questions below.



Page 1:

- Explain to students that Sir Isaac Newton was a mathematician and scientist who lived about three hundred years ago. Ask: Why do you think the artist drew Sir Isaac the way that he did?
- Ask students to restate the first law of motion in their own words.

Page 2:

- Explain that force is a push or a pull. Which is Dr. Sputnik attempting to use on Spud? [*pull*]
- Have students rub their hands on a desk or table to feel friction.

Page 3:

- Have students wave their hands through the air and compare what they feel to what they felt when they rubbed their hands on a desk. Ask students to describe friction in their own words.

Page 4:

- You may need to explain to students that a handbrake, or parking brake, makes the brakes of a car push very hard against the wheels, applying friction to keep them from moving.
- Explain to students that acceleration is when the speed of an object increases. Explain that Newton's second law means that the heavier something is, the more force is needed to accelerate it.
- Have students apply force (push) to a pencil on their desk. What happens? [*It moves easily.*] Then, have students apply force to the whole desk. What happens? [*You have to push much harder to move it.*] Why? [*Because it has more mass.*]
- When Dr. Sputnik applies force by pushing on the car, why doesn't it move? What is working against him? [*Friction applied by the handbrake.*]
- When Spud releases the handbrake, is Dr. Sputnik applying force to the car? [*No*]
- So, what causes the car to accelerate (move faster and faster) down the hill? [*Gravity*]

Page 5:

- To demonstrate Newton's third law, have students stand facing a wall, place their hands on the wall, and push. What happens? [*They move away from the wall.*]
- Have students restate the third law of motion in their own words.
- When the car hits the tree (on the previous page), the tree doesn't move. But when the car hits the rocket, the rocket falls over. Why doesn't the tree move? [*Friction of the roots against the ground keeps the tree in place.*]
- In the real world, do you think a rocket would fall over when hit by a car? [*No*] Why or why not? [*Because the rocket would be too heavy for the car to knock it over—it has too much mass.*]

Page 6:

- Explain how Dr. Sputnik trying to push Spud up the ladder demonstrates all three laws of motion. [*Dr. Sputnik is trying to use force to overcome Spud's inertia (first law), trying to apply enough force to accelerate Spud's mass (second law), and Spud's weight is having an equal and opposite reaction to Dr. Sputnik's push (third law).*]

Page 7:

- Work with students to help Dr. Sputnik calculate the force acting on Spud: If Spud weighs 100 kg (mass) and the rocket is accelerating at 80 meters per second squared (acceleration), use Newton's second law (force = mass x acceleration, or $F = M \times A$) to calculate the force that Spud is experiencing. The unit of measure for force is Newtons. [*100 kg. \times 80 m/s² = 8,000 Newtons.*]

- Why do you think the unit of measure for force is named Newtons?

Page 8:

- Explain Spud's mistake. Why won't air friction slow the rocket? [*There is no air in space.*]
- Which law explains why Dr. Sputnik and Spud may keep going forever? [*First law*]

After Reading

5. Revisit the questions that students posed before reading and answer them as a class.
6. As a class, write student-friendly interpretations of Newton's three laws of motion and display them in the classroom so that students can reference them during the following activity. These restatements should be appropriate to your students' age and prior knowledge. Here are some examples:
 - **First law:** An object that is not moving will stay still and a moving object will keep moving, unless a force (push or pull) is applied.
 - **Second law:** The more mass an object has, the more force (push or pull) you have to apply to accelerate (move) it.
 - **Third law:** When one object pushes another object, it gets pushed back in the opposite direction with the same amount of force.
7. Group students in pairs or small groups and give each group a smooth, lightweight ball, such as a ping-pong ball, and a heavier ball, such as a large marble. Distribute copies of Newton's Laws of Motion Activity worksheet to students and tell them to follow the directions and answer the questions. Circulate to assist and observe students as they work. When students have completed their work, discuss everyone's results and answers as a class.

Assessment

Have students write each of Newton's laws of motion in their own words and cite a specific real-world example of each.

Extended Learning

- Let students explore Newton's first law of motion by building "crash test dummies" of clay or paper and placing them on top of toy cars. Then, have students build ramps with blocks or books and crash the cars to see what happens to the "passengers." Have students use what they know about Newton's first law to write about why they should always wear seatbelts.
- Demonstrate Newton's first law, as well as friction, by performing the "tablecloth trick." Set some nonbreakable dishes on a silky piece of cloth, and then yank the cloth out quickly from under the dishes. You may want to practice first! Students can try the trick with a piece of paper and small, unbreakable classroom objects like erasers, pencils, and paperclips. Have them experiment to see what works best, and then write explanations using the laws of motion.
- Have students research and write about how Newton's laws apply in sports and present their findings to the class. For example, what law explains what happens when a baseball batter hits a ball? How does swinging the bat harder affect the ball and what law applies?
- Have students design and test containers to protect an egg dropped from a height. Remind them to use what they learned about the laws of motion in designing their protective container.

Newton's Laws of Motion Activity

Name _____ Date _____

1. Place a ball on a flat surface (desk, table, or floor). What happens to the ball?

Which of Newton's laws explains this? Why?

2. Push the ball gently with your finger. What happens to the ball?

Which of Newton's laws explains this? Why?

Why doesn't the ball keep rolling forever?

Newton's Laws of Motion Activity (cont.)

3. Place both a light ball and a heavier ball on a flat surface. Push each ball with your finger. What do you feel?

Which of Newton's laws explains this? Why?

4. Place both a light ball and a heavier ball on a flat surface. Push the heavier ball into the lighter ball. What happens?

Which of Newton's laws explains this? Why?



Answer Key

Newton's Laws of Motion Activity

1. It does not move;

First law of motion, because a body at rest tends to stay at rest.

- OR -

First law of motion, because things that aren't moving won't move without a force acting on them.

2. The ball moves;

First law of motion, because an object moves when an unbalanced force is applied.

- OR -

First law of motion, because an object will move when you push it hard enough.

Because gravity and friction slow it down.

3. You have to push harder to move the heavier ball;

Second law of motion, because the more mass an object has, the more force it takes to move it.

- OR -

Second law of motion, because you have to push something harder if it has more mass.

4. The first ball slows down or stops moving and the second ball starts moving (accelerates);

Third law of motion, because for every action there is an equal and opposite reaction.

- OR -

Third law of motion, because when one object pushes another object, it gets pushed back.

Lesson Plan for
Like Galileo by James Peaty and Tintin Pantoja
By Tracy Edmunds, M.A. Ed., Curriculum Consultant

Overview: “Like Galileo” is a brief biography of Galileo Galilei (1564-1642). Students will read and discuss the comic as a group, observe the Moon and keep a Moon journal, analyze Galileo’s drawings of the Moon, and create a model and diagram of the movement of the Earth, Moon, and Sun.

Subject: Science—Phases of the Moon

Grade Levels: Grades 3–6

Content Standards: Science

Next Generation Science Standards: www.nextgenscience.org

- **Grade 5:** Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. (Examples of patterns could include the position and motion of Earth with respect to the Sun. . . .) [\[5-ESS1-2\]](#)
- **Grades 6–8:** Develop and use a model of the Earth-Sun-Moon system to describe the cyclic patterns of lunar phases, eclipses of the Sun and Moon, and seasons. [\[MS-ESS1-1\]](#)
- **All grades:** Science and Engineering Practices—Developing and Using Models

McREL Compendium: www2.mcrel.org/compendium

- **Grades 3–5:** Knows that the Earth is one of several planets that orbit the Sun and that the Moon orbits the Earth [\[Earth and Space Sciences, 3.II.2\]](#)
- **Grades 3–5:** Knows that telescopes magnify distant objects in the sky and dramatically increase the number of stars we can see [\[Earth and Space Sciences, 3.II.6\]](#)
- **Grades 6–8:** Knows characteristics and movement patterns of the planets in our Solar System [\[Earth and Space Sciences, 3.III.1\]](#)
- **Grades 6–8:** Knows characteristics of the Sun and its position in the universe [\[Earth and Space Sciences, 3.III.3\]](#)

Objectives

- Students will gain a basic understanding of the life and contributions of Galileo
- Students will observe and record the phases of the Moon
- Students will create a simple model and diagram of the movement of the Earth, Moon, and Sun



Vocabulary

- **monastery:** a place where people live together and study religion
- **natural philosophy:** what people called study of nature and the physical universe before modern science
- **Aristotle:** an ancient Greek thinker who believed in geocentric theory
- **astronomy:** the study of stars, planets, and space
- **telescope:** an instrument that makes far away things look closer and larger
- **heliocentric:** the theory that Sun is the center of the universe and everything revolves around it
- **geocentric:** the theory that Earth is the center of the universe and everything revolves around it
- **heresy:** contradicting the teachings of the Catholic Church
- **incarcerated:** put in jail
- **Copernicus:** a scientist who lived about one hundred years before Galileo; believed in heliocentric theory
- **Ptolemy:** an ancient Greek thinker who believed in geocentric theory

Materials

- “Like Galileo” comic by James Peaty and Tintin Pantoja
- student worksheets:
 - Moon Journal
 - Galileo’s Moon Drawings,
 - Moon Models
- lamps or flashlights, one for each student group
- small balls (tennis, ping pong, Styrofoam, etc.), one for each student group
- pencils



Time Frame: three to four class periods, with one month for students to complete their Moon Journals

Preparation

Gather some strong flashlights or lamps and some small-to-medium-sized, light-colored balls, such as Styrofoam, ping pong, or tennis balls. Students will use these to create simple models of the Sun, Earth, and Moon system and recreate the phases of the Moon.

Procedure

Before Reading

1. Either project the comic “Like Galileo” so the entire class can see it (using a document camera or computer connected to a projector) or distribute copies so students can follow along. Allow a few minutes for students to look through the comic without reading the text.

2. Ask students to predict what they think the comic will be about and who the characters are. Remind them that in comics, information comes from pictures as well as words (and they way they work together). Have students make predictions based on visual cues.
3. Have students generate a few questions about the comic and record them for the class to answer later.

During Reading

4. Read through the story together and discuss using the information and questions below.

Pages 2/3:

- Explain to students that a monastery is a place where people live together and study religion. If Galileo had “. . . commit(ed) himself to the order” he would have stayed in the monastery and studied religion for the rest of his life.
- Explain to students that natural philosophy was what people called study of nature and the physical universe before modern science.

Pages 4/5:

- Explain to students that Aristotle was an ancient Greek thinker. His ideas about astronomy (the study of stars, planets, and space) were what many people believed in Galileo’s time. In part, they believed that the Earth was the center of the universe and everything revolved around it.
- Ask students if they have ever looked through a telescope. Ask them to describe what they saw. Ask students to explain what a telescope does. [*A telescope makes far away things look closer and larger.*]
- Explain that other people had used telescopes to look across the land and ocean, but Galileo was the first to use it to look into space. Before that, people had only looked at the Moon and stars with their eyes alone. Ask students to describe what they see when they look at the Moon with their eyes alone.

Pages 6/7:

- Ask students why they think people thought the Moon was “smooth and perfectly spherical.” What do they think made Galileo believe that it was not?
- Galileo was the first person to observe moons rotating around another planet. Tell students that we now know that many of the planets in our solar system have moons: Mars has two moons, Jupiter has fifty, Saturn has fifty-three, Uranus has twenty-seven, and Neptune has at least thirteen. Mercury and Venus have no moons.
- Ask students how Galileo’s discovery of Jupiter’s Moons and his assertion that the Earth rotates around the Sun conflicted with Aristotle’s ideas. Why do they think this caused people to get angry with Galileo?

Pages 8/9:

- Explain to students that the ancient Greek thinker Ptolemy, like Aristotle, said that the Earth was the center of the universe and everything revolved around it. This is called geocentric theory (geo=Earth). Copernicus, who lived about one hundred years before Galileo, said that the Sun was the center. This is called heliocentric theory (*helio*=Sun). Ask students which theory Galileo believed. [*heliocentric*]
- Explain to students that the crime of heresy meant that Galileo contradicted the teachings of the Catholic Church. *Incarcerated* means he was put in jail.

After Reading

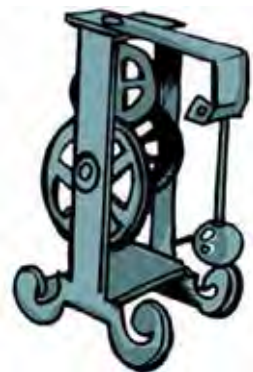
5. Revisit the questions that students posed before reading and answer them as a class.
6. Ask students how Galileo discovered that Earth isn't the only planet that is orbited by a Moon. [*He observed the Moons of Jupiter through his telescope.*]
7. Tell students that, like Galileo, they will be making scientific observations of Earth's Moon. They will keep a Moon journal and report on their findings.
8. Distribute copies of the Moon Journal worksheet to students. Assign students to observe the Moon for one month and draw what they see.
9. Once the Moon journals are complete, distribute copies of the Galileo's Moon worksheet and have students complete it either individually or in groups.
10. Review the worksheet as a class and discuss students' answers.
11. Distribute copies of the Moon Model worksheet. Divide students into groups and provide each group a lamp or flashlight and a ball. You will need to darken the room and groups will have to spread apart enough that their light won't shine brightly on neighboring groups of students. Allow students time to experiment with their models.
12. Review and compare students' models and diagrams as a class.

Assessment

Observe students' models and diagrams as they work on the Moon Model project to assess their thinking and problem solving. As a final assessment, after students have observed and assessed each other's diagrams, have students create new diagrams individually, using what they have learned about the movements of the Moon, Earth, and Sun.

Extended Learning

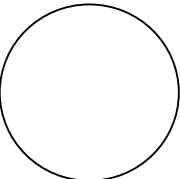
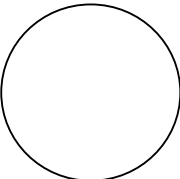
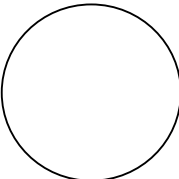
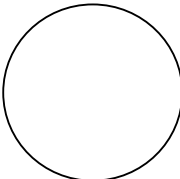
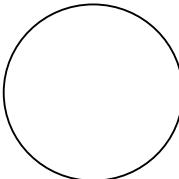
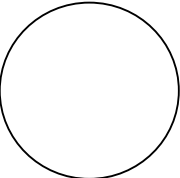
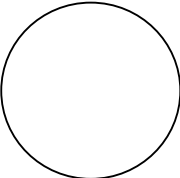
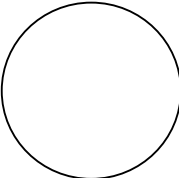
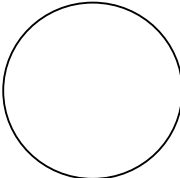
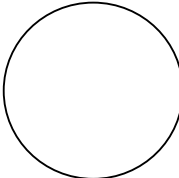
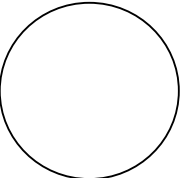
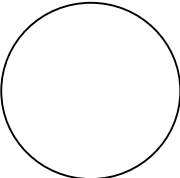
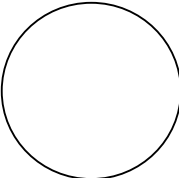
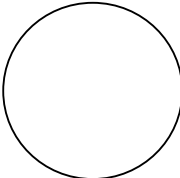
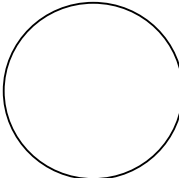
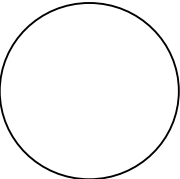
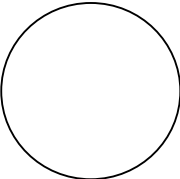
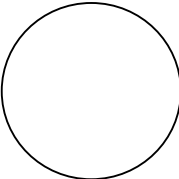
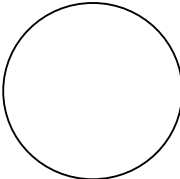
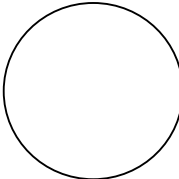
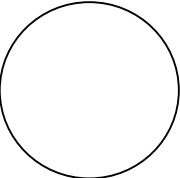
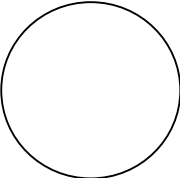
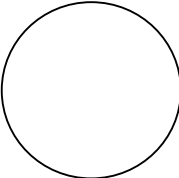
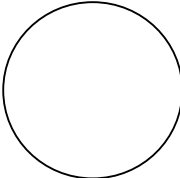
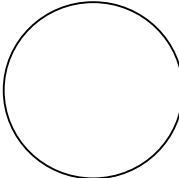
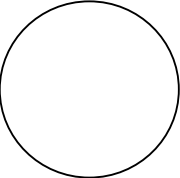
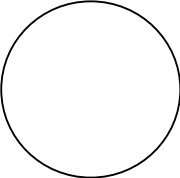
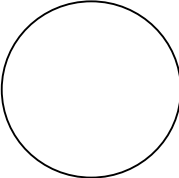
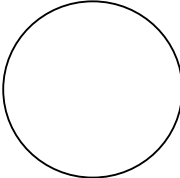
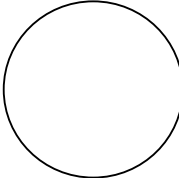
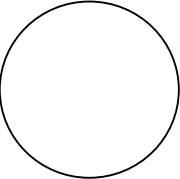
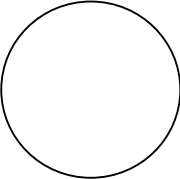
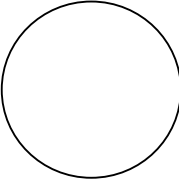
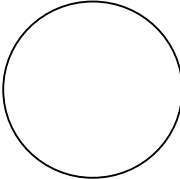
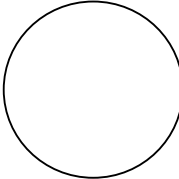
- Tell students that one of Galileo's theories was that any two items, regardless of their weight or mass, would fall at the same speed if there were no air to slow them down. He dropped two balls of different weights from the leaning tower of Pisa to test his theory. Have students hold a piece of paper and a pencil at the same height and drop them. Then, have them crumple the paper tightly into a ball and repeat the experiment. Ask students to draw conclusions about what they observed. Show students this video of astronaut David Scott performing Galileo's experiment on the Moon: www.teachersdomain.org/resource/phy03.sci.phys.mfw.galMoon/.
- Show students the NOVA video about Galileo's observations of the Moons of Jupiter: www.teachersdomain.org/resource/ess05.sci.ess.eiu.galileoMoon/
- Have students research the work of Aristotle, Ptolemy, Copernicus, and Galileo. Stage a debate between proponents of the geocentric and heliocentric theories.
- Have students research and debate current scientific controversies.
- Have students create both geocentric and heliocentric models of the solar system and compare them.



Moon Journal

Name _____ Date _____

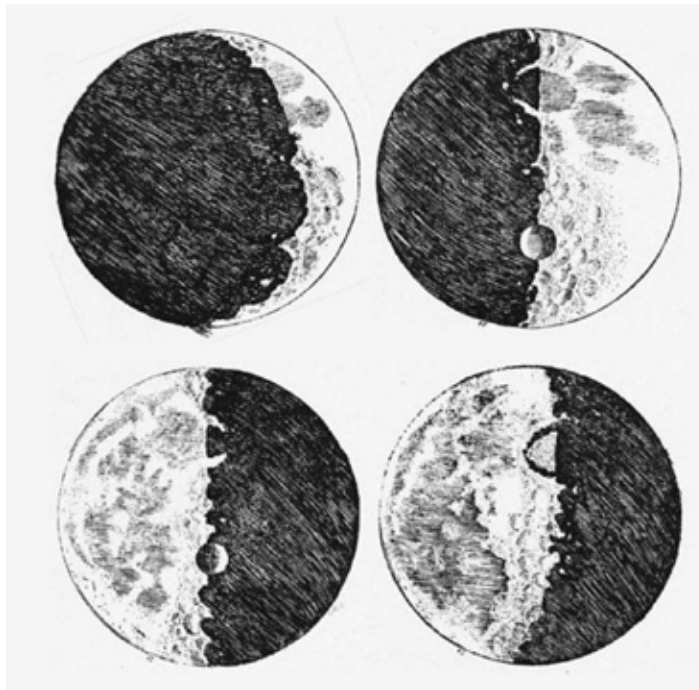
Directions: For five weeks, observe the Moon each night and shade the circle to show what you see.

Saturday					
Friday					
Thursday					
Wednesday					
Tuesday					
Monday					
Sunday					

Galileo's Moon Drawings

Name _____ Date _____

Directions: Below are copies of some of Galileo's drawings of the Moon. Galileo made these drawings as he observed the Moon through his telescope on different nights. Look at the drawings and answer the questions at the bottom of the page.



1. Describe any similarities or differences between the drawings you did in your Moon journal and Galileo's drawings.

2. Can you explain the differences?

3. What do Galileo's drawings tell you about the surface of the Moon?

Moon Models

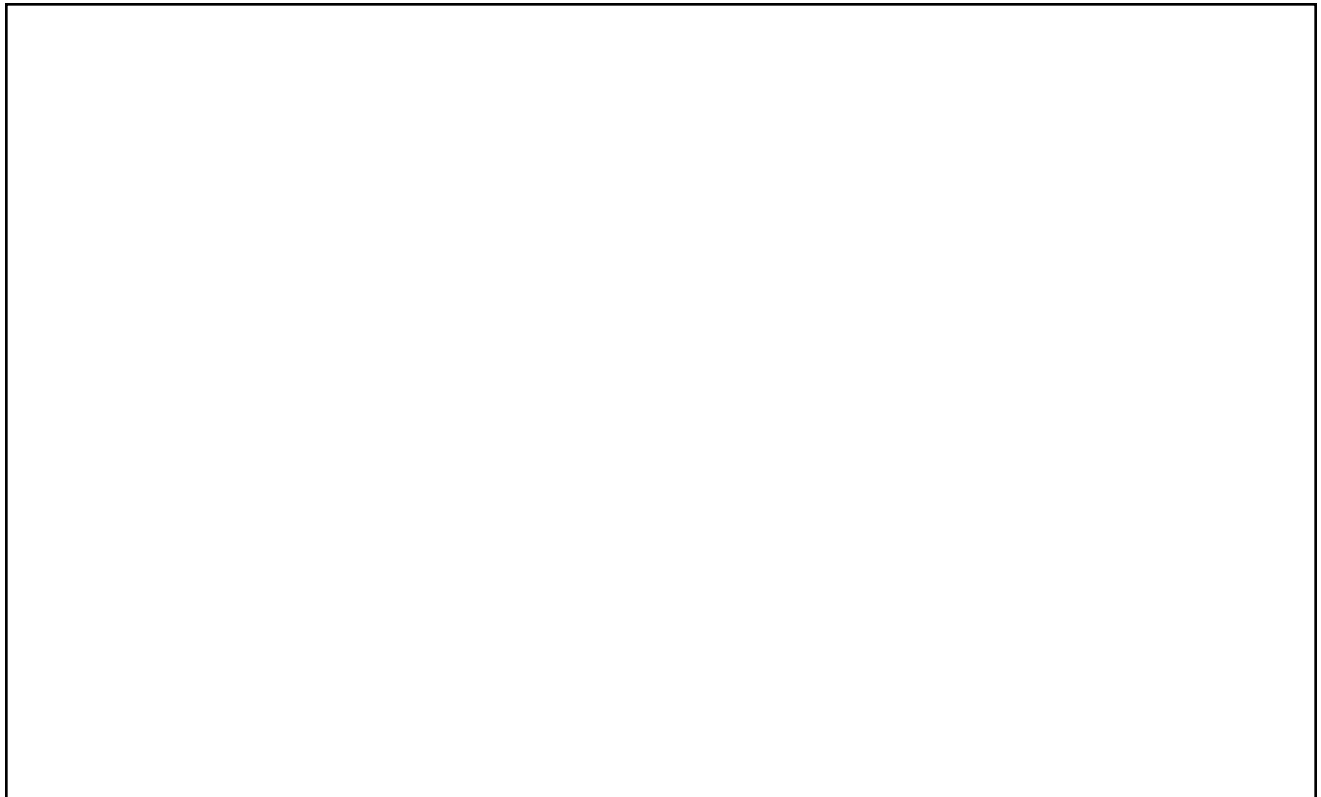
Name _____ Date _____

Directions: Follow the steps below to create a model of the Earth, Moon, and Sun.

1. Using a light and a ball, create a physical model of the movement of the Earth and Moon relative to the Sun. The light will represent the Sun, the ball will represent the Moon, and you will be the observer on Earth. The "Sun" should remain still in this model. Hold the ball still in your hand (the Moon does not rotate as it revolves around the Earth) and move your body in a way that recreates the movement of the Earth and the Moon. Observe closely the way your "sunlight" appears on your "Moon" as you move.

2. Describe how your model functions:

3. Using what you observe in your model, as well as the information in your Moon journal, develop a diagram of the movement of the Earth and Moon relative to the Sun and sketch it below. Don't forget to label the important parts. Check to be sure that your diagram explains your observations as completely as possible.



Moon Models (cont.)

Directions: Answer the questions using what you learned by creating your model.

4. How much of the Moon is always illuminated by the Sun?

5. Is it always the same part? Why or why not?

6. How much of the Moon is always visible from Earth?

7. Is it always the same part? Why or why not?

Lesson Plan for
Mail Order Ninja and the Silverback Horde
by Josh Elder and Tim Smith III

By Tracy Edmunds, M.A. Ed., Curriculum Consultant

Overview: In “Mail Order Ninja and the Silverback Horde,” the reluctant hero uses the square cube law to defeat the overgrown ape villain. Students will read and discuss the comic as a group, and then explore the role that the square cube law plays in biology.

Subject: Science—Square cube law in biology

Grade Level: Grades 3–6

Content Standards: Science

Next Generation Science Standards: www.nextgenscience.org

- **Grade 3:** Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all. [3-LS4-3]
- **Grade 4:** Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. [4-LS1-1]
- **Grades 6–8:** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. [MS-LS1-5]

McREL Compendium: www2.mcrel.org/compendium

- **Grades 3–5:** Knows that the Earth’s gravity pulls any object toward it without touching it [Earth and Space Sciences, 10.II.2]
- **Grades 6–8:** Knows that organisms have a great variety of body plans [Life Sciences, 5.III.5]

Objectives

- Students will gain a basic understanding of the square cube law as it relates to biology.
Square cube law: When an object undergoes a proportional increase in size, its new surface area is proportional to the square of the multiplier and its new volume is proportional to the cube of the multiplier.

Vocabulary

- **physiology:** the study of how living things function
- **thesaurus:** a list of synonyms
- **heir:** a person inheriting and continuing the legacy of a predecessor.
- **height:** a measurement of something from top to bottom
- **width:** a measurement of something from side to side
- **depth:** a measurement from the nearest to the farthest point of something or from the front to the back
- **area:** the extent of a two-dimensional surface
- **volume:** the amount of space occupied by a three-dimensional object
- **mass:** the amount of matter in an object
- **weight:** the force on an object due to gravity



Materials

- “Mail Order Ninja and the Silverback Horde” comic by Josh Elder and Tim Smith III
- student worksheets:
 - Square Cube Law: Genghis Kong
 - Square Cube Law Activity
 - Big, Bigger, Biggest
- pencils

Time Frame: two to three class periods

Procedure

Before Reading start here

1. Either project the comic “Mail Order Ninja and the Silverback Horde” so the entire class can see it (using a document camera or computer connected to a projector) or distribute copies. Allow a few minutes for students to look through the comic without reading the text.
2. Ask students to predict what they think the comic will be about and who the characters are. Remind them that in comics, information comes from pictures as well as words (and they way they work together). Have students make predictions based on visual cues.
3. Have students generate a few questions about the comic and record them for the class to answer later.

During Reading

4. Read through the story together and discuss using the information and questions below.

Page 1:

- Explain to students that the first page is a flashback—it shows something that happened in the past.
- Discuss with students the difference between monkeys and apes. The most noticeable difference is that monkeys have tails, while apes do not. Also, apes are usually larger than monkeys. Apes have higher intelligence than monkeys, which explains why General Kong would not want to be called a monkey.

Page 2:

- Have students look at the title of the book that Herman is reading. Ask if anyone knows what physiology is. If necessary, explain that physiology is the study of how living things function.

Page 3:

- Ask if anyone can explain Timmy’s comment about needing a dinosaur. [*Timmy thinks a thesaurus is a type of dinosaur because it contains the root “saurus,” which is also in many dinosaur names.*] Ask students to explain what a thesaurus actually is.



Page 4:

- After reading this page, you may want to revisit the first page of the story and review with students why Emperor Kong is so angry.
- Ask students if they know what *heir* means. [*Someone who is next in line to carry on, usually a son or daughter.*] How do they think Emperor Genghis Kong and General Kublai Kong are related?



Page 7:

- Tell students that they will be learning more about the square cube law after they finish reading the story.

After Reading

5. Revisit the questions that students posed before reading and answer them as a class.
6. Display or project Square Cube Law: Genghis Kong for students to see. Read through the page with students and answer any questions or clear up any misconceptions students may have. This is a complicated concept!
7. Distribute copies of the Square Cube Law Activity worksheet to students. You may wish to have students complete this activity independently, in small groups, or as a class with your leadership, depending on their abilities and interest.
8. Review the answers to Square Cube Law Activity with students and have them correct any errors. Reteach as needed.
9. Distribute copies of Big, Bigger, Biggest worksheet to students. Read through the information with students and then have them answer the questions individually or in small groups.
10. Have students share their answers to Big, Bigger, Biggest with the class. Discuss any misconceptions and reteach as necessary.

Assessment

Have students write an explanation of the square cube law in their own words and assess their understanding based on their explanation. If desired, give them the following scenario to write about: Imagine you put a puppy in the mad scientist's growth machine and turned it up to a growth factor of 3. What would happen to the puppy's height, strength, and mass (weight)? Could you play with your new, giant puppy? Why or why not?

Extended Learning

- Give students 1 cm cubes and have them model the square cube law by making successively larger cubes and calculating and recording the area and volume of each.
- Let students experiment with 1-inch gelatin cubes. Have them stack the cubes to make larger cubes, then calculate the surface area and volume of each new cube. How many can they stack before the volume is too much and the stack collapses under its own weight?
- Have students research one large and one small animal, then write a comparison report detailing the physiological differences between them.

Square Cube Law: Genghis Kong

Height is measured in one dimension.



height (top to bottom)

When height increases, you only need to multiply by the growth factor (how much bigger it gets).

Kong's growth factor is 5 because he is 5 times larger than a regular gorilla.

Regular gorilla height $\times 5$ = Kong's height

Area (which determines strength) is measured in two dimensions (height \times width).



height (top to bottom)

width (side to side)

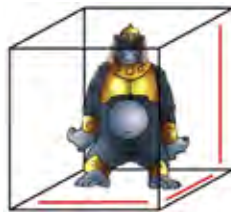
Both height and width increase by the same growth factor.

So (5 times the width) \times (5 times the height) means you square the growth factor: 5×5 .

Kong is not just 5 times stronger than a regular gorilla; he's 5×5 or 25 times stronger!

Regular gorilla strength $\times 5^2$ = Kong's strength

Volume (which determines weight) is measured in three dimensions (height \times width \times depth).



height (top to bottom)

width (side to side)

depth (front to back)

Height, width, and depth increase by the same growth factor.

So (5 times the width) \times (5 times the height) \times (5 times the depth)
means you cube the growth factor: $5 \times 5 \times 5$.

Kong is not just 5 times heavier than a regular gorilla; he's $5 \times 5 \times 5$ or 125 times heavier!

Regular gorilla weight $\times 5^3$ = Kong's weight

Square Cube Law Activity

Name _____ Date _____

Part 1: Genghis Kong

How did Emperor Genghis Kong get so big? Let's imagine that a mad scientist put him in a growth machine and turned it up to a growth factor of 5. Every part of Kong's body grew at the same rate to 5 times his original size.

1. Genghis Kong is 30 feet tall, which is 5 times taller than the average gorilla.

How tall is an average gorilla? _____ feet



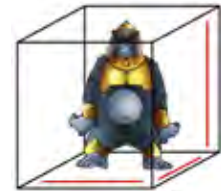
2. Fill in the missing information below about Genghis Kong.

• Regular gorilla height (_____ feet) $\times 5 =$ Kong's height (_____ feet)



• Regular gorilla strength $\times (5 \times 5) =$ Kong's strength,
so Kong is _____ times stronger than an average gorilla.

• Regular gorilla weight $\times (5 \times 5 \times 5) =$ Kong's weight,
so Kong is _____ times heavier than an average gorilla.



3. If an average gorilla weighs approximately 200 lbs, how much does Genghis Kong weigh?

200 lbs \times _____ = _____ lbs
(how many times heavier?)

4. Explain why Genghis Kong wouldn't be able to hold himself up.

Square Cube Law Activity (cont.)

Part 2: YOU!

Let's imagine that the mad scientist put you in the growth machine and turned it up to a growth factor of 10. Every part of your body would grow at the same rate to ten times its current size.

5. How tall were you before the mad scientist put you in the machine?

Round to the nearest foot. _____ feet

6. If the machine increases your height by a factor of 10, how tall will you be when you come out?



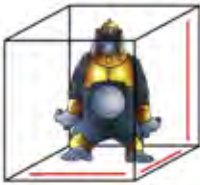
_____ feet $10 =$ _____ feet

7. How much stronger will you be?



$10 \times 10 =$ _____ times stronger

8. How much heavier will you be?



$10 \times 10 \times 10 =$ _____ times heavier

9. What was your weight before the mad scientist put you in the machine? _____ lbs

How much will you weigh when you come out? _____ lbs

(Hint: Look at your answer to question 8!)

10. Could you hold yourself up? Why or why not?

Big, Bigger, Biggest

Name _____ Date _____

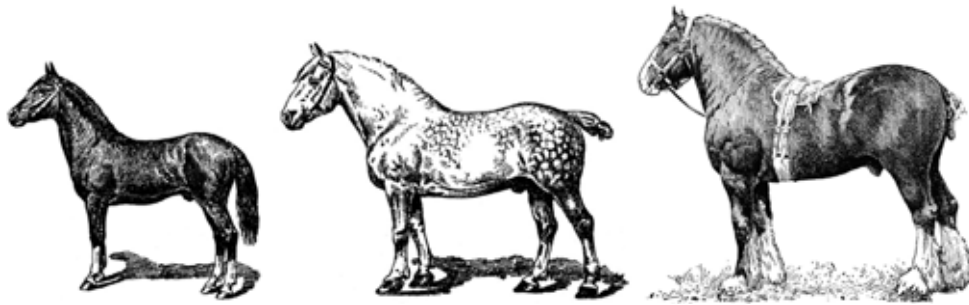
How do they do it?

As an animal gets larger, its mass increases at a much faster rate than its strength. Our pal Genghis Kong grew to 5 times the size of a normal gorilla. He had 25 times the strength, but he was 125 times heavier, so he collapsed.

So how do animals like elephants get so large? Why don't they collapse under their own weight? Not all animals have the same proportions. Larger animals have proportionally shorter and thicker bones and muscles to hold up all that weight! That's why an elephant's legs look so thick, while cat legs and mouse legs are much thinner.

Genghis Kong's proportions stayed the same, but if his bones and muscles had become stronger and thicker to handle his extra weight, Jiro and Timmy might have been in real trouble!

The illustration below shows the difference in proportion between different types of horses. Notice how the legs on the larger breeds are thicker and the muscles are larger to hold up the increased weight.



1. Which has proportionally thicker legs, a house cat or a tiger? Why?




2. A tortoise might not be very big, but has very thick legs. Why do you think this is?

3. The blue whale is the largest animal on Earth, but it doesn't have any legs at all! How does the blue whale survive with all that weight?

Big, Bigger, Biggest (cont.)

Big Changes

As bodies get larger and bones get proportionally shorter and thicker, hearts also get larger and beat more slowly. And the larger the animal, the less strength it has relative to its mass.

		
mouse	human	elephant
very small	medium size	huge
can lift several times its own weight	can lift almost its own weight	can only lift 25% of its own weight
can jump several times higher than its body length	can jump less than its own height	can't jump at all
500 heartbeats per min	70 heartbeats per min	28 heartbeats per min
life span is less than a year	life span is 70-80 years	life span is 60-70 years

4. Explain, using the principles of the square cube law, why an elephant can't jump.

5. Can you explain why the human life span is longer than the elephant's, even though the elephant is larger?

The Great Heat Escape

Animals generate heat when they move, and some of that heat is released from the body through their skin. Larger animals have significantly more inside (volume) relative to their outside (surface area) and have a much harder time cooling down their body temperatures. A mouse needs to eat all the time and move quickly so it generates a lot of heat. An elephant needs to move slowly so it doesn't overheat. Maximizing the surface area for cooling also explains an elephant's big floppy ears and wrinkly skin, which can expel more heat than a smooth surface.

6. Do you need to expel heat? _____

7. How does your body help expel heat when you get too hot?

Answer Key

Square Cube Law Activity

1. 6
2. 6, 30, 25, 125
3. 125, 25,000
4. Because he is many times heavier than he is stronger. His mass is too much for his strength.
5. Answers will vary depending on student's height.
6. Answers will vary
7. 100
8. 1,000
9. Answers will vary
10. No, because you would be many times heavier than you are stronger.

Big, Bigger, Biggest

1. A tiger, because it has a proportionally larger mass and needs larger bones and muscles to hold its weight.
2. Because its shell is heavy.
3. It floats in the water.
4. Because his mass is proportionally too large for his strength.
5. Because humans have medicine to stop disease.
6. Yes
7. We sweat.



COMICS FOR TEACHING MATHEMATICS

Finding Ivy

Comic by Michael Vincent Bramley & Alice Meichi Li – Lesson Plan by Tracy Edmunds

Probamon: Gotta Chance 'em All!

Comic by Geoffrey Golden & Nate Pride – Lesson Plan by Tracy Edmunds

Solution Squad: You Know the Drill

Comic by Jim McClain & Rose McClain – Lesson Plan by Jim McClain
Poster by Gene Ha & Jim McClain

Lumina: Menace of the Mathemagician

Comic by Josh Elder & Jen Brazas – Lesson Plan by Tracy Edmunds

Squirrels vs. Birds “Prime-Composite Showdown”

Comic by Jason Allen & Heidi Arnhold – Lesson Plan by Tracy Edmunds



Lesson Plan for
Finding Ivy by Michael Vincent Bramley and Alice Meichi Li
By Tracy Edmunds, M.A. Ed., Curriculum Consultant

Overview: “Finding Ivy” is an adventure story about a little girl named Thyme who gets lost, and a boy, Jung, who helps her find her family. As Jung and Thyme travel through their fantasy world on three different trains that run through twelve different zones, students learn to read Roman numerals and solve problems involving time. Students will read and discuss the comic as a group, learn to read and form Roman numerals, solve mathematics problems involving time based on the story, and create, solve, and analyze their own mathematics problems involving time.

Subject: Mathematics—Telling time, Roman numerals, and solving word problems

Grade Level: Grades 3–6

Content Standards: Mathematics

Common Core State Standards: www.corestandards.org

- **Grade 3:** Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes. [\[CCSS.Math.Content.3.MD.A.1\]](#)
- **Grade 4:** Use the four operations to solve word problems involving distances, intervals of time. [\[CCSS.Math.Content.4.MD.A.1\]](#)
- **All Grades:** Make sense of problems and persevere in solving them. [\[CCSS.Math.Practice.MP1\]](#)
- **All Grades:** Reason abstractly and quantitatively. [\[CCSS.Math.Practice.MP2\]](#)
- **All Grades:** Construct viable arguments and critique the reasoning of others. [\[CCSS.Math.Practice.MP3\]](#)
- **All Grades:** Model with mathematics. [\[CCSS.Math.Practice.MP4\]](#)

McREL Compendium: www2.mcrel.org/compendium

- **Grades 3–5:** Knows approximates size of basic standard units and relationships between them [\[Mathematics 4.II.3\]](#)
- **Grades 6–8:** Understands the structure of numeration systems that are based on numbers other than 10 (e.g., base 60 for telling time and measuring angles, Roman numerals for dates and clock faces) [\[Mathematics 2.III.6\]](#)

Objectives

- Students will create rules for forming Roman numerals up to twelve.
- Students will solve word problems involving time.
- Students will create, solve, and analyze word problems involving time.



Vocabulary

- Roman numerals: letters used by the Romans to represent cardinal numbers
- zone: an area or region

Materials

- “Finding Ivy” comic by Michael Vincent Bramley and Alice Meichi Li
- student worksheet:
Jung and Thyme’s Journey
Pocket Watch Map
- pencils

Time Frame: one to two class periods

Preparation

During reading, you will be creating a list of rules for Roman numerals for students to refer to later. You could do this on a whiteboard, chart paper, overhead projector, or any method you prefer. Students will need to refer to this list throughout the lesson.

Procedure

Before Reading

1. Either project the comic “Finding Ivy” so the entire class can see it (using a document camera or computer connected to a projector) or distribute copies. Allow a few minutes for students to look through the comic without reading the text.
2. Ask students to predict what they think the comic will be about and who the characters are. Remind them that in comics, information comes from pictures as well as words (and they way they work together).

During Reading

3. Read through the story together and discuss using the information and questions below.

Page 1:

- What do you think “Zone V” means? (Write “V” on the board.)
- Why do you think the red train is labeled “little train”?

Page 3:

- What does V mean? What does I mean? So what does VI mean? (Write “V+I=6” on the board.)
- How long is six decades? If frogs only live six years, what is the princess’ problem?

Page 4:

- As you read through the page, write each Roman numeral as an equation on the board:

$$V+I+I=7 \qquad X-I=9$$

$$V+I+I+I=8 \qquad X=10$$

Page 5:

- (Add $X+I=11$ and $X+I+I=12$ and $I=1$ to your list.)



Page 6:

- (Add $1+1=2$ to your list.)
- How did the guard get to Zone III ahead of Jung and Thyme?

Page 8:

- (Add $V-I=4$ to your list.)
- What did Jung give to Thyme? Why do you think he called it a map?

Page 9:

- How is the pocket watch like a map?
- Which clock hand is represented by the big, yellow train? How fast does it travel?
- Which clock hand is represented by the little, red train? How fast does it travel?
- Which train represents the second hand? What color is it? How fast does it travel?

After Reading

4. Go over the list of Roman numerals with students and put them in a logical order. With students, generate a list of written rules that explain how Roman numerals work.
5. With students, practice determining the time of various journeys using the pocket watch map as a reference. Counting by 5 comes in very handy! Below are some questions to start with. Have students generate and answer additional questions as well.
 - How long would it take to go from Zone III to Zone IV on the yellow train (minute hand)?
[five minutes]
 - How long would it take to go the same distance on the green train (second hand)?
[five seconds]
 - How long would it take to go from Zone IV all the way to Zone II on the red train (hour hand)? [ten hours]
6. Distribute copies of the Pocket Watch Map and Jung and Thyme's Journey worksheets. Depending on your students' grade level, interest, and ability, you may want to use only the first page, or challenge students by including the more difficult questions on the second page. Have students work in partners or in groups to answer the questions. Encourage students to draw pictures or create equations to help them solve the problems.
7. Review Jung and Thyme's Journey and have students share the processes and models they used to solve the problems. Point out to students that there may be more than one model or approach to solving each problem.
8. Challenge students to create their own math problems using time. For example, "It takes Darrel 20 minutes to walk to school. School starts at 8:10 AM. What is the latest time he can leave home and still make it to school on time?" or "Kiki has soccer practice for 45 minutes on Monday, Tuesday, and Thursday. How long does she practice each week?" Remind them that there are 60 seconds in a minute and 60 minutes in an hour. When they are working with total times, they can calculate answers in total seconds or minutes and then convert their answers to hours and minutes or minutes and seconds.
9. Have students analyze and solve each other's time problems. Remind students that they may have to make revisions to the problems repeatedly until they are solvable.



Assessment

Assess students' problem-solving skills as they work through the problems on the worksheet and as they create and solve their own and other students' problems. In addition to observing students' thought processes as they share them with the class (Procedures, Step 7) visit with groups of students during work time and ask them to explain their models and strategies. Take notes on your observations.

At the end of lesson (perhaps as an exit slip), have students write down the most successful problem they created, a model or strategy for solving it, and their answer. Collect these for assessment and evidence of learning.

Extended Learning

- Place students in pairs. Give each pair of students five index cards. Have them write I, I, I, V, and X on the cards. First, have them take turns creating Roman numerals by combining cards and having their partner identify the numbers. Then, have them take turns naming a number and having their partner make it in Roman numerals with the cards. Can they make their ages in Roman numerals? With older students you can introduce the Roman numerals L, C, D, and M and add them to the deck.
- Have students make a list or picture collage of places that they see Roman numerals. (Copyright dates in books, dates on monuments or buildings, Super Bowl, Olympics, names of royalty, movie dates)
- Have students write out and illustrate their time problems and assemble them into a class book to share with other classes and with parents.



Jung and Thyme's Journey

Name _____ Date _____

Directions: Use the Pocket Watch Map worksheet to help you answer the questions below.

1. Thyme arrived at the Zone V station on the red (hour hand) train at what time?

2. What time did Jung and Thyme leave the Zone V station on the yellow (minute hand) train?
How do you know?

3. Jung and Thyme traveled on the yellow (minute hand) train from Zone V to Zone III. How long did that take?

4. When Jung and Thyme arrived at the Zone III station on the yellow train, how long was it until the green train (second hand) arrived at the station so they could jump on and escape from the guard?

5. Jung and Thyme traveled from Zone III to Zone IV on the green (second hand) train. How long did that take?

6. So how long was Jung and Thyme's train journey from the Zone V station to the Zone IV station all together?



Jung and Thyme's Journey (cont.)

7. The guard traveled from zone to zone on the green Express (second hand) train. How long did it take him to get from one zone to the next?
-

8. If the guard started at Zone V and stopped and searched for Jung and Thyme at each zone for three minutes, how long did it take him to get to Zone III? (Don't include his search time at Zone V or Zone III.)
-

9. If the guard left the Zone V station at 5:28, what time did he start searching for Jung and Thyme in Zone III?
-

Challenge: If Jung and Thyme left Zone V at 5:25, what time did they arrive at Zone IV?

Super Challenge: How long was the guard waiting at Zone III for Jung and Thyme?



Pocket Watch Map



Answer Key

Jung and Thyme's Journey

1. 5:00
2. 5:25 because the yellow train (minute hand) doesn't come by Zone V until 25 minutes after the hour or 5:25.
3. 50 minutes
4. 15 seconds
5. 5 seconds
6. 50 minutes and 20 seconds (50 min on the yellow train, 15 seconds in the station, and 5 seconds on the green train)
7. 5 seconds
8. 9 searches at 3 min. each = 27 min., 10 train trips at 5 seconds each = 50 seconds, added together makes 27 min., 50 seconds
9. 5:55:50 (27 min., 50 seconds later)

Challenge: 6:15:20

Super Challenge: 19 minutes and 30 seconds ($\{50 \text{ minutes}, 20 \text{ sec}\} - \{27 \text{ min}, 50 \text{ sec}\} - 3 \text{ minutes for his later departure.}$)



Lesson Plan for
Probamon! "Gotta Chance 'Em All!"
by Geoffrey Golden and Nate Pride

By Tracy Edmunds, M.A. Ed., Curriculum Consultant

Overview: Math Addem loves the game of Probamon, but he never wins. His friends teach him the basics of probability so he can play strategically to improve his chances of winning. Students will read and discuss the comic as a group, complete a probability worksheet, and play a card game using probability.

Subject: Mathematics—Probability

Grade Level: Grades 3–6

Content Standards: Mathematics

National Council of Teachers of Mathematics Standards: www.nctm.org/standards/default.aspx

- **Grades 3–5:** Describe events as likely or unlikely and discuss the degree of likelihood using such words as certain, equally likely, and impossible [Data Analysis and Probability]
- **Grades 3–5:** Predict the probability of outcomes of simple experiments and test the predictions [Data Analysis and Probability]

McREL Compendium: www2.mcrel.org/compendium

- **Grades 3–5:** Recognizes events that are sure to happen, events that are sure not to happen, and events that may or may not happen (e.g., in terms of "certain," "uncertain," "likely," "unlikely") [Mathematics 7.11.2]
- **Grades 3–5:** Understands that when predictions are based on what is known about the past, one must assume that conditions stay the same from the past event to the predicted future event [Mathematics 7.11.3]
- **Grades 3–5:** Uses basic sample spaces (i.e., the set of all possible outcomes) to describe and predict events [Mathematics 7.11.5]

Objectives

- Students will gain a basic understanding of probability and make simple predictions about the likelihood of an event based on this understanding.

Vocabulary

- **probability:** the chance that a given event will occur
- **predict:** to declare or indicate in advance
- **certain:** sure to happen; incapable of failing
- **likely:** having a high probability of occurring
- **unlikely:** having a low probability of occurring
- **impossible:** incapable of occurring



Materials

- "Probamon! 'Gotta Chance 'Em All!'" comic by Geoffrey Golden and Nate Pride
- student worksheet: Probamon Probability
- set of Probamon Playing Cards and directions for each group of students
- pencils

Time Frame: one to two class periods

Procedure

Before Reading

1. Either project the comic "Probamon! 'Gotta Chance 'Em All!'" so the entire class can see it (using a document camera or computer connected to a projector) or distribute copies to students. Allow a few minutes for students to look through the comic without reading the text.
2. Ask students to predict what they think the comic will be about and who the characters are. Remind them that in comics, information comes from pictures as well as words (and they way they work together). Have students make predictions based on visual cues.
3. Have students generate a few questions about the comic and record them for the class to answer later.

During Reading

4. Read through the story together and discuss using the information and questions below.

Page 1:

- Ask students if they have ever played or seen a game similar to the one depicted.

Page 2:

- Ask students if they can guess the rules of the Probamon game based on what they have seen so far.

Page 4:

- Review with students how to play the Probamon game. (Each player predicts which type of Probamon will appear, then they throw their Probamon balls. If they predicted correctly, they win and they keep both Probamon.) Ask students what they think should happen if neither player predicts correctly or if both players predict correctly.

Page 5:

- As the characters explain the probability of each choice (the numerical expression of the chance that it will happen), have student volunteers record the probability on the board. [*water-8 out of 18; air-6 out of 18; fire-3 out of 18; earth-1 out of 18*]
- Discuss with students which Probamon the main character should have chosen to call at the beginning of the game and why. Ask them if he makes the best choice, is it certain that he will win?

Page 6:

- Ask students how they can determine the total remaining number of Probamon in the middle of the match using the information in panel 1. [*Add together the remaining Probamon; 7 Probamon were still in play.*]
- Ask students to state the chances of throwing each Probamon for the middle of the match. [*water-2 out of 7; air-4 out of 7; fire-1 out of 7*]
- Discuss with students which Probamon they would have chosen at this point in the match. Introduce the terms likely and unlikely and have students use these terms to describe each possible choice.
- Math Addem makes the best choice when he chooses air, because the chances of air coming up are the greatest. Does this mean that his guess is certain to be right? [*No, but it is the most likely outcome.*]

Page 9:

- How did Math Addem figure out his best choice for the next throw (panel 4)? [*He removed the water and earth Probamon that were thrown in the first round, and then saw that water was still the most likely choice.*]

Page 10:

- Ask students to use the information in the pictures to explain Math Addem's reasoning for each throw.
- On the final throw, the Team Random player chose water. Ask students to state the probability of that outcome and explain why that was not a smart choice. [*The chances are 0 out of 2. It is impossible for water to be thrown, as there are no water Probamon left.*]

After Reading

5. Revisit the questions that students posed before reading and answer them as a class.
6. Distribute the Probamon Probability worksheet and have students complete it individually or in groups.
7. Review the worksheet and discuss students' answers. Review and reteach as necessary until all students understand the concept well enough to play the game.
8. Distribute Probamon card games to small groups or pairs of students and have them use what they learned to play the game.
9. Discuss with students their experiences playing the Probamon card game.

Assessment

Students' worksheet answers can be used as formative assessment to determine their level of understanding before continuing on to the Probamon card game, or you could save the worksheet and use it as summative assessment at the end of the lesson. Summative assessment could also include teacher observation of students as they play the game, including asking students to explain their reasoning as they play.

Extended Learning

- Have students make lists of things in their lives that are likely, unlikely, certain, or impossible. For example, the likely list might include, "I will do my homework tonight," or "My sister and I will play video games this weekend." The impossible list could include, "I will fly home from school today," or "Monkeys will do my homework for me." The more imaginative, the better! Students could then create comics based on the "unlikely" events.
- Have students create simple probability experiments and carry them out. For example, a student could put 5 red cubes and 2 blue cubes in a bag, and predict which cube she will draw out most often. Then she can draw out one cube at a time for a certain number of trials (returning the cube to the bag each time), record the results, and compare the results to her prediction. Other possibilities include flipping a coin, spinning a spinner, rolling a die, or even a game of "rock, paper, scissors."
- Challenge students to create their own games using probability, including detailed rules and an explanation of how probability is used in the game.

Answer Key

Probamon Probability

First page:

Round 1: water

Round 4: water

Round 9: air

Round 12: air

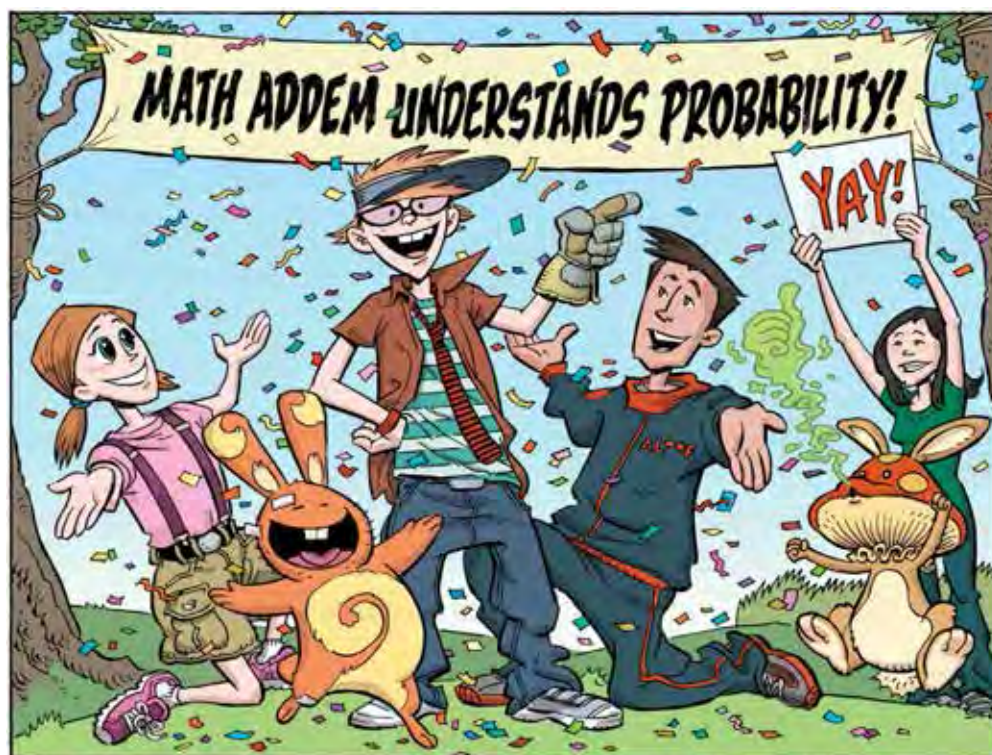
Second page:

Fire: $\frac{3}{18}$; unlikely

Water: $\frac{6}{15}$; likely

Earth: $\frac{0}{10}$; impossible













Air: $\frac{3}{7}$; somewhat likely



Probamon Probability

Name _____ Date _____

Directions: For each of the Probamon rounds below, write the Probamon type that would be the best choice based on probability.

Water	Air	Fire	Earth
			
			
			
			
			
			
			
			

Round 1: _____

Water	Air	Fire	Earth
			
			
			
			
			
			
			
			

Round 4: _____

Water	Air	Fire	Earth
			
			
			
			
			
			
			
			



















Round 9: _____

Water	Air	Fire	Earth
			
			
			
			
			
			
			
			

Round 12: _____

Probamon Probability (cont.)


For each Probamon probability chart below, look at the probability for the chosen Probamon. Write the chances of the chosen Probamon being thrown, and then write a describing word to tell how likely it is, such as certain, likely, somewhat likely, unlikely, or impossible.

Water	Air	Fire	Earth
			
			
			
			
			
			
			
			

"I choose fire!"

Chances: _____

How likely is it? _____

Water	Air	Fire	Earth
			
			
			
			
			
			
			
			

"I choose water!"

Chances: _____

How likely is it? _____

Water	Air	Fire	Earth
			
			
			
			
			
			
			
			

"I choose earth!"

Chances: _____

How likely is it? _____

Water	Air	Fire	Earth
			
			
			
			
			
			
			
			

"I choose air!"

Chances: _____



















How likely is it? _____



















Probamon Card Game



















Directions: Shuffle the cards and place them face down in a stack. Decide who will go first. The first player predicts which type of Probamon is on the top card, and then turns the card over. If their prediction was correct, they keep the card. If not, the card goes into a discard pile. Take turns predicting and revealing cards. Cross each card off on a Probability Chart as it is played, and use your knowledge of probability to make your predictions! After all of the cards have all been revealed, the player with the most cards wins the game.



















Challenge: Play without using the Probability Chart and try to keep track of the cards in your head!

Probability Charts

Water	Air	Fire	Earth
			
			
			
			
			
			
			
			

Water	Air	Fire	Earth
			
			
			
			
			
			
			
			

Water	Air	Fire	Earth
			
			
			
			
			
			
			
			

Water	Air	Fire	Earth
			
			
			
			
			
			
			
			

Probamon Cards



Directions: Print on card stock, cut cards out with scissors. Fold along the line where the front and back meet. Glue together.

BIRDUMB



SPECIAL ATTACK:

Wingding-a-ling

Birdumbs constantly crash into windows, telephone poles and remarkably, *themselves*.

"PROBAMON!" by Geoffrey Golden. Art by Nate Pride. Reading With Pictures. 2013.

BOSSETTE



SPECIAL ATTACK:

Taplands

Bossette's Face was *born to run* (both hot and cold water).

"PROBAMON!" by Geoffrey Golden. Art by Nate Pride. Reading With Pictures. 2013.



Probamoni!
"Gotta Chance 'em All!"



Probamoni!
"Gotta Chance 'em All!"

FISHERMOUSE



SPECIAL ATTACK:

Flop!

Fishermouse: Part fish, part mouse,
and entirely useless in battle.

"PROBAMON!" by Geoffrey Golden. Art by Nate Pride. Reading With Pictures, 2013.

HUNWIND



SPECIAL ATTACK:

Winds of Trample

Either capture the Hunwind or be captured
by the Hunwind. There are no other options.

"PROBAMON!" by Geoffrey Golden. Art by Nate Pride. Reading With Pictures, 2013.



Probamoni!
"Gotta Chance 'em All!"



Probamoni!
"Gotta Chance 'em All!"

HYDRAANT



SPECIAL ATTACK:

Hose Down

Hydraant is a Fierce opponent in battle,
and an absolute necessity at block parties.

"PROBAMON" by Geoffrey Golden. Art by Nate Pride. Reading With Pictures, 2013.

LAGOONIE



SPECIAL ATTACK:

Torrential Shuffle

When Lagoonie's in battle, he's
baby ruthless!

"PROBAMON" by Geoffrey Golden. Art by Nate Pride. Reading With Pictures, 2013.



Probamon!
"Gotta Chance 'em All!"



Probamon!
"Gotta Chance 'em All!"

LEAFIT



**SPECIAL
ATTACK:**

The Pile-On

Make sure you housetrain your pet
Leafit, or it'll crinkle everywhere.

"PROBAMON!" by Geoffrey Golden. Art by Nate Pride. Reading With Pictures, 2013.

M.C. NIX



**SPECIAL
ATTACK:**

Roaster's Delight

The M.C. Nix doesn't just drop the mic,
it burns the mic to a crisp!

"PROBAMON!" by Geoffrey Golden. Art by Nate Pride. Reading With Pictures, 2013.



Probamoni!
"Gotta Chance 'em All!"



Probamoni!
"Gotta Chance 'em All!"

MUSHBUNNY



**SPECIAL
ATTACK:** That Swirl Is Poison

Nuts give Mushbunnies gas, which is a good thing! Poisonous gas is their defense mechanism.

"PROBAMONI" by Geoffrey Golden. Art by David Petersen. Reading With Pictures, 2013.

PLANE-TIFF



**SPECIAL
ATTACK:** Turbu-Lance

When sparring with a Plane-Tiff, make sure you're in your full upright position.

"PROBAMONI" by Geoffrey Golden. Art by Nate Pride. Reading With Pictures, 2013.



Probamoni!
"Gotta Chance 'em All!"



Probamoni!
"Gotta Chance 'em All!"

POOLNOODLE



SPECIAL ATTACK:

Pool Around

Use Poolnoodle to Float in the water,
just don't expect it to be happy about
the arrangement.

"PROBAMON!" by Geoffrey Golden. Art by Nate Pride. Reading With Pictures. 2013.

RAINDELAY



SPECIAL ATTACK:

Drizzle Header

There is no joy in Mudville – mighty
Raindelay has come out.

"PROBAMON!" by Geoffrey Golden. Art by Nate Pride. Reading With Pictures. 2013.



Probamon!
"Gotta Chance 'em All!"



Probamon!
"Gotta Chance 'em All!"

ROCKEE



**SPECIAL
ATTACK:** Jab and Slab

Probamon Masters often debate over whether or not Rockees are "bums".

"PROBAMON!" by Geoffrey Golden. Art by Nate Pridé. Reading With Pictures, 2013.

SHARKTOPUNK



**SPECIAL
ATTACK:** Blitzkrieg Chomp

Some say Sharktopunks are rebels. Others call them Fin-atics.

"PROBAMON!" by Geoffrey Golden. Art by Nate Pridé. Reading With Pictures, 2013.



Probamon!
"Gotta Chance 'em All!"



Probamon!
"Gotta Chance 'em All!"

TIKIBURNER



**SPECIAL
ATTACK:** The Enchanted
Tiki Boom

Don't be alarmed if Tikiburner's hair is
on fire. That's kind of its thing.

"PROBAMON!" by Geoffrey Golden. Art by Nate Pride. Reading With Pictures, 2013.

WETWILLIE



**SPECIAL
ATTACK:** Tongue Depressor

Wetwillie's attacks are often effective
and always gross feeling.

"PROBAMON!" by Geoffrey Golden. Art by Nate Pride. Reading With Pictures, 2013.



Probamoni!
"Gotta Chance 'em All!"



Probamoni!
"Gotta Chance 'em All!"

Lesson Plan for **Solution Squad by Jim McClain and Rose McClain**

*By Jim McClain, Mathematics Consultant and Classroom Teacher,
Pierre Moran Middle School, Elkhart, Indiana*

Overview: “Solution Squad” is an adventure story about a team of teenage heroes whose powers are based on mathematical concepts. Caught in a deathtrap in which the only means of escape is solving a prime number puzzle, the team creates a list of prime numbers using a prime number sieve to crack the alphanumeric code and catch their archenemy, The Poser. Students will read and discuss part of the comic as a group and solve the encoded message alongside the heroes.

Subject: Mathematics—Prime numbers

Grade Level: Grades 4–6

Content Standards: Mathematics

Common Core State Standards:

www.corestandards.org

- **Grade 4:** Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite.



- **All Grades:** Make sense of problems and persevere in solving them. [CCSS.Math.Practice.MP1]
- **All Grades:** Reason abstractly and quantitatively. [CCSS.Math.Practice.MP2]
- **All Grades:** Construct viable arguments and critique the reasoning of others. [CCSS.Math.Practice.MP3]
- **All Grades:** Model with mathematics. [CCSS.Math.Practice.MP4]

McREL Compendium: www2.mcrel.org/compendium

- **Grades 3–5:** Understands basic number theory concepts (e.g., prime and composite numbers, factors, multiples, odd and even numbers, divisibility)

Objectives

- Students will create a list of prime and composite numbers from 2 through 100, inclusive, by using the Sieve of Eratosthenes.

Vocabulary

- **prime numbers:** whole numbers greater than one that are only divisible by one and themselves. This definition can be refined to replace “whole numbers” with “positive integers” if students have been introduced to them.
- **composite numbers:** whole numbers greater than one that are divisible by whole numbers other than one and themselves. Again, “whole numbers” can be replaced by “positive integers” if appropriate.

Materials

- “Solution Squad” comic
- student worksheet: The Prime Number Sieve
- pencils

Procedure

Before Reading

1. Either project the comic “Solution Squad” so the entire class can see it (using a document camera or computer connected to a projector) or distribute copies to students. Allow a few minutes for students to look through the comic without reading the text.
2. Ask students to predict what they think the comic will be about and who the characters are. Remind them that in comics, information comes from pictures as well as words (and they way they work together). Have students make predictions based on visual cues.
3. Have students generate a few questions about the comic and record them for the class to answer later.

During Reading

4. Read through the story together and discuss using the information and questions below.

Page 1:

- Tell students that SOH-CAH-TOA is an acronym, which is a word where each letter stands for another word. They will learn more about acronyms in middle school.
- Tell students that La Calculadora is Spanish for “the calculator.”

Page 2:

- Tell students that
Absolutia is pronounced, “ab-suh-LOO-shuh.”
La Calculadora is pronounced, “lah-CAHL-coo-lah-DOE-ruh.”

Page 3:

- Tell students that
Abcissa is pronounced, “ab-SIS-uh”
Xiao Sheng is pronounced, “sh-OW (as in “OW, that hurts!”) shung”
Yao Feng is pronounced, “yow fung.”
Marchesi is pronounced, “mar-KAY-zee.”

Page 5:

- Tell students that a pneumatic tube is like the plastic tube at a bank drive-through that transports money and receipts between the bank building and their cars. The device is powered by air pressure.

Page 13:

- Either have the students write down the code for themselves, or you write it on the board. They’ll be solving the code themselves along with the heroes.

Page 15:

- After students have read page 15, hand out copies of The Prime Number Sieve worksheet.
- The activity is narrated by La Calculadora, who is trapped outside the force field, but she can see the rest of the team trapped inside. The students, who have now seen the first step in getting rid of the numbers on the sieve that are multiples of two in the bottom panel on page 15, can follow the steps and duplicate what Abscissa does in the story in step 1 on the worksheet. The students can either read independently from there, solve the puzzle themselves, and then return to the story, or instruct the students to do the following while reading the story as a group:

Page 16:

- **Top panel:** Students should eliminate the multiples of three. Some of them are already gone because they are also multiples of two. You can point out that if a number is both a multiple of two and three, it is also a multiple of the product of two and three, which is six. This is also a good opportunity to show students that multiples of three all have digit sums that add up to a multiple of three. For example, 18 has a digit sum of $1 + 8 = 9$, and that sum is also multiple of three. All multiples of three have this quality.
- **Bottom panel:** Students should eliminate all the multiples of five. Multiples of five end in either five or zero, and the ones that end in zero were taken out with the multiples of two. You can point out that just like with the multiples of both two and three, multiples of two and five are also multiples of their products. Therefore, the multiples of 10 were already eliminated and all end in zero.

Page 17:

- **Top panel:** Students should eliminate the multiples of seven. It would be nice if there was a trick to it, but there isn't one. If students have a multiplication table to help them with their work, using it here would be helpful. There are only three multiples of seven left. The others were already multiples of two, three, or five.
- **Bottom panel:** Students should have no multiples of 11 left to eliminate, as they should have been eliminated in previous turns. It's fun to point out that the multiples of 11 that are less than 100 are all double digits. Now that there are no more numbers remaining, that means the water passing through the sieve has run out! Have students circle the remaining numbers. There should be 25 prime numbers in all: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, and 97.
- Now students should make a key to the code: A is 2, B is 3, C is 5, D is 7, E is 11, F is 13, G is 17, H is 19, I is 23, J is 29, K is 31, L is 37, M is 41, N is 43, O is 47, P is 53, Q is 59, R is 61, S is 67, T is 71, U is 73, V is 79, W is 83, X is 89, Y is 97, and La Calculadora has just told them that Z is 101.
- Students should then replace the prime numbers with the appropriate letters. The answer to the puzzle is ERATOSTHENES OF CYRENE. Once the students have that, they can return to the story to find out who that is.

Page 19:

- La Calculadora has written in code on the ground. Have the students decode the message to reveal her battle plan. The message reads SKYLIGHT.

After Reading

5. Encode another message on the board using your code key. Using pangrams (sentences that utilize every letter in the alphabet) as a message is fun: *The quick brown fox jumps over the lazy dog*, for example. The more encoded messages using prime numbers they do, the better they'll recognize prime numbers.
6. Have students write encoded messages to each other.

Assessment

Have students make a prime number sieve covering numbers 2 to 50 without the use of their worksheet to determine their mastery of the process.

Extended Learning

- Have students research and report on the life and work of Eratosthenes, who did much more than invent the prime number sieve. He devised a system for computing the size of the Earth and the distance from Earth to the Sun and the Moon. He also invented the armillary sphere, among other accomplishments. Start them off by showing a video about Eratosthenes' life.
- Show students an entertaining and informative video about the Sieve of Eratosthenes, such as the youtube video: *Prime Numbers—Sieve of Eratosthenes*. Challenge students to create comics or videos explaining mathematical concepts.
- Give students some fun practice on identifying prime and composite numbers with the Fruit Shoot online game. Or have them play a prime-numbers game with a deck of cards.
- Challenge advanced students to decrypt a secret message using the properties of prime numbers.



The Prime Number Sieve



Hola! I'm La Calculadora, the leader of the math-based hero team, Solution Squad! My team is trapped inside a force field, trying to solve a puzzle made of prime numbers! There's not a whole lot I can do from out here, so let's try to figure out the puzzle together.

A *prime number* is defined as a whole number greater than one that is divisible only by one and itself. A whole number that is not prime is called a *composite number*. The prime number sieve eliminates composite numbers until only prime numbers are left behind.

If we can figure out which letter each prime number stands for, we can decode the Poser's secret message. Follow these steps to get a list of all the prime numbers through 100:

1. Check 2 to see if it is prime. Since 2 is only divisible by one and itself, it is the first prime number, so circle it over there on the chart to the right. I can see that they're doing the same thing inside the force field, so they're doing well. Since any number that divides by 2 must be composite, cross out all the multiples of 2. That's every even number higher than 2!
2. Check 3. It is the next prime number. Circle 3 and cross out all the other multiples of 3. You will notice that some of them are already crossed out. Why is that? That's right, because they're also multiples of two! So, if they're multiples of both two and three, that means they're multiples of what?
3. Since 4 was eliminated as a multiple of 2, Check 5. It is the next prime number, so circle it. Then cross out all the multiples of 5. You will notice that you crossed out fewer numbers this time than you did in the previous two steps.
4. Repeat this process until no more numbers are eliminated. When you have accomplished that, the remaining numbers will be prime numbers!
5. Circle all the remaining prime numbers and you will have a list of all the primes from 2 to 100!

	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Now make a key to the code! The first number you circled is A, the second one is B, and the third one is C, and so forth. I'll just go ahead and tell you that Z is 101. You can check it if you want. It doesn't divide by 2, 3, 5, or 7, either.

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
												101

And now you can solve the puzzle. Not only that, but now you can write encoded messages to your friends if they also know the code! Oops! Looks like my team is about to solve the puzzle. See you later!

_ _ _ _ _ / _ _
 _ _ _ _ _

SOLUTION SQUAD
in
THE FOUR STEPS OF PROBLEM SOLVING

STEP 1: UNDERSTAND THE PROBLEM!

Dudes, someone sank our boat!

**STEP 2: MAKE A PLAN!
CHOOSE A STRATEGY
YOU CAN USE TO
SOLVE THE PROBLEM.**

Ordinate, take Absolutia and Equality down there so they can encase the SOH-CAH-TOA in ice and raise her!

My sister was aboard. Now she's--

**STEP 3: CARRY OUT THE PLAN!
DO THE WORK YOU PLANNED TO DO IN STEP 2.**

STORY BY GENE HUI
ART BY PHILIP HUI
COLORS BY LINA HUI
EDIT BY ROSE MCCLAIN
PROOF BY GENE HUI

**STEP 4: LOOK BACK!
CHECK YOUR WORK!**

Guys, that's so **NOT** our boat!

Now I understand!

The pirates sank their own vessel in order to delay us.

Wait. Then where's Abscissa??

Abscissa to Solution Squad! I'm on board the SOH-CAH-TOA! The Dread Pirate Radius has been jamming my comm signal! **Help!**

Sit tight, Xiao! We're on our way. Solution Squad, we have a **new** problem to solve!

WWW.SOLUTIONSQUAD.NET

Lesson Plan for
Lumina: Celebrity Super-Heroine in “Menace of the Mathemagician” by Josh Elder and Jen Brazas

By Tracy Edmunds, M.A. Ed., Curriculum Consultant

Overview: In this math-based comic, teen superhero Lumina must use her mathematical skills to battle the evil Mathemagician! Students will read and discuss the comic as a group, solving mathematical problems based on the events in the story. They will then explore calculating discounts and sales tax as outlined in the story.

Subject: Mathematics—Percentages and fractions

Grade Level: Grades 3–6

Content Standards: Mathematics

Common Core State Standards: www.corestandards.org

- **Grade 4:** Solve word problems involving multiplication of a fraction by a whole number (e.g., use visual fraction models and equations to represent the problem).
[CCSS.Math.Content.4.NF.B.4c]
- **Grade 5:** Solve real world problems involving multiplication of fractions and mixed numbers (e.g., use visual fraction models or equations to represent the problem).
[CCSS.Math.Content.5.NF.B.6]
- **Grade 6:** Find a percent of a quantity as a rate per 100; solve problems involving finding the whole, given a part and the percent. [CCSS.Math.Content.6.RP.A.3c]
- **Grade 6:** Fluently add, subtract, multiply, and divide multidigit decimals using the standard algorithm for each operation. [CCSS.Math.Content.6.NS.B.3]

McREL Compendium: www2.mcrel.org/compendium

- **Grades 3–5:** Understands equivalent forms of basic percents, fractions, and decimals and when one form of a number might be more useful than another [Mathematics 2.II.2]
- **Grades 3–5:** Uses specific strategies to estimate computations and to check the reasonableness of computational results [Mathematics 3.II.4]
- **Grades 6–8:** Understands the relationships among equivalent number representations and the advantages and disadvantages of each type of representation [Mathematics 2.III.1]
- **Grades 6–8:** Uses proportional reasoning to solve mathematical and real-world problems [Mathematics 3.III.6]
- **Grades 6–8:** Knows when an estimate is more appropriate than an exact answer for a variety of problem situations [Mathematics 3.III.8]

Objectives

- Students will estimate and solve real world problems involving cost, including discounts and sales tax.



Vocabulary

- **estimate:** to make a close guess of the actual value, usually with some approximate calculation
- **calculate:** determine the amount or number of something precisely by mathematical methods
- **discount:** a deduction from the usual cost of something
- **sales tax:** a percentage of cost paid to the government

Materials

- “Lumina: Celebrity Super-Heroine in ‘Menace of the Mathemagician’” comic by Josh Elder and Jen Brazas
- student worksheet: Calculating and Estimating Cost
- pencils

Time Frame: one to two class periods

Procedure

Before Reading

1. Either project the comic “Lumina: Celebrity Super-Heroine in ‘Menace of the Mathemagician’” so the entire class can see it (using a document camera or computer connected to a projector) or distribute copies to students. Allow a few minutes for students to look through the comic without reading the text.
2. Ask students to predict what they think the comic will be about and who the characters are. Remind them that in comics, information comes from pictures as well as words (and they way they work together).
3. Have students generate a few questions about the comic and record them for the class to answer later.

During Reading

4. Read through the story together and discuss using the information and questions below.

Page 1:

- Tell students that they will learn more about the math on this page after they finish reading the comic.

Page 2:

- If students are not familiar with social media, you may want to explain that the dialogue on this page parodies a popular social media website.

Page 4:

- Using the information in each of the Mathemagician’s tricks, work with students to solve the following problems.
 - a. If Alpha Male weighs 200 pounds and has 1% body fat, how much does his body fat weigh? [20 *lbs.*] After the Mathemagician multiplies Alpha Male’s body fat by 70, what percentage of his body is fat? [70%] What does his body fat weigh? [140 *lbs.*] What fraction of his body weight is that? [$\frac{7}{10}$]
 - b. Ingenova is 5’10” tall and weighs 112 pounds. If the Mathemagician split her into 4 mini-Ingenovas, what would the height and weight be of each Ingenova? [1’ 5.5”, 28 *lbs.*] What fraction of her original size would each mini-Ingenova be? [$\frac{1}{4}$]

- c. B-Boy has 1,784 dance moves and the Mathemagician subtracts 1,783 of them. What fraction of his dance moves does B-Boy have left? [$1/1784$] If the Mathemagician subtracted 99% of B-Boy's dance moves, what percentage would B-Boy have left? [1%] How many dance moves would that be? [18] What fraction of his original dance moves would he have left? [$18/1784$, or $9/892$]

Page 6:

- Ask students to explain how they think the Mathemagician's "180 Degree Reversal" trick works. Why did the author choose the specific number 180?

Page 8:

- The Mathemagician starts with 2 rabbits, and then multiplies the rabbits by 2 nine times so there are 1,024 rabbits [210]. How many rabbits would there be if he multiplied them by 2 again? [211] And again? [212] How many times would he have to multiply them by 2 to get over a million rabbits? [220 = 1,048,576 rabbits.]

Page 9:

- Ask students to explain what happens when the Mathemagician tries to multiply himself by 0. What might happen if he multiplied himself by -1?

After Reading

5. Distribute copies of the Calculating and Estimating Cost worksheet to students. (Note: Review the problems to be sure that students have enough previous experience to tackle them. You may want to pre-teach some strategies if students are unfamiliar with the concepts.) You may want to have students work individually, with partners, or in small groups. Tell students that the problems are based on the first scene of the comic in which Lumina buys coffee.
6. Give students time to complete the problems on their own or with their groups. Remind them to use strategies and methods they have learned and to show their thinking.
7. As a class, review the answer to each problem and discuss the methods students used to solve them. Point out to students that there may be more than one way of arriving at a correct answer.

Assessment

Take observational notes as students work in groups and as they share their problem-solving strategies. As a final assessment, give students the following problem to solve on their own. Require them to show their strategy and calculations, as well as the answer.

At the end of the story, Lumina says that she is headed back to get more coffee. She goes to a coffee shop in a different city where sales tax is 9.7% and this time she decides to get a discount card! How much money will she save if she buys a *gigante* coffee (\$4.93 each) for each of her three teammates and herself using the 10% discount? (Note: At Queequeg's Coffee they total the bill before subtracting a discount and adding tax.) [Answer: \$2.16]

Extended Learning

- Place students in small groups and have them create problems involving fractions and percentages. Have groups switch papers and solve each others' problems. Discuss as a class the challenges of this activity and what students learned about creating and solving problems.
- Have students create their own math-based stories about the characters in the comic. What other battles might Lumina and the Mathemagician have? Students can invent their own characters too—maybe a math-powered hero? Each story should involve at least one math problem or challenge. Students can present their stories in comic format and invite others to solve their problems.

Answer Key

1.

Item	Size	Price
Regular coffee	12 oz.	\$3.70
<i>Gigante</i> coffee	12 oz. + 12 oz. = 24 oz. 24 oz.	\$3.70 × 1.333 or \$3.70 + 1.23 \$4.93
Total cost		Cost per oz.
Two regular: 12 oz. + 12 oz.	\$3.70 + 3.70 \$7.40	\$7.40 / 24 oz. \$0.31
One <i>gigante</i> : 24 oz.	\$4.93	\$4.93 / 24 oz. \$0.21

2. Estimate: **accept reasonable answers** Actual cost: $\$4.93 - 0.49 = \4.44

3.

	Without tax	With tax (+11.2%)
Regular price of a <i>gigante</i> coffee	\$4.93	\$5.48
Discount price of a <i>gigante</i> coffee (-10%)	\$4.44	\$4.94

4. How much money would Lumina have saved on a *gigante*-sized coffee if she had the discount card? **\$0.54**



Calculating and Estimating Cost

Name _____ Date _____

Directions: Answer the questions below.

1. The barista asks Lumina:



Assuming the regular size is 12 oz. and costs \$3.70, how big is the *gigante* size and how much does it cost? Show your thinking as you calculate the answers. The first section has been done for you as an example.

Item	Size	Price
Regular coffee	12 oz.	\$3.70
<i>Gigante</i> coffee	$12 \text{ oz.} + 12 \text{ oz.} = 24 \text{ oz.}$ _____ 24 _____ oz.	\$ _____

2. If Lumina bought two regular cups of coffee, she would get the same amount of coffee as one *gigante*. What is the cost per ounce of two regulars? One *gigante*? Show your thinking in each box as you calculate the answers.

	Total cost	Cost per oz.
Two regular: 12 oz. + 12 oz.	\$ _____	\$ _____
One <i>gigante</i> : 24 oz.	\$ _____	\$ _____

3. How much money does Lumina save by getting a *gigante* instead of two regulars? _____

Calculating and Estimating Cost (cont.)

4. The barista asks:



What is the price of a *gigante* with the 10% discount? Show your thinking in each box.

First, estimate the cost by rounding numbers to make the arithmetic simpler.

Estimate: _____

Now, calculate the actual cost.

Actual cost: _____



Calculating and Estimating Cost (cont.)

5. The barista says:



What is the total cost of Lumina's drink with sales tax, both with and without the discount? For each size of coffee, calculate the price first, and then add the tax. Fill in the chart below and show your thinking for each part of the problem.

	Without tax	With tax (+11.2%)
Regular price of a <i>gigante</i> coffee		
Discount price of a <i>gigante</i> coffee (-10%)		

6. How much money would Lumina have saved on a *gigante*-sized coffee if she had the discount card?



Lesson Plan for
Squirrels vs. Birds "Prime-Composite Showdown"
by Jason Allen and Heidi Arnhold

By Tracy Edmunds, M.A. Ed., Curriculum Consultant

Overview: Students will read the story "Squirrels vs. Birds 'Prime-Composite Showdown.'" In small groups, students will play a game in which they generate random two-digit numbers and identify them as prime or composite. Students will then combine the outcome of all games and synthesize the information to create an explanation of why there are more composite numbers than prime numbers.

Subject: Mathematics—Prime and composite numbers

Grade Level: Grades 3–6

Content Standards: Mathematics

Common Core State Standards: www.corestandards.org

- Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite. [CCSS.MATH.CONTENT.4.OA.B.4]

Objectives

- Students will identify whole numbers from 2 to 100 inclusive as prime or composite.
- Students will play a math game and determine whether there are more prime or composite numbers.
- Students will explain why there are more composite numbers than prime numbers.

Vocabulary

- **prime:** a whole number greater than 1 that can only be divided evenly by 1 and itself
- **composite:** a whole number greater than 1 that can be divided evenly by numbers other than 1 and itself

Materials

- "Squirrels vs. Birds 'Prime-Composite Showdown'" comic by Jason Allen and Heidi Arnhold
- student worksheet: Squirrels vs. Birds worksheet
- two 10-sided dice or two 1–10 spinners
- pencils

Time Frame: one class period

Procedure

Before Reading

1. As a class, review (or introduce) the definitions of prime and composite numbers.

During Reading

2. Either project "Squirrels vs. Birds 'Prime-Composite Showdown'" so the entire class can see it (using a document camera or computer connected to a projector) or distribute copies to students. Read through the story with students.

After Reading

3. Tell students they will play a game in which they will identify prime and composite numbers.
4. Divide students into pairs or small groups. Give each group a pair of 10-sided dice or two number spinners (1–10) and a copy of the Squirrels vs. Birds worksheet.
5. Have student groups play the game according to the directions on the worksheet.
6. As a class, tally the results of the game for all groups. Who won most of the games, the squirrels (prime numbers) or the birds (composite numbers)?
7. Have students, either with their groups or individually, write an explanation for the results.

Assessment

Evaluate students' written explanations to determine their understanding of the concept. In addition, you could have students individually identify random numbers from 1 to 100 as prime or composite.

Extended Learning

- Have students create their own story or comic showing the battle between the squirrels and the birds. Who wins? Why?



Squirrels vs. Birds

Name _____ Date _____

Directions: Roll both of your dice (or spin both spinners) 20 times. Each time, combine the digits to form a two-digit number. Decide whether the number is prime or composite and write it in the correct column. The winner is the team with the most numbers in their column after 20 rolls or spins.

Squirrels (prime numbers)	Birds (composite numbers)

COMICS FOR TEACHING SOCIAL STUDIES

The Black Brigade

Comic by Chris Schweizer – Lesson Plan by Sari Wilson

Field Trip

Comic by Russell Lissau & Marvin Mann – Lesson Plan by Sari Wilson

George Washington: Action President

Comic by Fred Van Lente & Ryan Dunlavey – Lesson Plan by Sari Wilson



Lesson Plan for
The Black Brigade by Chris Schweizer
By Sari Wilson, Curriculum Consultant

Overview: “The Black Brigade” is a powerful story about a group of African American soldiers—many of who were escaped slaves—who fought on the British side during the American Revolutionary war. Within a study on The Revolutionary War, “The Black Brigade” works well paired with “George Washington: Action President!”

Subject: Social Studies—The American Revolutionary War and the African American experience

Grade Level: Grades 3–6

Content Standards: Social Studies

Common Core State Standards: www.corestandards.org

- **Grade 4:** Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text. [RI. 4.3]

McREL Compendium: www2.mcrel.org/compendium

- **Grades 3–5:** Knows how to identify patterns of change and continuity in the history of the community, state, and nation, and in the lives of people of various cultures from times long ago until today. [Historical Thinking, 1.4]
- **Grades 5–6:** Understands the causes of the American Revolution, the ideas and interests involved in shaping the revolutionary movement, and reasons for the American victory. [U.S. History, Era 3, Standard 6]

Common Core State Standards: www.corestandards.org

- **Grade 4:** Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text. [RI. 4.3]

Objectives

- Students will better understand the role of African Americans in early American history and the American Revolutionary War

Vocabulary

- **scrounge:** to get by any means to get by, such as stealing or foraging
- **skirmish:** a minor fight
- **rash:** too quickly or hastily
- **craven:** cowardly
- **insubordination:** not obeying an authority figure
- **falter:** stumble or hesitate
- **escort:** to go with, accompany
- **guerilla:** small-scale military force that uses strategies like ambushing



NOTE: You may wish to review the following with students, as well as any other period words: naught: not; rot (as in “rot foolishness”): British slang meaning nonsense; whence: from what place.

Materials

- “The Black Brigade” comic by Chris Schweizer
- student worksheet: The Black Brigade: Finding Text Evidence
- pencils

Time Frame: two to three class periods

Procedure

Before Reading

1. You may wish to create a timeline of the Revolutionary period of American history or use one you already have. As you read, have students use the timeline for points of reference.
2. Tell students the following:

Colonel Tye was born named Titus as an enslaved man in America. His owner was especially cruel. In 1775, during the American Revolution the British offered freedom to any enslaved person who joined the British troops, also called the Loyalists (because they were “loyal” to the British King George). Titus escaped from slavery and, along with hundreds of others escaped slaves, joined the Loyalists. He became commander of The Black Brigade. Known as Colonel Tye, he became famous for his bravery and superior military skills.

During Reading

3. Either project “The Black Brigade” comic so the entire class can see it (using a document camera or computer connected to a projector) or distribute copies to students. Have students read the comic as a whole class or in groups. Use the following notes to check for comprehension and build context.

Page 1:

- What is the setting of this scene? [*It is a very cold, harsh wooded area outside New York.*] What can you tell about Tye from the set-up on this page? [*He is mysterious. He has a reputation as being able to get supplies when no one else can.*]

Page 2:

- “Ethiopes” was a term the British used for African Americans. The British referred to the Black Brigade as “The Ethiopian Brigade.”
- What does Captain James Galt-Brown learn that surprises him? [*That Colonel Tye is black. That the “brigade” is actually twenty-four men.*] What does this tell you about Captain Galt-Brown? [*That he is not used to seeing black soldiers.*]

Page 3:

- What is the conflict between Captain James Galt-Brown and Colonel Tye? [*Galt-Brown wants to lead Tye’s troops because he is of higher rank. Tye does not want him to.*]



Page 4:

- What are Galt-Brown and Tye arguing about? [*Military tactics. Tye wants to fight from behind trees—"guerilla" style. Galt-Brown wants to fight by lining up in the open and shooting.*] What reasoning does each use to support these tactics? [*Tye argues that exposing oneself to death needlessly doesn't help the cause. Galt-Brown argues that they should fight according to the customs and rules of war of the time.*]

Page 5:

- Make sure students understand that a colonel is a higher rank than a captain. However, Tye is not an "official" colonel because African American officers were not allowed to hold an officer's rank.
- What is the conflict? [*The British captain is ordering Colonel Tye to follow his orders. Tye is resistant.*] Why is Tye resistant? [*He thinks they will come to harm.*]

Page 6:

- In panel 1, what can you tell about the colonial army from this panel? [*It has horses and a cannon. It looks better equipped than Tye's army.*] What happens to the captain when he engages the colonial army? [*They fire at him, wounding him. Tye orders one of his men to save the captain.*] What is ironic about this? [*The captain's poor strategy requires Tye to end up saving the man who orders him into battle.*]

Page 7:

- Why isn't Colonel Tye an actual colonel? [*Black soldiers are not allowed to be officers.*]
- Make sure students understand Crogan's point that the "cry of freedom" from British rule that the American colonists fought for seemed like hypocrisy to African American slaves who were enslaved by Americans. They feared that they would be treated even worse without the British presence.

Page 8:

- What does the conversation in panels 1–6 reveal about the captain? [*He is prejudiced. He believes a black officer can't be as good a leader because of his education.*] Does Crogan agree? [*No.*] What does Crogan say when given permission to speak "frankly"? [*That Tye's understanding of military strategy useful in these woods is better than the Captain's. The Captain's misguided strategy almost got Tye's men all killed.*]

Page 9:

- What is surprising about the Captain's response to Tye's question, "Are you all right, sir?" [*The Captain's attitude seems to have changed.*] What does the Captain learn about the results of the battle? [*That not one of Tye's men has been killed. That Tye has killed a dozen of the revolutionaries and that the rest retreated.*]

Page 10:

- How has the Captain's attitude about Tye changed? What panel on this page tells you? [*The Captain comes to respect and admire Tye as a military leader. In the last panel, he grants Tye all the respect and authority of a commissioned colonel.*]



After Reading

4. For homework or in class, have students fill out the worksheet Finding Text Evidence: Captain Galt-Brown's Beliefs.
5. Discuss the message of the story. What does Captain Galt-Brown learn through his encounter with Colonel Tye and his brigade? Ask students to support their ideas with text evidence they collected for their chart.
6. Discuss what prejudices or biases people hold today. Are they the same or different?

Assessment

Ask students to write a few paragraphs on one of the following questions. Have them support their ideas with details from "The Black Brigade" and examples from their own lives.

- What series of events causes the captain to rethink his ideas about Tye? What "lesson" does the Captain learn in this episode?
- America has a long history of racial prejudice. How does prejudice express itself in this comic? Discuss if prejudice still exists and, if so, how it reveals itself. Are there modern situations that remind you of this encounter? Explain.
- It is often said that "history is written by the victors." How would Tye's story be told differently if the Loyalists had won the Revolutionary War?

Extended Learning

- If you paired this comic with "George Washington: Action President!," ask students to discuss what qualities made Washington and Tye heroes. Are they the same or different? Explain.
- If students are interested in this comic, refer them to Chris Schweitzer's historical-fiction series about the Crogan family. In particular, they may be interested in *Crogan's Loyalty*, which tells the story of two brothers who fight on opposing sides during the Revolutionary War. www.onipress.com/title/crogans-loyalty



The Black Brigade: Finding Text Evidence

Name _____ Date _____

Directions: How did Captain Galt-Brown's beliefs change before and after his encounter with Colonel Tye? Fill in the chart with your ideas and add text evidence. The first box shows an example.

BEFORE	AFTER
<p>My idea:</p> <p><i>Captain Galt-Brown believed that black soldiers couldn't be good leaders.</i></p> <p>Text evidence:</p> <p><i>He says, "An officer ought be raised an officer and though a black man might be lucky on the field with odds favored. . . . He'll not have the cool head and mannered reason of his betters." (p. 8)</i></p>	<p>My idea:</p> <p>Text evidence:</p>
<p>My idea:</p> <p>Text evidence:</p>	<p>My idea:</p> <p>Text evidence:</p>

Answer Key

The Black Brigade: Finding Text Evidence

Student worksheets will vary. See below for possible responses.

BEFORE	AFTER
<p>My idea: Captain Galt-Brown believed that black soldiers couldn't be good leaders.</p> <p>Text evidence: "An officer ought be raised an officer and though a black man might be lucky on the field with odds favored. . . . He'll not have the cool head and mannered reason of his betters." (p. 8)</p>	<p>My idea: Captain Galt-Brown believed that black soldiers can be excellent leaders.</p> <p>Text evidence: "You needn't ask my leave, sir. I am but a mere captain . . . you are a colonel." (p. 10)</p>
<p>My idea: Captain Galt-Brown believed that a smaller force couldn't win against a larger force.</p> <p>Text evidence: "You can't hope to match your lot against higher numbers and artillery." (p. 3)</p>	<p>My idea: Captain Galt-Brown believed that a small force with a great leader can beat a much larger force.</p> <p>Text evidence: "I'm not foolish 'colonel,' and that foolishness has painted your men with a blood-brush." (p. 9)</p> <p>"They had you three to two, with artillery, and you didn't lose a single man?" (p. 9)</p> <p>"I've never seen the like." (p. 9)</p>

Lesson Plan for
Field Trip by Russell Lissau and Marvin Mann
By Sari Wilson, Curriculum Consultant

Overview: Through reading “Field Trip,” students will gain a background in people, events, and culture of the Middle Ages. “Field Trip” can be used as a stand-alone piece, as an introduction to a unit on the Medieval period, or to generate independent research ideas on the Middle Ages.

Subject: Social Studies—The Middle Ages in Europe

Grade Level: Grades 3–6

Standards: Social Studies

Common Core State Standards: www.corestandards.org

- **Grade 4:** Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text. [ELA. RI.4.3]

McREL Compendium: www2.mcrel.org/compendium

- **Grades 3–6:** Understands and knows how to analyze chronological relationships and patterns [Historical Thinking, 1]
- **Grades 3–5:** Knows how to identify patterns of change and continuity in the history of the community, state, and nation, and in the lives of people of various cultures from times long ago until today [Historical Thinking, 1.4]
- **Grades 5–6:** Understands the redefinition of European society and culture from 1000 to 1300 CE [World History, Standard 20]

Objectives

- Students will gain background in the Medieval period of European history.

Vocabulary

- **arms:** weapons
- **armor:** defensive covering for the body
- **feudal system:** system in which people received land from kings or lords in exchange for their work or loyalty
- **knights:** soldiers who protected lords or kings
- **lord:** a powerful land owner who ruled over an area
- **monarch:** a king or queen who rules a territory



Materials

- “Field Trip” comic by Russell Lissau and Marvin Mann
- student worksheets:
 - The Middle Ages: Research Chart
 - The Middle Ages: Historical Thinking
- pencils

Time Frame: one to three class periods



Procedure

Before Reading

1. Ask students what they know about the Middle Ages in Europe. What aspects are they familiar with? On chart paper or a white board, write words students know related to this time period.
2. Set the scene by giving some basic facts about the Medieval period. Tell students that the Middle Ages began around 400 CE and lasted until about 1400 CE. In the early part of the Middle Ages, Europe was divided into tribes that fought each other. In the middle and later part of the Middle Ages, the feudal system developed. Under this system, peasants lived on and farmed the land owned by lords. Knights were powerful soldiers that protected lords and kings. The famous stories of brave knights, lords, kings, queens, and ladies in waiting all come from this period.
3. Either project the comic “Field Trip” so the entire class can see it (using a document camera or computer connected to a projector) or distribute copies to students. Have students look through the comic without reading the text. What do they think the comic will be about? What makes them think so? Remind them that in comics, information comes from pictures as well as words (and they way they work together). Have students make predictions based on visual cues.

During Reading

4. Give students a few minutes to read “Field Trip” to themselves. Then conduct a group read. You may wish to have students play different parts as they read through the comic. Use the below questions to check for comprehension.

Page 1:

- What is the setting? [*an art museum*] What is the situation? [*a field trip*] Who are the main characters? [*a group of students, one is named Caleb*] Why do you think the artist drew all the characters as different kinds of animals? [*Possible response: The artist wanted to show how each person is unique.*]

Page 2:

- What are the students’ feelings about museums? [*Caleb thinks it’s boring, others seem interested.*] What is the conflict in this story? [*Caleb thinks the museum is boring, but his teacher wants him to see it as interesting.*] Where do you think Mrs. Medieros is taking them? [*Many possible answers*]

Page 3:

- Remind students that many objects from the past had a function in the society of their time and were also viewed as art. Examples are jewelry, bowls, and urns.

- Where are the students now? [*Arms and Armor gallery.*] What do they learn that changes their ideas about museums? [*They learn that weapons are art, too.*]

Page 4:

- Explain that during the Middle Ages in Europe, war and invasions between countries and kingdoms were very common. From 1286 to 1328, Scotland fought England for its independence. Have students find Scotland and England on the map.
- What medieval weapons do students learn about on this page? [*The claymore sword*] What is an example of its use? [*Fight for Scottish independence*]

Page 5:

- What medieval weapon do students learn about on this page? [*crossbow*] What was the origin of this weapon? [*dates back to China and Greece*]

Page 6:

- What was the entertainment of the Middle Ages? [*knights' tournaments and jousting*]

Page 7:

- What was an advantage and disadvantage of Medieval armor? [*advantage: very strong; disadvantage: very heavy*] What led to the demise of heavy Medieval armor? [*the invention of gunpowder*]

Page 8:

- How have the characters' thoughts and feelings about art museums changed? [*They are excited. They learned that some weaponry is art.*]

After Reading

5. Hand out The Middle Ages: Research Chart to students. Individually, or in small groups, have students fill out the chart. Ask them to look back through the comic and make notes about people, places, dates, and objects that characterized this time period. Discuss: What surprised them? What inferences can they draw about the Middle Ages?

Assessment

For homework or in class, have students fill out The Middle Ages: Historical Thinking worksheet. These questions encourage students to analyze connections between the past and present.

Extension

- Discuss how students feel about museums. Have them pick a local museum exhibit to go to and report back. What surprised them most about the exhibit? What did they learn?
- Have students choose a person, place, object, or aspect of life in the Middle Ages. Then have them present their findings to the class. Tell them to include the two facts that were most surprising to them.
- New inventions produce change. What new inventions were developed in the Middle Ages. How did they change the culture of the Middle Ages? Have students research this question and report their findings.



Answer Key

The Middle Ages: Research Chart

PEOPLE	PLACES
William Wallace, Scottish leader Louis VII, King of France	Scotland England France
EVENTS	OBJECTS
Scotland fights England for independence (13th and 14th centuries) Battle of Hastings (1066) jousting tournaments	Claymore sword Crossbow

The Middle Ages: Historical Thinking

1. **Possible answers:** Culture of the Middle Ages was violent, difficult, exciting, dangerous. Students should show use of details—visual or textual—to support their inferences.
2. Answers will vary. Students should show an effort to connect the past to the present and draw connections between the two—an important part of “historical thinking.” Students might, for example, point out continued violence in the modern world and continued use of weapons. However, the types of weapons and how they are used have changed considerably from medieval times (e.g., guns instead of swords, bombs instead of cross bows).

The Middle Ages: Research Chart

Name _____ Date _____

Directions: Look back through “Field Trip.” What did you learn about the people, places, events, and objects during the Middle Ages? Fill in the chart below with details.

People	Places
Events	Objects

The Middle Ages: Historical Thinking

Name _____ Date _____

Directions: Answer the questions below.

1. Culture is the way of life of a group of people. Look over the notes on your Research Chart. How would you describe the culture of the Middle Ages? Use details to support your ideas.

2. What similarities can you see between the Middle Ages and our modern world? What differences? Support your ideas with details from "Field Trip."



Lesson Plan for
George Washington: Action President!
by Fred Van Lente and Ryan Dunlavey

By Sari Wilson, Curriculum Consultant

Overview: “George Washington: Action President!” gives students an excellent introduction to key concepts in American History and Civics, including the formation and functions of the United States federal government. Students will also gain a deeper understanding of the forces that led to the American Revolutionary War. Recommended for use with an early American History or Civics unit.

Subject: Social Studies—President George Washington and the American Revolutionary War

Grade Level: Grades 3–6

Standards: Social Studies

Common Core State Standards: www.corestandards.org

- **Grade 4:** Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text. [\[RI.4.3\]](#)

McREL Compendium: www2.mcrel.org/compendium

- **Grades 3–5:** Knows how to identify patterns of change and continuity in the history of the community, state, and nation, and in the lives of people of various cultures from times long ago until today [\[Historical Thinking, 1.4\]](#)
- **Grades 5–6:** Understands the causes of the American Revolution, the ideas and interests involved in shaping the revolutionary movement, and reasons for the American victory [\[U.S. History, Era 3, Standard 6\]](#)
- **Grades 5–6:** Understands the institutions and practices of government created during the Revolution and how these elements were revised between 1787 and 1815 to create the foundation of the American political system based on the U.S. Constitution and the Bill of Rights [\[U.S. History, Era 3, Standard 8\]](#)
- **Grades 3–5:** Understands why Americans and those who led them (e.g., George Washington, Benjamin Franklin, and Thomas Jefferson) went to war to win independence from England [\[K-4 History, Standard 4, Level II, grades 3–4\]](#)

Objectives

Students will understand:

- the myths and facts about George Washington
- the origins of the American Revolutionary War
- the founding fathers’ concept of “freedom”
- the origins of American political institutions



Vocabulary

- **myth:** a popular belief that embodies the ideals of a society or people
- **self-restraint:** control over emotions and actions; self-control
- **innate:** existing in one from birth; inborn
- **corrupt:** guilty of dishonest practices; crooked
- **aristocracy:** a member of a ruling class or of the nobility
- **monarchy:** a nation ruled by a sole ruler, especially a king or queen
- **militia:** an army composed of ordinary citizens
- **colony:** a group of people who settle in a new territory but maintain ties with their homeland
- **punitive:** inflicting punishment
- **debt:** something that is owed
- **taxes:** money owed a government for its support or services
- **draft:** to select from a group for army service

Materials

- “George Washington: Action President!” comic by Fred Van Lente and Ryan Dunlavey
- Timeline of the Revolutionary War period of American history (optional)
- student worksheets:
 - President George Washington: Myth or Fact?
 - The Revolutionary War: Causes and Effects
- pencils

Time Frame: two to four class periods

Procedure

Before Reading

1. Discuss what students know about George Washington. Distribute the worksheet *President George Washington: Myth or Fact?* to students and have them fill out the first column. (They will fill out the second column after they read this comic.) Tell them they are going to read a very interesting comic about George Washington and his role in the Revolutionary War that might challenge—or confirm—some of their assumptions.
2. Discuss the difference between myth and fact, and have students give examples of each. Establish that a myth is a popular belief and can be based on false ideas or assumptions. Establish that a fact is information that can be independently verified.
3. You may wish to create or locate a timeline of the Revolutionary War period of American history. A good one can be found at www.ushistory.org/declaration/revwartimeline.htm. As you read, have students use the timeline for points of reference.



During Reading

4. "George Washington: Action President!" is a substantial piece of nonfiction. Have students do a first read at home.
5. Follow-up the at-home read with an in-class group read, stopping frequently for comprehension checks and discussion.

Page 1:

- What two creation myths does the artist depict on this page? [*The Aztec and the Roman*]
- What power might these myths have had for the ancient civilizations that created them? [*They explained the origins of their civilizations.*]

Page 2:

- You may need to unpack some of the concepts on this page for students. It may help to review the vocabulary.
- What are creation myths for the United States? [*Possible responses: Some farmers beat the English without help; they fought in the name of their own personal freedom; the "Founding Fathers" were average citizens of the time, etc.*] What is the author saying can be the problem with creation myths—and myths in general? [*They can be mistaken for the truth.*]

Page 3:

- Help students "read the visuals" on this page by analyzing the artist's intent.
- What does the author say are the differences between myth and fact? [*Myths are the stories people want to hear. Facts are information that is true.*] How is this concept conveyed by the artist? [*Panel 1 shows a static Washington museum bust representing "myth;" panel 4 shows a dynamic action hero representing "fact."*]

Page 4:

- What are some facts that you learn about George Washington's early life on this page? [*Washington was from one of the wealthiest families in the American colonies. Washington's father and older brother died when he was young. Washington owned hundreds of slaves.*]

Page 5:

- How did Washington define "freedom"? [*Washington believed freedom came from self-discipline and restraint.*] Does this differ from your understanding of freedom? Explain. [*Answers will vary*]

Page 6:

- You may wish to review the French and Indian War on your timeline.
- What physical attributes contributed to George's being seen as a powerful soldier? [*He was tall and strong.*] What did Washington initially think of the colonial militia he was appointed to lead? [*It was undisciplined and unprofessional.*]

Page 7:

- Describe the militia of the early American colonies. [*Possible response: It was a volunteer army made up mostly of poor soldiers who didn't have important positions in their communities.*]



Page 8:

- You may wish to review the Boston Tea Party, Intolerable Acts, and Continental Congress of 1775 on your timeline. Help students understand the cycle of protest and punishment.
- What was the effect of England's defeat of France? [*Soldiers would remain in America. Colonists would be taxed more.*] What was the response of the American colonists to these taxes? [*They protested.*] What was England's reaction to these protests? [*More harsh laws.*]

Page 9:

- What was England's strategy at the start of the American Revolutionary War? [*To defeat Washington's army in New York City.*] What advantage did the British have? [*They had a larger and better-organized army.*]

Page 10:

- What successful strategy did Washington pursue against the English in Princeton, New Jersey? [*Washington created a Christmas Eve raid on the enemy.*] Why was this victory so important? [*It inspired support for the American independence movement.*]

Page 11:

- What strategies did Washington use to avoid defeat? [*He kept the Continental Army from having to surrender. He got outside training for his soldiers.*]

Page 12:

- What events turned the tide of the war in favor of the Americans? [*France entered the war on the colonists' side.*] How did Washington respond to ultimate victory? [*With deep humility*]

Page 13:

- What was the problem with the first national government for America? [*The federal government wasn't powerful enough to have any real effect.*]
- How does the image in panel 2 convey this idea? [*"Federal government" is depicted as a small caged animal surrounded by its powerful owners.*]

Page 14:

- How did the Constitutional Convention of 1789 redefine the American government? [*It created an executive branch of the government, which included the President and the cabinet positions.*]
- How does the artist depict the power of the new federal government? [*It is person-shaped to show that the president is the embodiment of the new nation. Each drawer of the filing cabinet below the president shows the functions of the presidents' powerful cabinet.*]

Page 15:

- What was one criticism of this new expanded government? [*The new executive branch put too much power in the hands of one person—the president.*] Why do you think Washington was considered as the obvious choice for the first American president? [*He was a reluctant leader. He saw the dangers of too much power.*]

Page 16:

- What was the biggest challenge Washington faced as president? [*The biggest challenge he faced was the national debt. Help students understand the meaning of debt.*] What did Alexander Hamilton do to solve the national debt problem? [*He had the federal government take on the states' debt and raised taxes.*]



Page 17:

- Why did the Pennsylvanian settlers rebel against this new federal government? [*They felt unfairly targeted by new taxes.*] In panel 2, why does the farmer say “this sounds vaguely familiar”? What is ironic about this situation? [*The colonists’ rebellion against English taxes led to the Revolutionary War and independence from England. Now we see the same cycle at work as farmers protest taxes by the new American federal government.*]

Page 18:

- What was George Washington’s response to the so-called “Whiskey Rebellion”? [*He gathered an army and put down the rebellion. He had the rebellion’s leaders tried. At the last minute he pardoned the leaders.*] What was the effect of his actions? [*A decrease in Washington’s popularity.*]

Page 19:

- How did Washington justify his actions during the Whiskey Rebellion in his “farewell address”? [*He said that people were free to establish the government they wanted. However, once the government was established, the citizens had a duty to obey this government.*]
- You may wish to discuss how Washington’s farewell address furthers his ideas about freedom, self-restraint, and obligation.

Page 20:

- What actions does Washington take at the end of his life that the writer admires? What words or phrases tell you? [*Washington orders his doctors to stop treating him, thus acting like “a true general”; he frees his slaves after his and his wife’s deaths and in doing so “led by example.”*] What is the author’s overall attitude—or tone—toward Washington in this piece? [*Possible answers are respectful and admiring.*]

After Reading

5. Have students complete the second column of the President George Washington: Myth or Fact? worksheet. Discuss whether students’ ideas of George Washington have changed. What was myth? What was fact?
6. For homework or in class, have students fill out The Revolutionary War: Causes and Effects. Discuss the multiple causes to the Revolutionary War—and the multiple effects that followed.

Assessment

Ask students to write a few paragraphs on one of the following. Have them support their ideas with details from “George Washington: Action President!” and examples from their own lives.

- Discuss how the portrait of George Washington as a man differs from the myth.
- How did Washington define freedom? How does Washington’s idea of freedom differ from today’s understanding of freedom?
- What were the causes of the American Revolutionary War? What were some effects of this war?

Answer Key

George Washington: Myth or Fact?

Answers will vary. Student's worksheets should demonstrate that they understand the difference between myth and fact. They should show that they in some way used information they learned in "George Washington: Action President!" to assess their prior knowledge.

The Revolutionary War: Causes and Effects

Answers will vary. Students should show an effort to draw connections between ideas, incidents and events—an important part of "historical thinking."

Possible Causes:

- colonists' strong self-reliance
- poorly trained colonial militia
- bad performance of colonial militia in French-Indian War
- British soldiers stationed in colonies
- British taxes on colonists
- colonial anti-tax protests
- British punitive laws

Possible Effects:

- establishment of American identity
- George Washington became hero and first president
- birth of an American federal government and political institutions we have today

President George Washington: Myth or Fact?

Name _____ Date _____

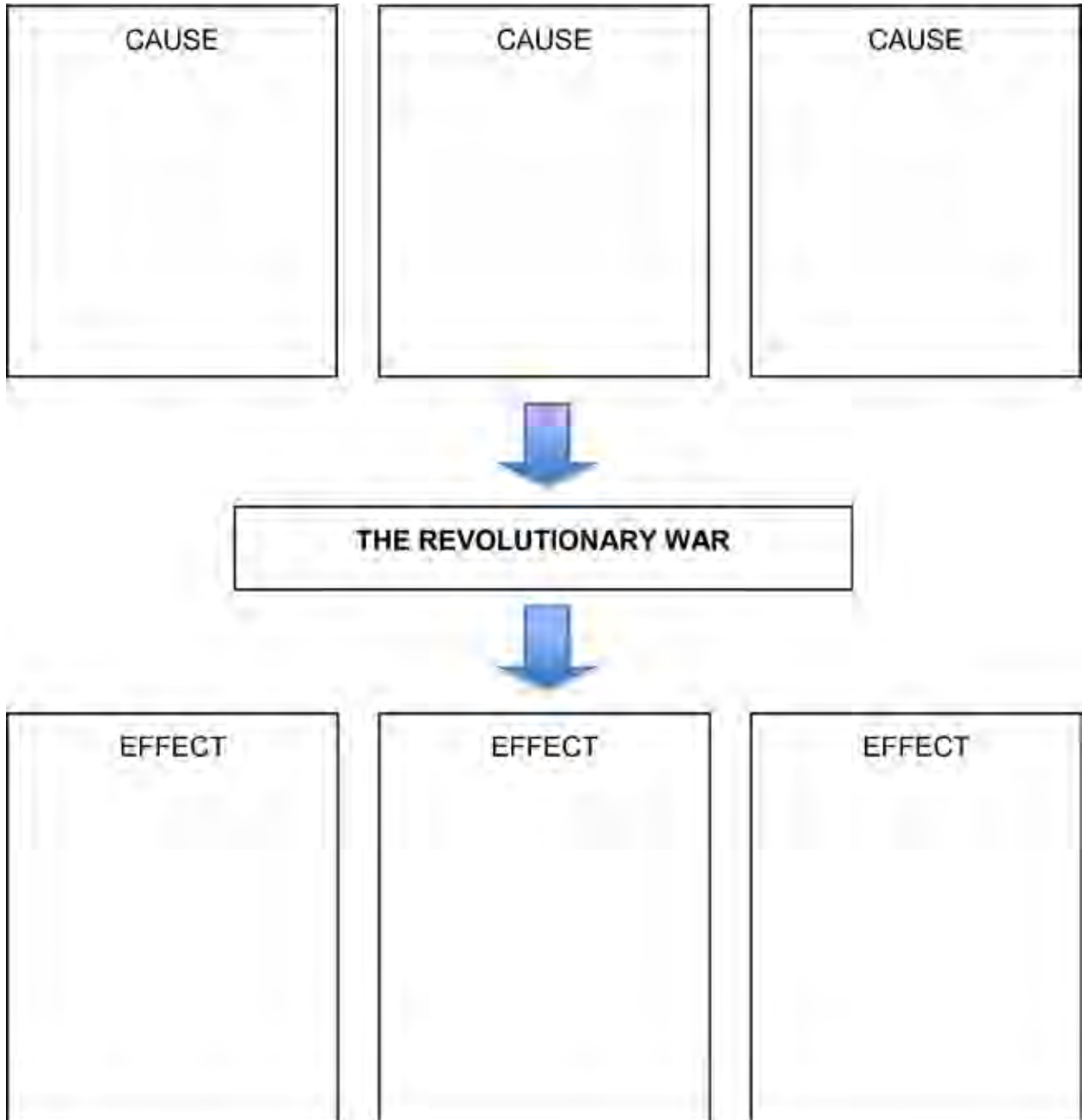
Directions: Write at least three pieces of information you know about Washington in the left column. After reading "George Washington: Action President!," write at least three things that you learned about George Washington.

What I already know about George Washington	What I learned about George Washington
<p>What was the most surprising thing you learned about president George Washington?</p>	

The Revolutionary War: Causes And Effects

Name _____ Date _____

Directions: Fill in the graphic organizer with details from "George Washington: Action President!"



Resources for Teaching With Comics

Text Resources

A Parent's Guide to the Best Kids' Comics: Choosing Titles Your Children Will Love by Snow Wildsmith and Scott Robins (Krause Publications, 2012)

Two librarians review over 100 graphic novels with another 750 additional title recommendations for children from pre-kindergarten to eighth grade.

Building Literacy Connections with Graphic Novels: Page by Page, Panel by Panel by Dr. James Carter (National Council of Teachers of English, 2007)

The first informational and educational text to solely address teaching comics and graphic novels in secondary settings, and it remains highly relevant today.

Comics and Sequential Art: Principles and Practices from the Legendary Cartoonist by Will Eisner (W. W. Norton & Company, 2008)

Graphic Storytelling and Visual Narrative by Will Eisner (W. W. Norton & Company, 2008)

Along with coining the terms “graphic novel” and “sequential art,” Eisner also wrote two seminal texts on comics aesthetics, pedagogy and process.

Connecting Comics to Curriculum: Strategies for Grades 6–12 by Karen W. Gavigan and Mindy Tomasevich (Libraries Unlimited, 2011)

Covers every aspect of graphic novel use in libraries and classrooms, including lesson plans for teaching a variety of middle and high school standards with graphic novels.

Manga High by Dr. Michael Bitz (Harvard Education Press, 2009)

When Commas Meet Kryptonite: Classroom Lessons from the Comics Book Project by Dr. Michael Bitz (Teacher's College Press, 2010)

Dr. Bitz's two texts provide proven advice for teachers and librarians who want to implement comic books and graphic novels into their curriculum, with a special emphasis on writing and composition.

Teaching Graphic Novels: Practical Strategies for the Secondary ELA Classroom by Dr. Katie Monnin (Maupin House, 2013)

Teaching Early Reader Comics and Graphic Novels by Dr. Katie Monnin (Maupin House, 2013)

Teaching Reading Comprehension with Graphic Texts by Dr. Katie Monnin (Maupin House, 2013)

Using Content Area Graphic Texts for Learning: A Guide for Middle-Level Educators by Dr. Katie Monnin and Meryl Jaffe (Maupin House, 2013)

From the early reader to the advanced reader, Dr. Monnin's texts cover teaching with comic books and graphic novels in various K–12 settings.

The Graphic Novel Classroom: POWERful Teaching and Learning with Images by Maureen M. Bakis (Corwin, 2011)

This comprehensive resource includes teaching and learning models, text-specific detailed lesson units, and examples of student work.

Understanding Comics: The Invisible Art by Scott McCloud (HarperCollins, 1994)

Presented in comic format, this is the foundational text for defining and—as the title says—understanding comics.

Online Resources

Author site for Dr. Katie Monnin

<http://maupinhouse.com/index.php/authors/katie-monnin.html>

Educational resources, including copy-friendly worksheets for home, classroom and library use

Billy Ireland Cartoon Library and Museum

<http://library.osu.edu/about/locations/billy-ireland-cartoon-library-and-museum/>

The premier library and museum for cartoons, comics, and graphic novels

Diamond Bookshelf

www.diamondbookshelf.com/Home/1/1/20/163

A treasure trove of articles, reviews, suggestions and lesson plans

Graphic Novels 101 by Anastasia Betts

www.graphicnovels101.com

Information on visual literacy and using graphic novels, including presentation materials

No Flying, No Tights by Robin Brenner

www.noflyingnotights.com

A rich resource full of comic book and graphic novel reviews

Reading with Pictures

www.readingwithpictures.org

A nonprofit organization dedicated to getting comics into schools and to getting school into comics. Contains resources for educators, academics and librarians—including comprehensive collections of lesson plans, research papers, recommended reading lists, and much more

SANE (Sequential Art and Narrative in Education) Journal

www.sanejournal.net

Research-based resources on how to teach comics and graphic novels to K-12 students

The Comic Book Project

www.comicbookproject.org/

Helps teachers design student-centered curriculum using comics as literature

The Graphic Classroom by Chris Wilson

www.graphicclassroom.org/

Reviews of comics and graphic novels specifically for classroom use

The Secret Origin of Good Readers by Robyn A. Hill

www.night-flight.com/secretorigin/

Provides a variety of resources for anyone interested in comic books and/or graphic novels: reviews, links, articles, and downloadable lesson plans

Graphic Texts for Teaching Common Core State Standards

Grades K-1

Texts	Common Core State Standards
<p>Fiction – Wordless Texts</p> <ul style="list-style-type: none"> • <i>The Adventures of Polo</i> series, by Regis Faller, Roaring Brook Press • <i>Korgi*</i> series, by Christian Slade, Top Shelf Productions • <i>Owly*</i> series, by Andy Runton, Top Shelf Productions • <i>Robot Dreams*</i>, by Sara Varon, First Second Books • <i>The Snowman</i>, by Raymond Briggs, Random House Books for Young Readers 	<p>CCSS.ELA-Literacy.RL.K.1, K.2, K.3, K.7**, K.9, K.10</p> <p>CCSS.ELA-Literacy.RL.1.1, 1.2, 1.3, 1.7**, 1.9</p>
<p>Fiction</p> <ul style="list-style-type: none"> • <i>Barry's Best Buddy</i>, by Renée French, Toon Books • <i>Benny and Penny</i> series, by Geoffrey Hayes, Toon Books • <i>The Big Wet Balloon</i>, by Liniers, Toon Books • <i>Bumperboy*</i> series, by Debbie Huey, AdHouse Books • <i>Guinea Pig, Pet Shop Private Eye</i> series, by Colleen AF Venable, Graphic Universe • <i>Johnny Boo</i> series, by James Kochalka, Top Shelf Productions • <i>Laundry Day</i> by Maurie J. Manning, Clarion Books • <i>Little Mouse Gets Ready</i>, by Jeff Smith, Toon Books • <i>Long Tail Kitty</i> by Lark Pien, Blue Apple Books • <i>Mr. Badger and Mrs. Fox</i> series, by Brigitte Luciani and Eve Tharlet, Graphic Universe 	<p>CCSS.ELA-Literacy.RL.K.1, K.2, K.3, K.4, K.6, K.7**, K.9, K.10</p> <p>CCSS.ELA-Literacy.RL.1.1, 1.2, 1.3, 1.4, 1.7**, 1.9</p>
<p>Folktales and Fairytales</p> <ul style="list-style-type: none"> • <i>Fairy Tale Comics: Classic Tales told by Extraordinary Cartoonists*</i>, edited by Chris Duffy, First Second Books • <i>Nursery Rhyme Comics: 50 Timeless Rhymes from 50 Celebrated Cartoonists</i>, edited by Chris Duffy, First Second Books • <i>The Three Pigs</i> by David Wiesner, Clarion Books 	<p>CCSS.ELA-Literacy.RL.K.1, K.2, K.3, K.4, K.5, K.7**, K.9, K.10</p> <p>CCSS.ELA-Literacy.RL.1.1, 1.2, 1.3, 1.7**, 1.9</p>
<p>Informational Text</p> <ul style="list-style-type: none"> • First Graphics* series (Body Systems, Dinosaurs, My Community, Nature Cycles, Science Mysteries, Seasons, Wild Earth, Healthy Eating), Capstone Press 	<p>CCSS.ELA-Literacy.RI.K.1, K.2, K.3, K.5, K.6, K.7**, K.10</p> <p>CCSS.ELA-Literacy.RI.1.1, 1.2, 1.3, 1.4, 1.6, 1.7**, 1.10</p>

*Texts on this list are recommended for instruction with students in grades K-1, AND UP.
Titles with an asterisk will be of interest to older readers as well.

**These standards lend themselves especially well to the graphic format as they specifically call for students to analyze images.

Graphic Texts for Teaching Common Core State Standards

Grades 2-3

Texts	Common Core State Standards
Fiction <ul style="list-style-type: none"> • <i>Binky the Space Cat*</i> by Ashley Spires, Kids Can Press • <i>Lions, Tigers, and Bears</i>, by Mike Bullock, Image Comics • <i>Odd Duck*</i>, by Cecil Castellucci & Sara Varon, First Second Books • <i>Pet Robots*</i>, by Scott Christian Sava & Diego Jourdan, Idea & Design Works LLC • <i>Zita the Space Girl*</i>, by Ben Hatke, First Second Books 	CCSS.ELA-Literacy.RL.2.1, 2.3, 2.5, 2.6, 2.7** CCSS.ELA-Literacy.RL.3.1, 3.3, 3.4, 3.6, 3.7**
Fiction Series <ul style="list-style-type: none"> • <i>Babymouse*</i> series, by Jennifer L. Holm and Matthew Holm, Random House Books for Young Readers • <i>Frankie Pickle</i> series, by Eric Wight, Simon & Schuster Books for Young Readers • <i>G-Man*</i> series, by Chris Giarruso, Image Comics • <i>Knights of the Lunch Table*</i> series, by Frank Cammuso, Scholastic Press • <i>Magic Pickle</i> series, by Scott Morse, Scholastic Press • <i>Magic Trixie*</i> series, by Jill Thompson, HarperCollins • <i>Sticky Burr</i> series, by John Lechner, Candlewick Press 	All from Fiction and CCSS.ELA-Literacy.RL.3.9
Myths and Folktales <ul style="list-style-type: none"> • <i>The Shark King*</i>, by R. Kikuo Johnson, Toon Books 	All from Fiction and CCSS.ELA-Literacy.RL.2.2, 3.2
Nonfiction <ul style="list-style-type: none"> • <i>I'm Not a Plastic Bag*</i>, by Rachel Hope Allison, Archaia Entertainment, LLC • <i>To Dance: A Ballerina's Graphic Novel*</i>, by Siena Cherson Siegel & Mark Siegel, Atheneum Books for Young Readers 	CCSS.ELA-Literacy.RI.2.1, 2.6, 2.8 CCSS.ELA-Literacy.RI.3.1, 3.2, 3.3
Informational Text <ul style="list-style-type: none"> • <i>Buzz Beaker</i> series by Scott Nickel, Stone Arch Books (science) • <i>Tail-end Charlie*</i> by Mick Manning & Brita Granstrom, Frances Lincoln Children's Books (biography, history) • <i>Zig and Wikki</i> series, by Nadja Spiegelman & Trade Loeffler, Toon Books (science) 	CCSS.ELA-Literacy.RI.2.1, 2.4, 2.6, 2.7** CCSS.ELA-Literacy.RI.3.1, 3.2, 3.4, 3.7**

*Texts on this list are recommended for instruction with students in grades 2-3, AND UP. Titles with an asterisk will be of interest to older readers as well. Be sure to look at the lists for lower grade levels, as some titles there will be of interest to this age group.

**These standards lend themselves especially well to the graphic format as they specifically call for students to analyze images.

Graphic Texts for Teaching Common Core State Standards

Grades 4-5

Texts	Common Core State Standards
Fiction – Wordless Text • <i>The Arrival*</i> , by Shaun Tan, Arthur A. Levine Books	CCSS.ELA-Literacy.RL.4.1, 4.2, 4.3 CCSS.ELA-Literacy.RL.5.2, 5.3, 5.7**
Fiction • <i>Amelia Rules!</i> series by Jimmy Gownley, Atheneum Books for Young Readers • <i>Amulet</i> series, by Kazu Kibuishi, Scholastic Press • <i>Dance Class</i> series by Beka & Crip, Papercutz • <i>Giants Beware!</i> by Jorge Aguirre & Rafael Rosado, First Second Books • <i>Princess at Midnight</i> , by Andi Watson; web comic: pmidnight.blogspot.com ; print: Image Comics • <i>Spiral-bound</i> , by Aaron Renier, Top Shelf Productions • <i>Three Thieves</i> series by Scott Chantler, Kids Can Press	CCSS.ELA-Literacy.RL.4.1, 4.2, 4.3 CCSS.ELA-Literacy.RL.5.1, 5.2, 5.3, 5.4, 5.7**
Myths and Folktales • <i>Graphic Myths and Legends*</i> series, Graphic Universe • <i>Olympians*</i> series, by George O'Connor, First Second Books • <i>Rapunzel's Revenge</i> and <i>Calamity Jack</i> by Dean and Shannon Hale and Nathan Hale, Bloomsbury Publishing • <i>Trickster: Native American Tales*</i> , edited by Matt Dembicki, Fulcrum Publishing	All from Fiction and CCSS.ELA-Literacy.RL.4.4, 4.9
Genre Fiction • <i>Bone*</i> series, by Jeff Smith, Scholastic Inc. (adventure) • <i>The Dreamland Chronicles*</i> by Scott Sava; webcomic www.thedreamlandchronicles.com ; print: Idea & Design Works LLC (adventure) • <i>The Hardy Boys*</i> series, by Scott Lobdell, Lea Hernandez, & Daniel Rendon, Papercutz (mystery) • <i>Nancy Drew*</i> series, by Stefan Petrucha, Sarah Kinney, and Sho Murase, Papercutz (mystery) • <i>Snarked!</i> by Roger Langridge, BOOM! (adventure)	All from Fiction and CCSS.ELA-Literacy.RL5.9

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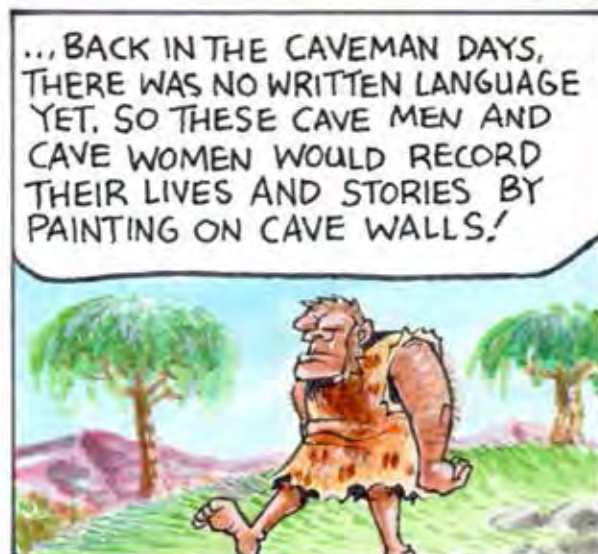
Graphic Texts for Teaching Common Core State Standards

Grades 4-5 (cont.)

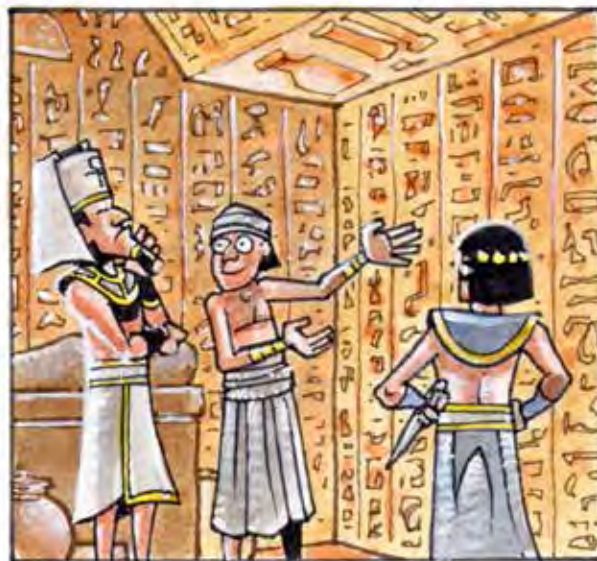
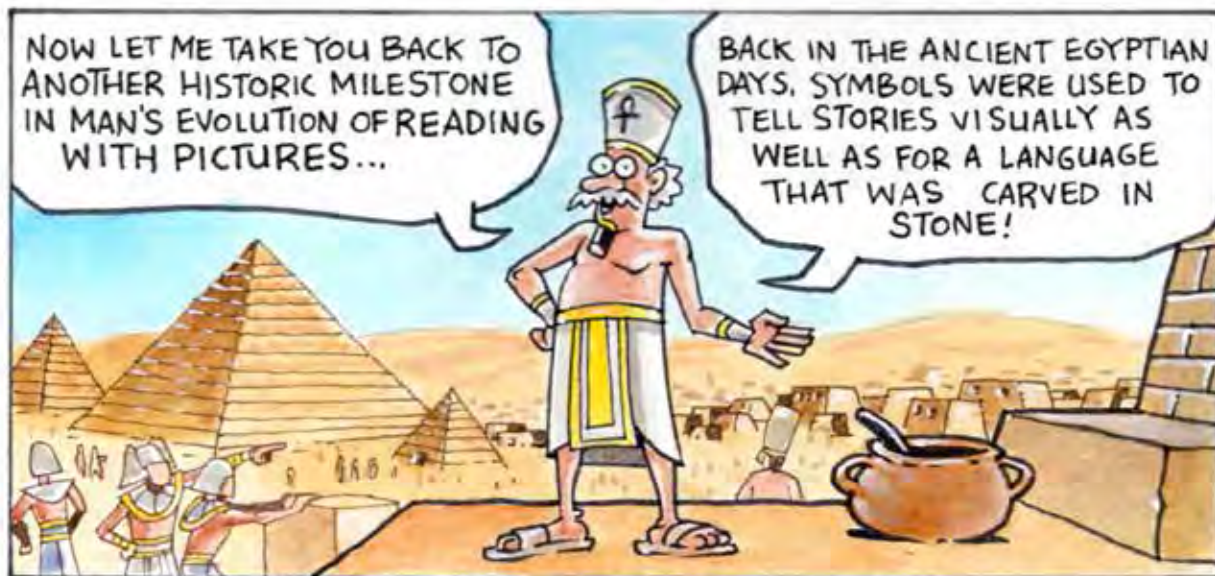
<p>Non-Fiction Biography</p> <ul style="list-style-type: none"> • <i>Graphic Biographies</i> series, Saddleback Educational Publishing • <i>Great Figures in History</i> series*, YKids • <i>Houdini the Handcuff King*</i>, by Jason Lutes & Nick Bertozzi, Hyperion Paperbacks for Children • <i>No Girls Allowed: Tales of Daring Women Dressed as Men for Love, Freedom and Adventure*</i>, by Susan Hughes & Willow Dawson, Kids Can Press • <i>Presidents of the United States Bio-Graphics</i> series, by Joeming Dunn, Magic Wagon • <i>Smile</i>, by Raina Telgemeier, Scholastic Press 	<p>CCSS.ELA-Literacy.RL.4.1, 4.3, 4.6</p> <p>CCSS.ELA-Literacy.RL.5.1, 5.3, 5.4, 5.6, 5.7**</p> <p>CCSS.ELA-Literacy.RI.4.1, 4.2, 4.3, 4.6, 4.9</p> <p>CCSS.ELA-Literacy.RI.5.1, 5.2, 5.3, 5.6</p>
<p>Content Areas</p> <ul style="list-style-type: none"> • <i>First in Space*</i>, by James Vining, Oni Press (history) • <i>Nathan Hale's Hazardous Tales*</i> series, by Nathan Hale, Abrams (history) • <i>Prime Baby*</i>, by Gene Luen Yang, First Second Books (math) • <i>The Secret Science Alliance</i>, by Eleanor Davis, Bloomsbury USA (science, engineering) • <i>Terra Tempo</i> series, by David R. Shapiro, Christopher Herndon, and Erica Melville, Craigmore Creation (science) 	<p>CCSS.ELA-Literacy.RI.4.1, 4.2, 4.3, 4.4, 4.5, 4.7, 4.8</p> <p>CCSS.ELA-Literacy.RI.5.1, 5.2, 5.3, 5.4, 5.8</p>
<p>Informational Text</p> <ul style="list-style-type: none"> • <i>Howtoons: The Possibilities are Endless!</i> by Saul Griffith, Joost Bonsen, and Nick Dragotta, Collins (science) 	<p>CCSS.ELA-Literacy.RI.4.4, 4.5, 4.7</p> <p>CCSS.ELA-Literacy.RI.5.4</p>

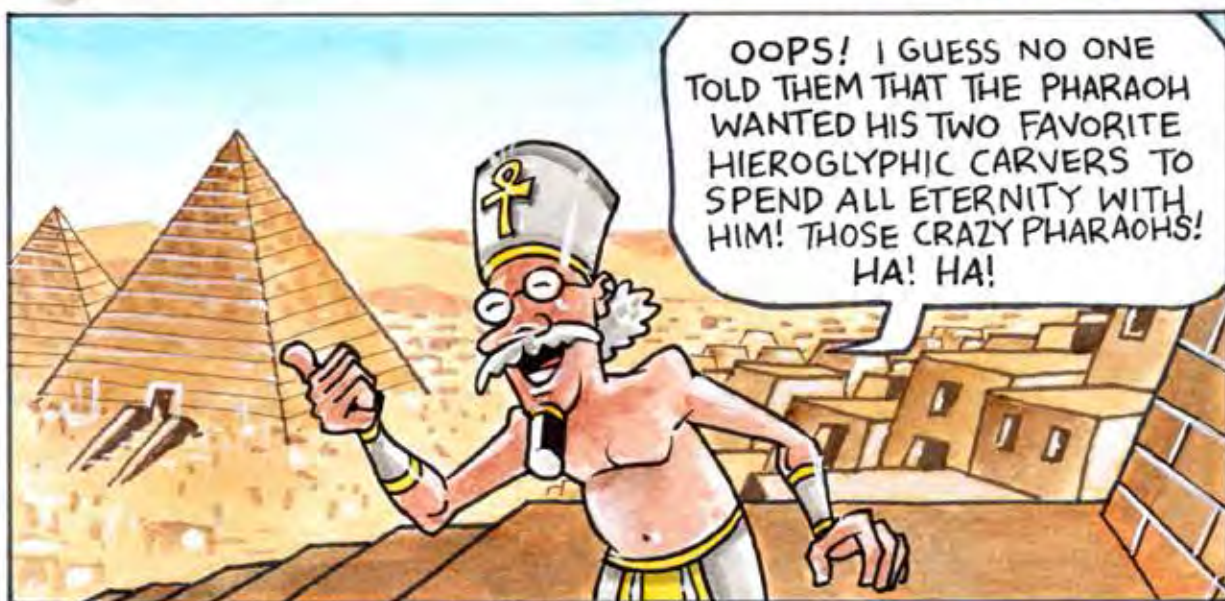
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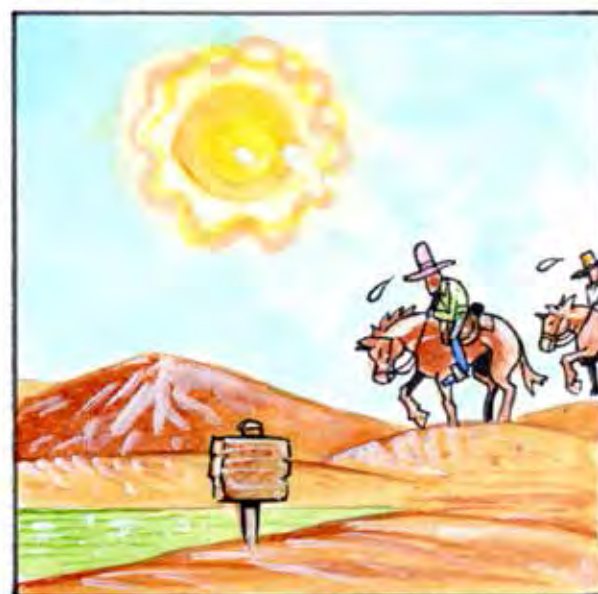
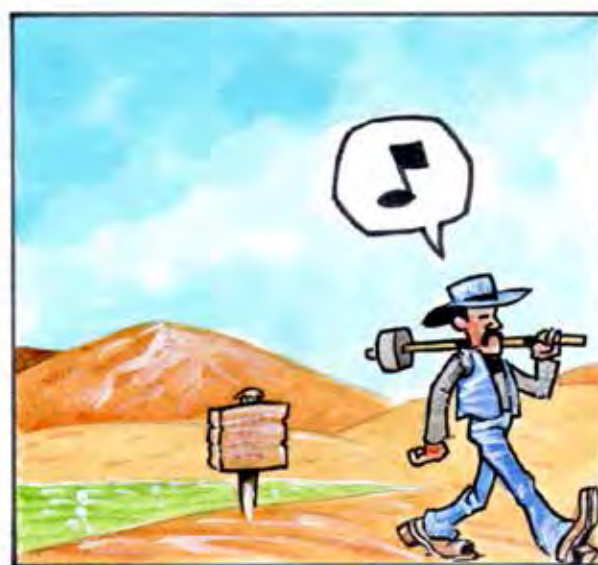
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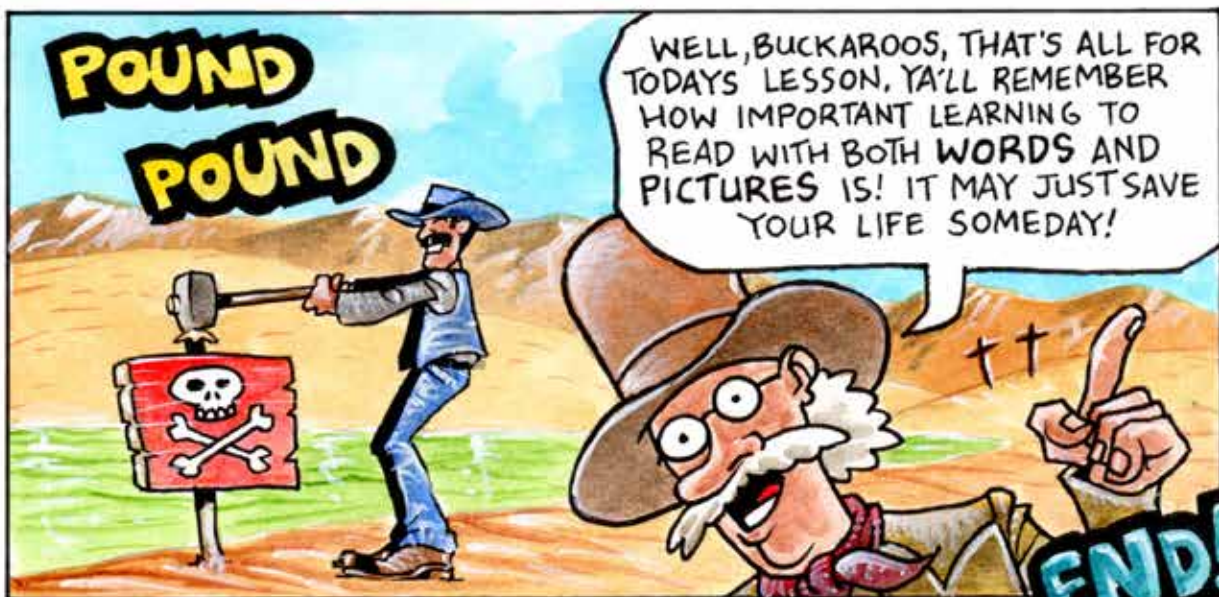
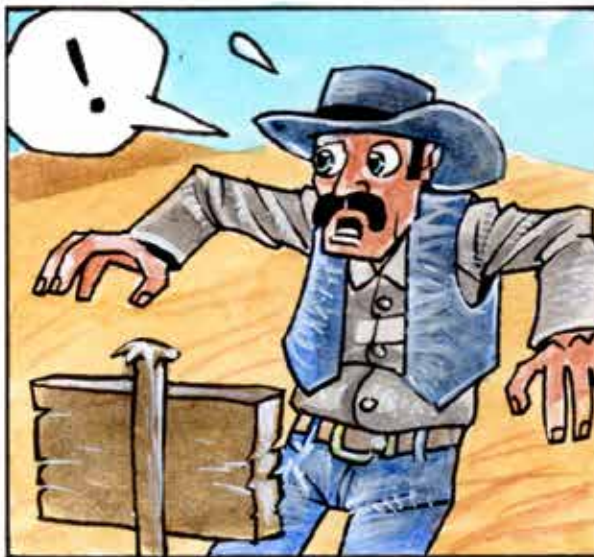








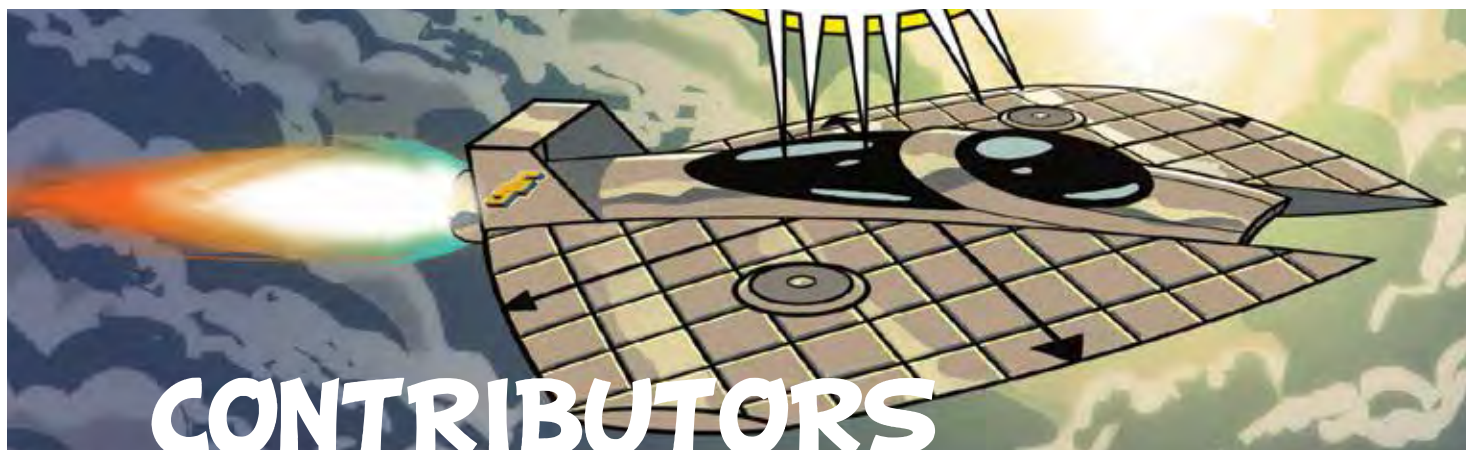




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END!



Dr. Katie Monnin is an Assistant Professor of Literacy at the University of North Florida. She is also the author of *Teaching Graphic Novels* (2010) and finalist for ForeWord's Education Book of the Year Award, *Teaching Early Reader Comics and Graphic Novels* (2011), *Really Reading with Graphic Novels* (2012), and *Teaching Content Area Graphic Novels* (2012).

Sari Wilson is an educational consultant and writer whose clients include Scholastic, PBS, Teachers & Writers Collaborative, and Random House academic marketing. Her fiction and comics writing has appeared in literary journals such as *Agni* and *The Oxford American*.

Tracy Edmunds, M.A. Ed. is an educational author, editor, curriculum developer, and comics enthusiast. In her nine years as a primary classroom teacher, she experienced first-hand the power of comics in teaching and learning. Tracy is also the Curriculum Resources Manager for Reading With Pictures.

Jim McClain has been a classroom teacher in mathematics for twenty-seven years and currently teaches seventh grade mathematics at Pierre Moran Middle School in Elkhart, Indiana. In his secret identity, he is the creator of Solution Squad and is a comic book writer, penciler, inker, colorist, letterer, editor, and designer.

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Tracy Edmunds—Editor
Jim McClain—Editor

Curriculum Writers

Dr. Katie Monnin
Sari Wilson
Tracy Edmunds, M.A. Ed.

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