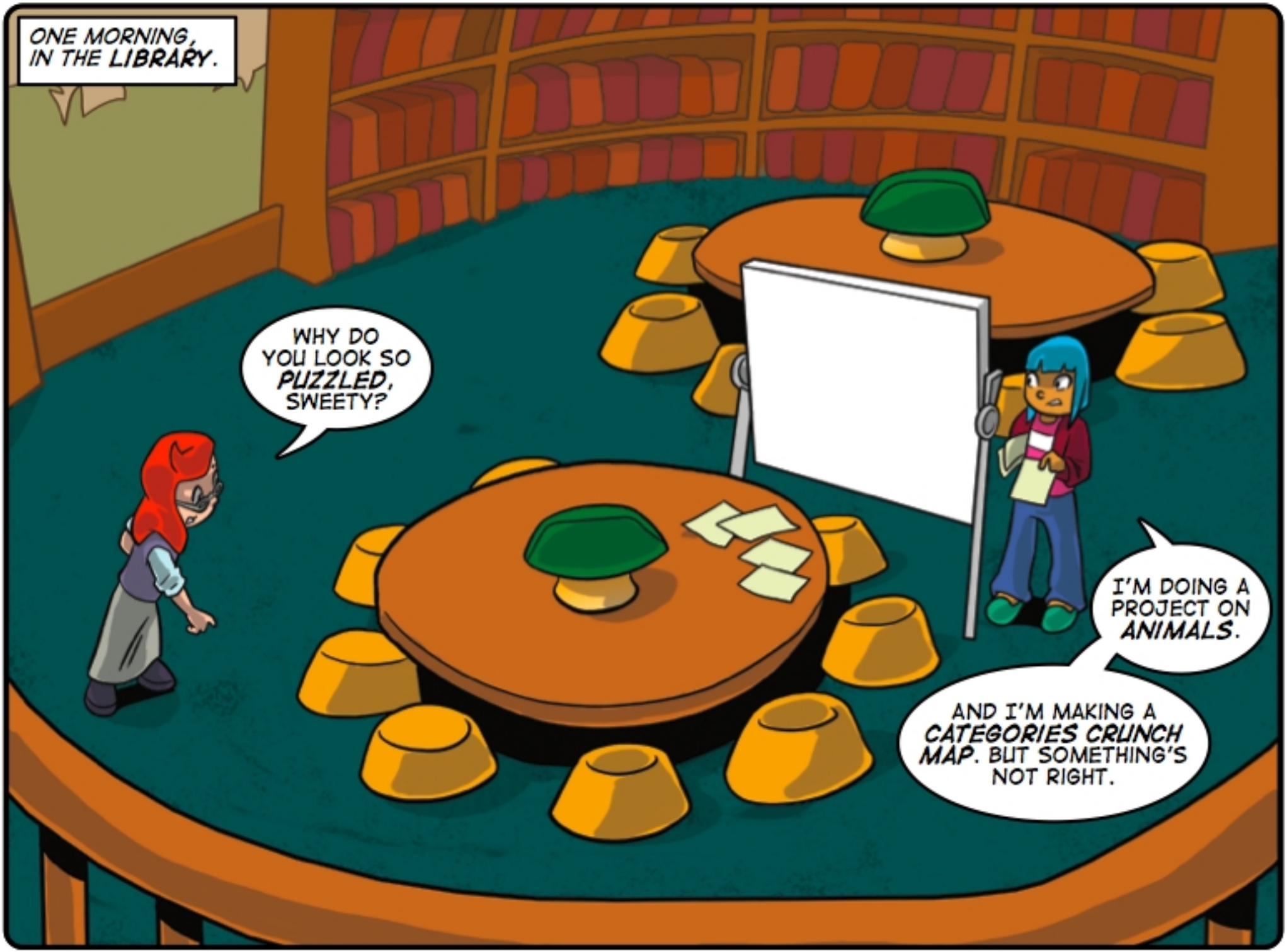
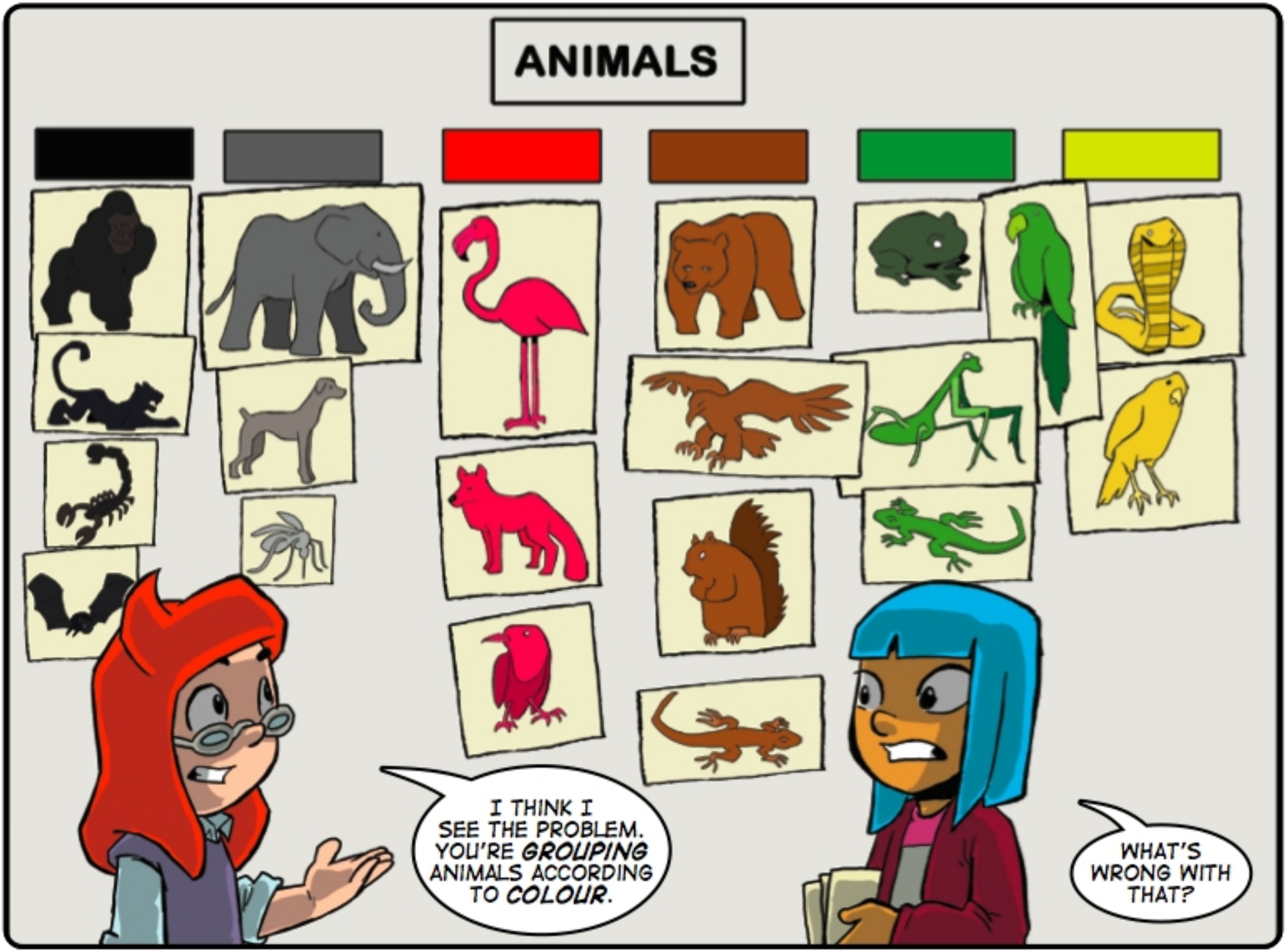
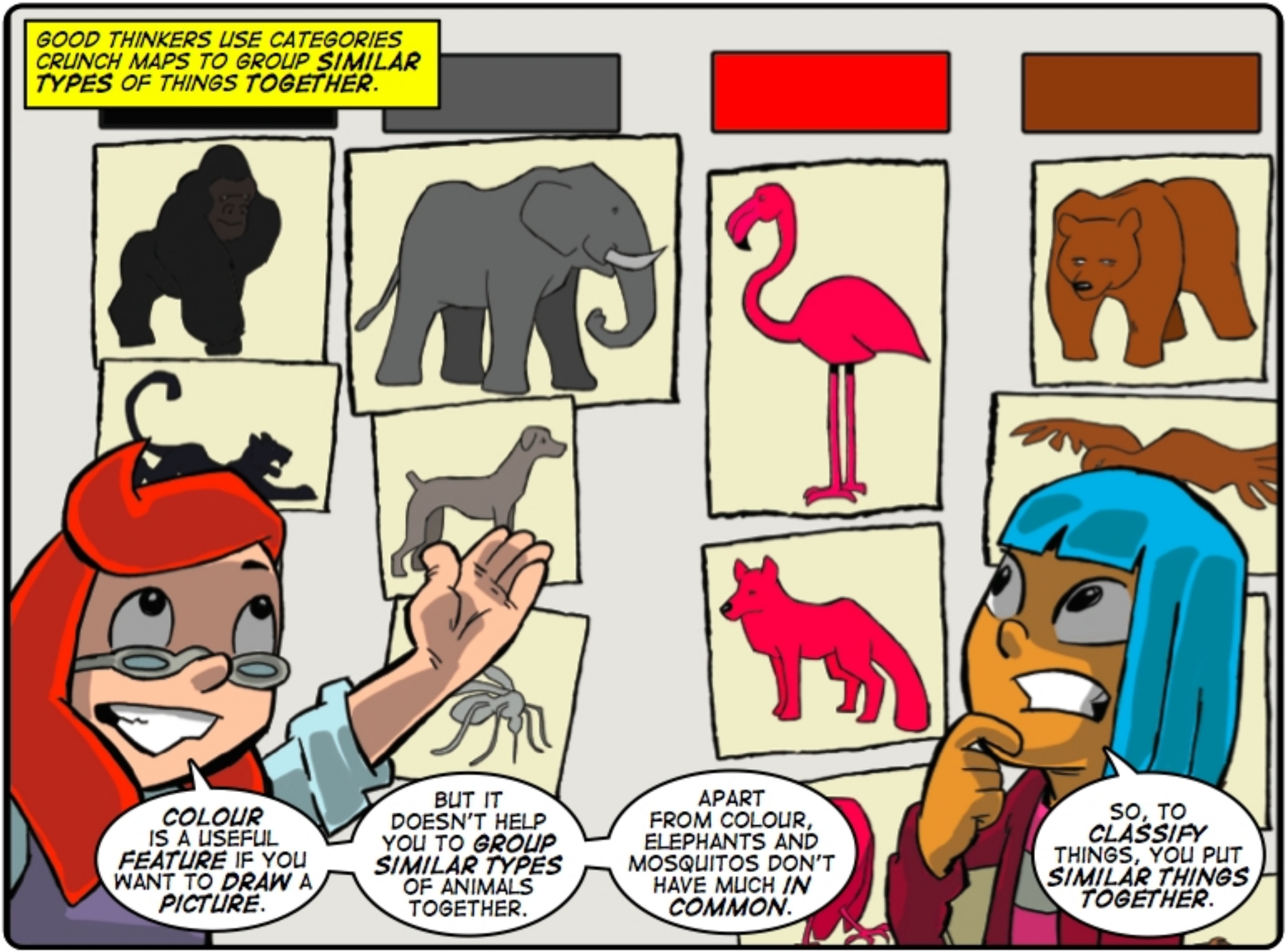
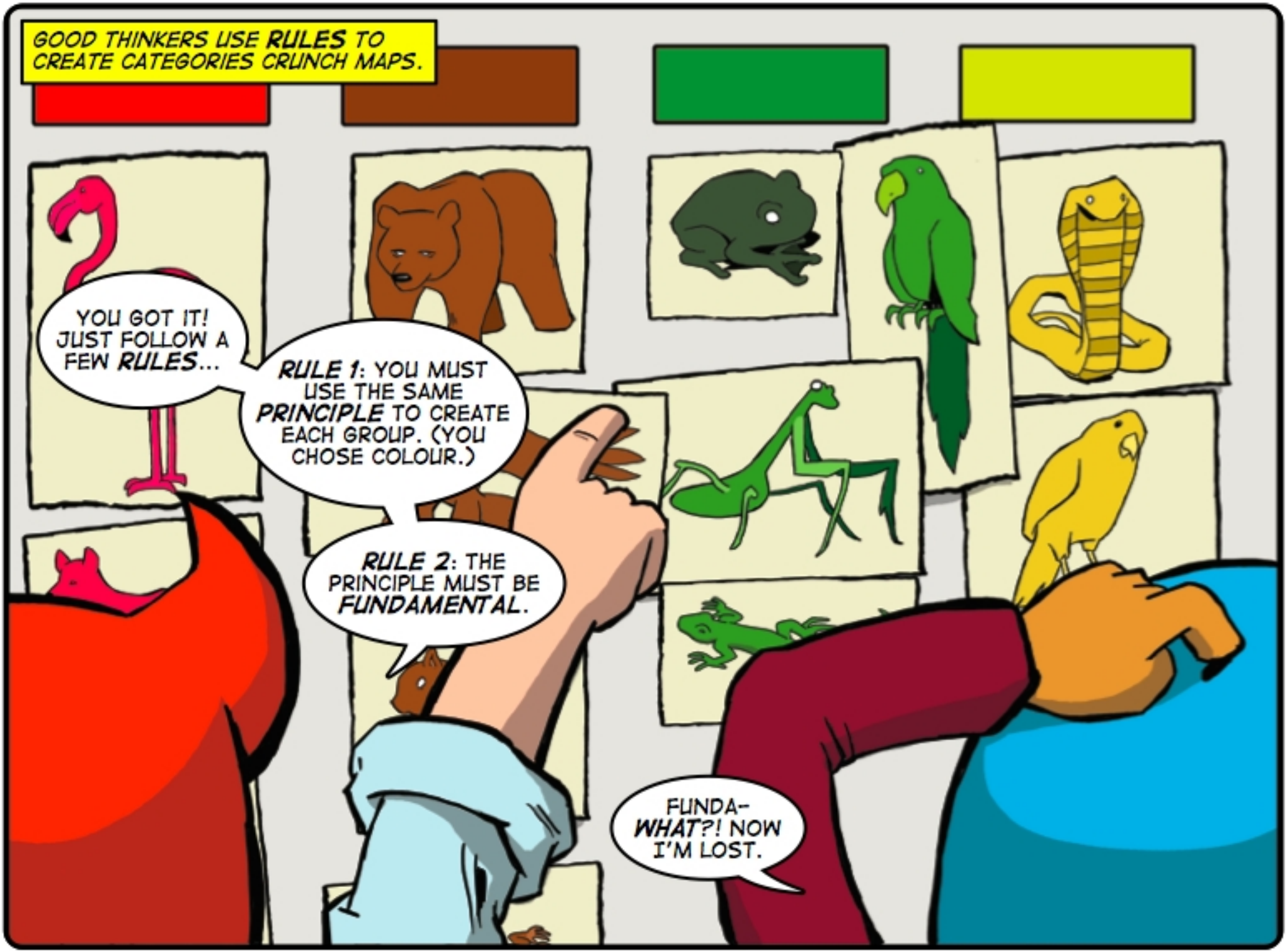
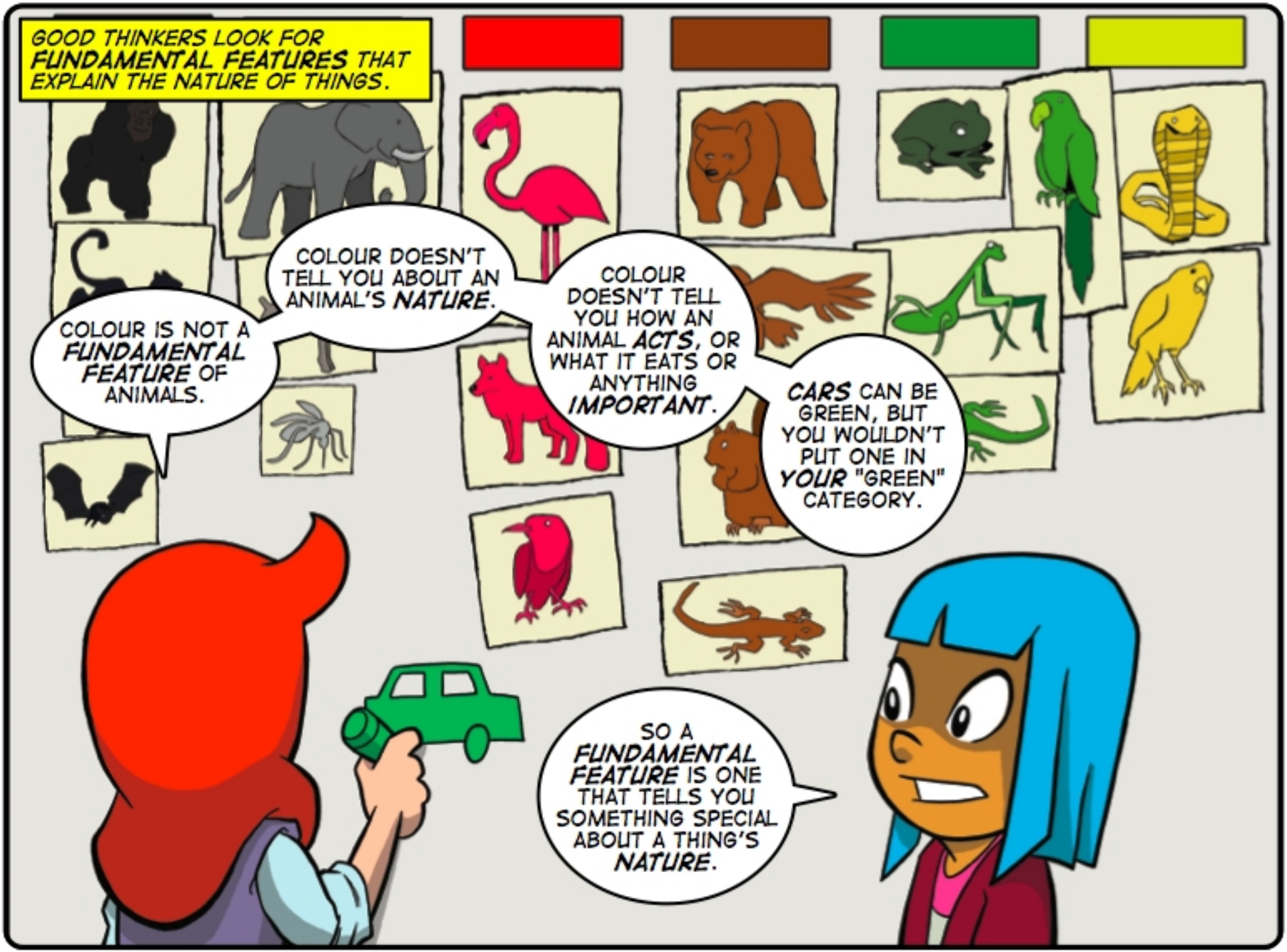
Classifying things

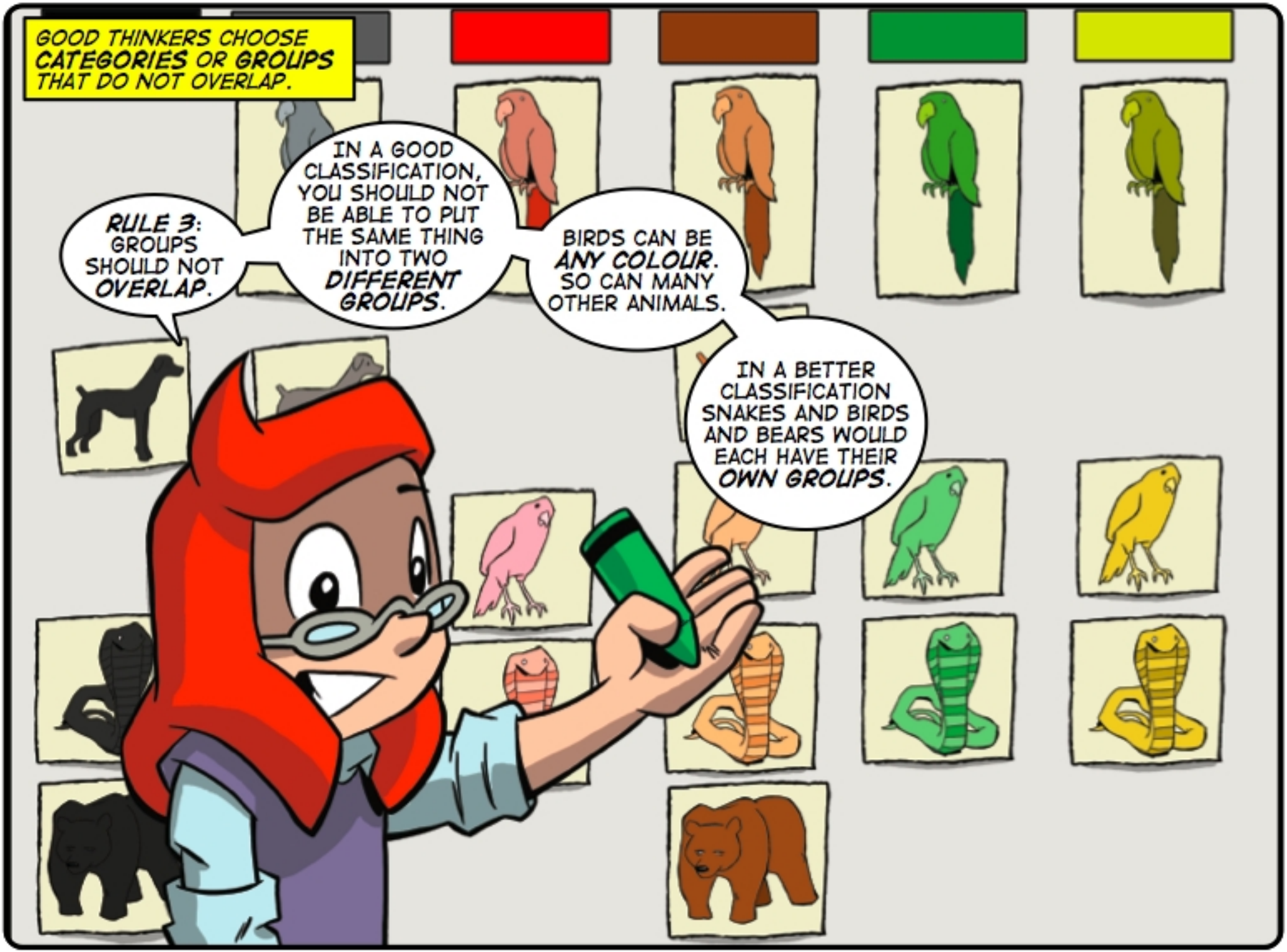

ONE MORNING, IN THE LIBRARY.
WHY DO YOU LOOK SO PUZZLED, SWEETY?
I'M DOING A PROJECT ON ANIMALS.
AND I'M MAKING A CATEGORIES CRUNCH MAP. BUT SOMETHING'S NOT RIGHT.

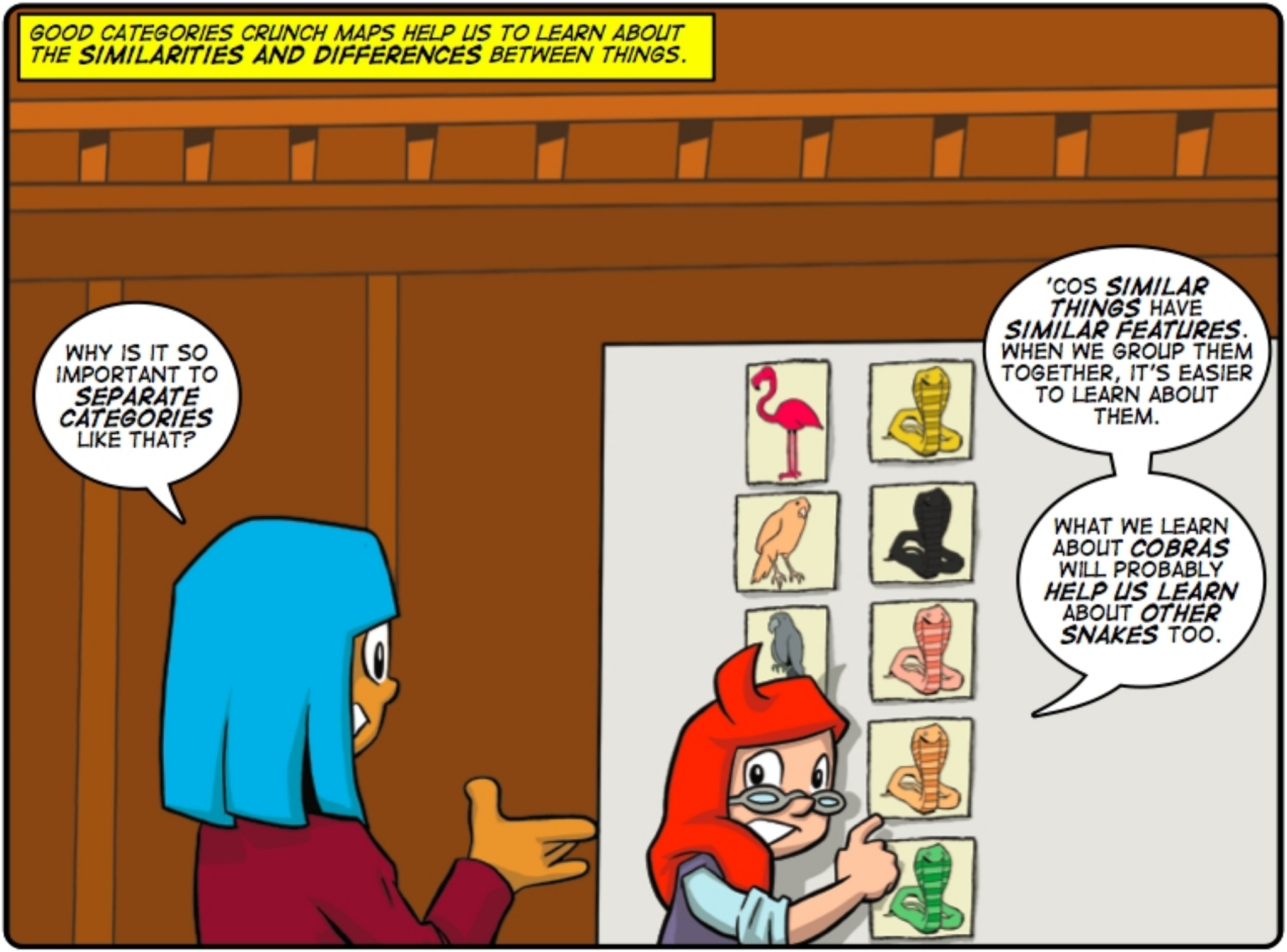

ANIMALS
I THINK I SEE THE PROBLEM. YOU'RE *GROUPING* ANIMALS ACCORDING TO *COLOUR*.
WHAT'S WRONG WITH THAT?


GOOD THINKERS USE CATEGORIES CRUNCH MAPS TO GROUP SIMILAR TYPES OF THINGS TOGETHER.
COLOUR IS A USEFUL FEATURE IF YOU WANT TO DRAW A PICTURE.
BUT IT DOESN'T HELP YOU TO GROUP SIMILAR TYPES OF ANIMALS TOGETHER.
APART FROM COLOUR, ELEPHANTS AND MOSQUITOS DON'T HAVE MUCH IN COMMON.
SO, TO CLASSIFY THINGS, YOU PUT SIMILAR THINGS TOGETHER.

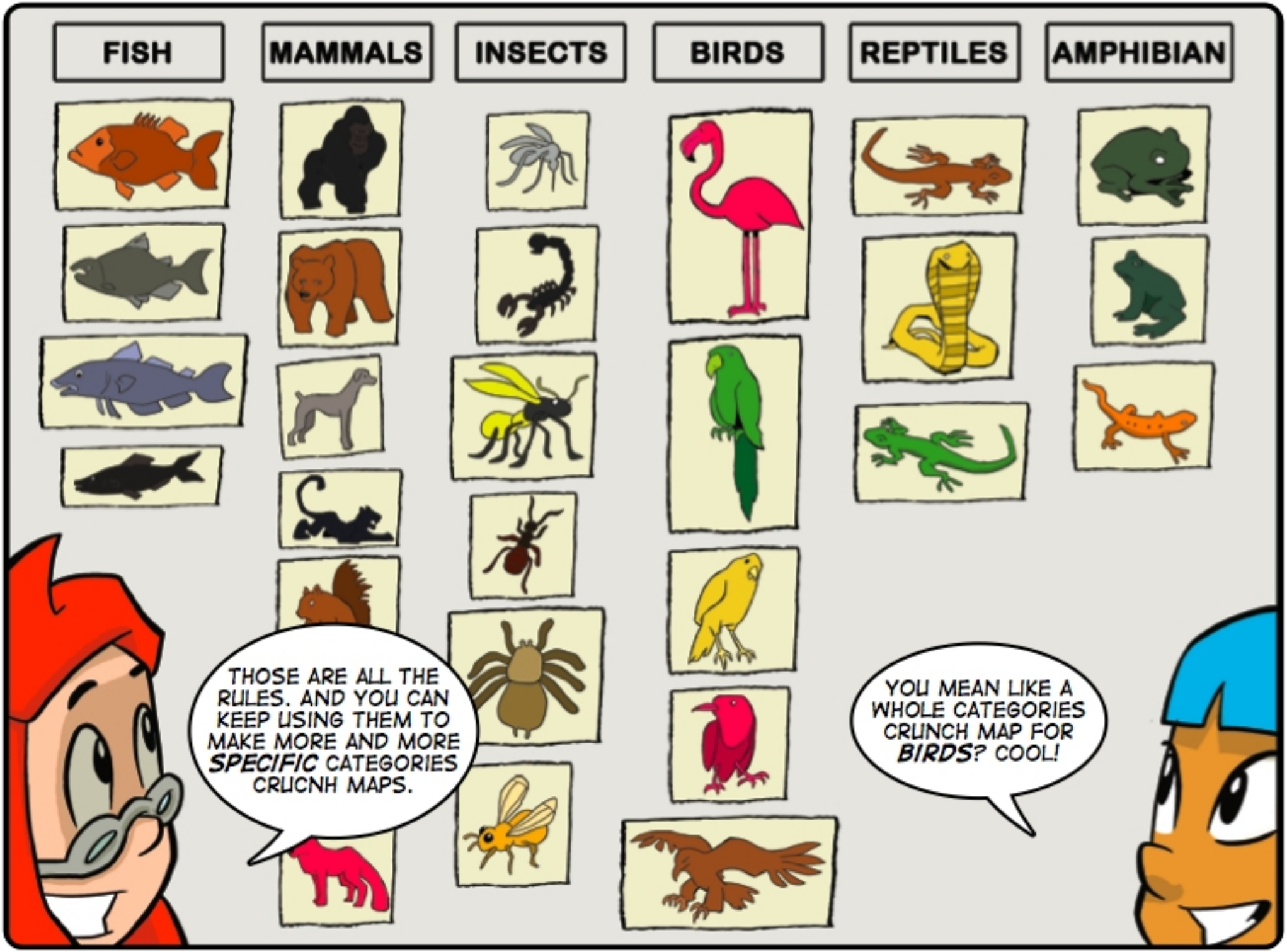

GOOD THINKERS USE **RULES** TO CREATE CATEGORIES CRUNCH MAPS.
YOU GOT IT! JUST FOLLOW A FEW **RULES**...
RULE 1: YOU MUST USE THE SAME **PRINCIPLE** TO CREATE EACH GROUP. (YOU CHOSE COLOUR.)
RULE 2: THE PRINCIPLE MUST BE **FUNDAMENTAL**.
FUNDA-**WHAT**?! NOW I'M LOST.


GOOD THINKERS LOOK FOR FUNDAMENTAL FEATURES THAT EXPLAIN THE NATURE OF THINGS.
COLOUR IS NOT A FUNDAMENTAL FEATURE OF ANIMALS.
COLOUR DOESN'T TELL YOU ABOUT AN ANIMAL'S NATURE.
COLOUR DOESN'T TELL YOU HOW AN ANIMAL ACTS, OR WHAT IT EATS OR ANYTHING IMPORTANT.
CARS CAN BE GREEN, BUT YOU WOULDN'T PUT ONE IN YOUR "GREEN" CATEGORY.
SO A FUNDAMENTAL FEATURE IS ONE THAT TELLS YOU SOMETHING SPECIAL ABOUT A THING'S NATURE.

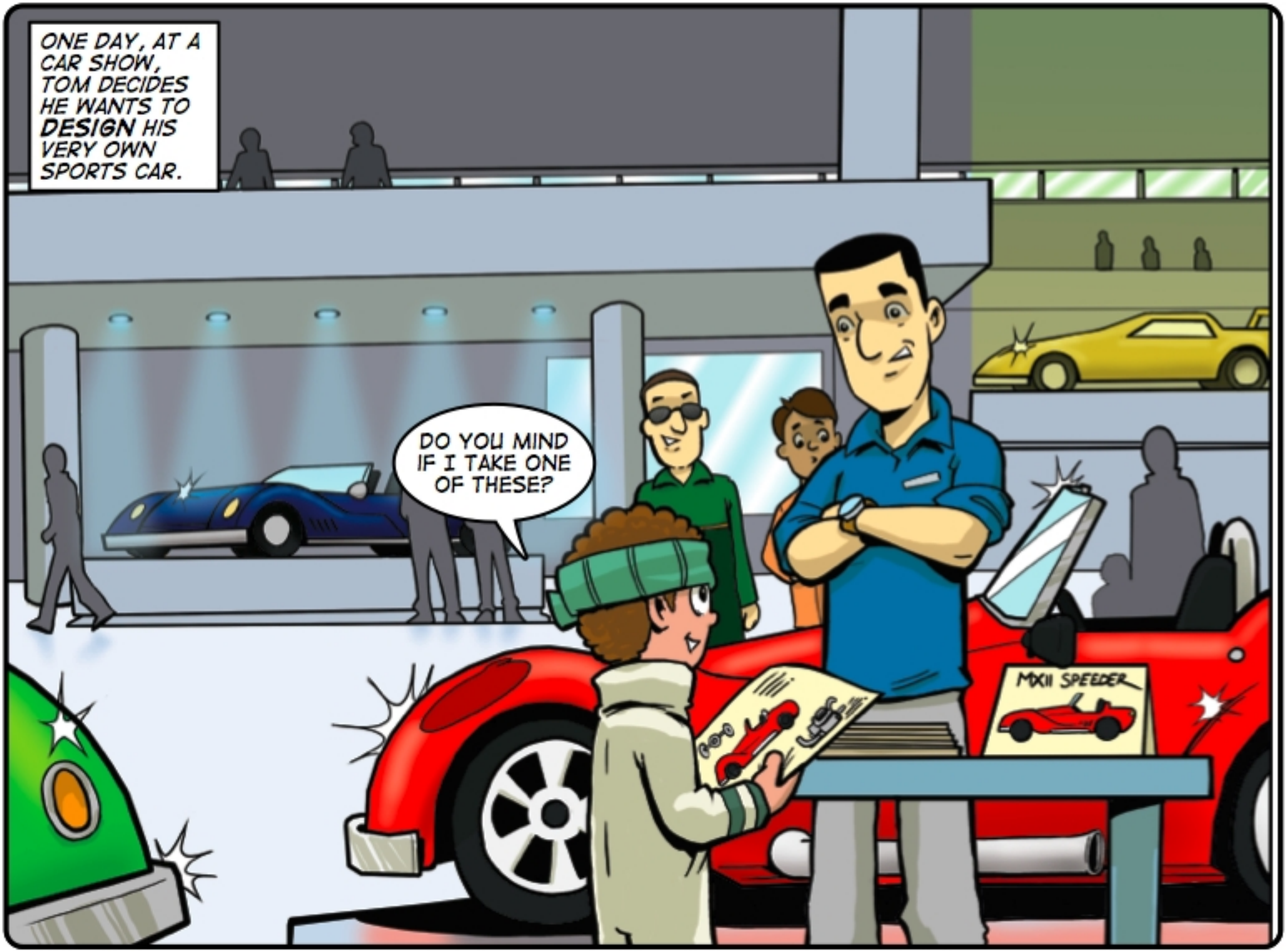

GOOD THINKERS CHOOSE CATEGORIES OR GROUPS THAT DO NOT OVERLAP.
RULE 3: GROUPS SHOULD NOT OVERLAP.
IN A GOOD CLASSIFICATION, YOU SHOULD NOT BE ABLE TO PUT THE SAME THING INTO TWO DIFFERENT GROUPS.
BIRDS CAN BE ANY COLOUR. SO CAN MANY OTHER ANIMALS.
IN A BETTER CLASSIFICATION SNAKES AND BIRDS AND BEARS WOULD EACH HAVE THEIR OWN GROUPS.

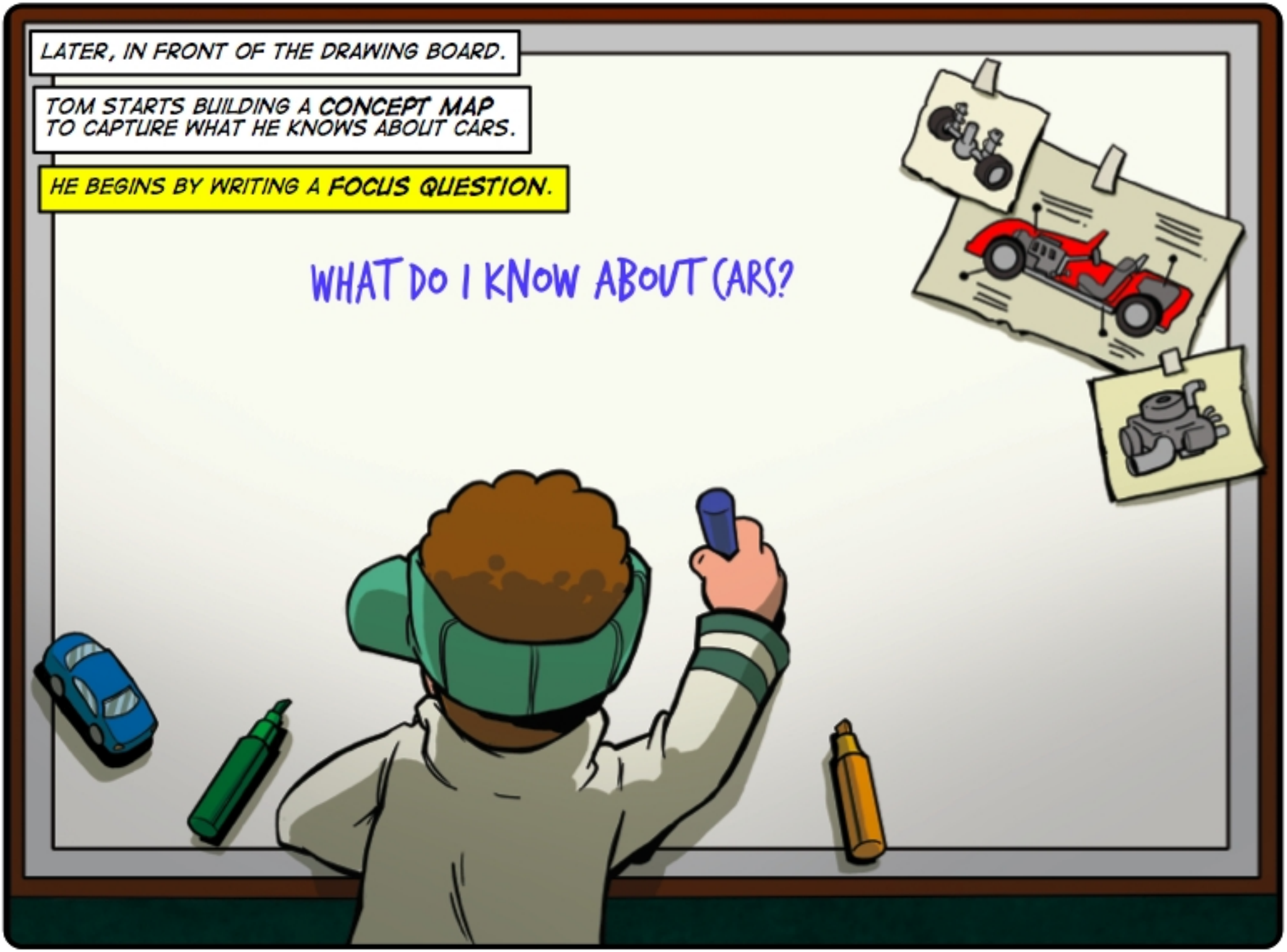

GOOD CATEGORIES CRUNCH MAPS HELP US TO LEARN ABOUT THE SIMILARITIES AND DIFFERENCES BETWEEN THINGS.
WHY IS IT SO IMPORTANT TO SEPARATE CATEGORIES LIKE THAT?
'COS SIMILAR THINGS HAVE SIMILAR FEATURES. WHEN WE GROUP THEM TOGETHER, IT'S EASIER TO LEARN ABOUT THEM.
WHAT WE LEARN ABOUT COBRAS WILL PROBABLY HELP US LEARN ABOUT OTHER SNAKES TOO.

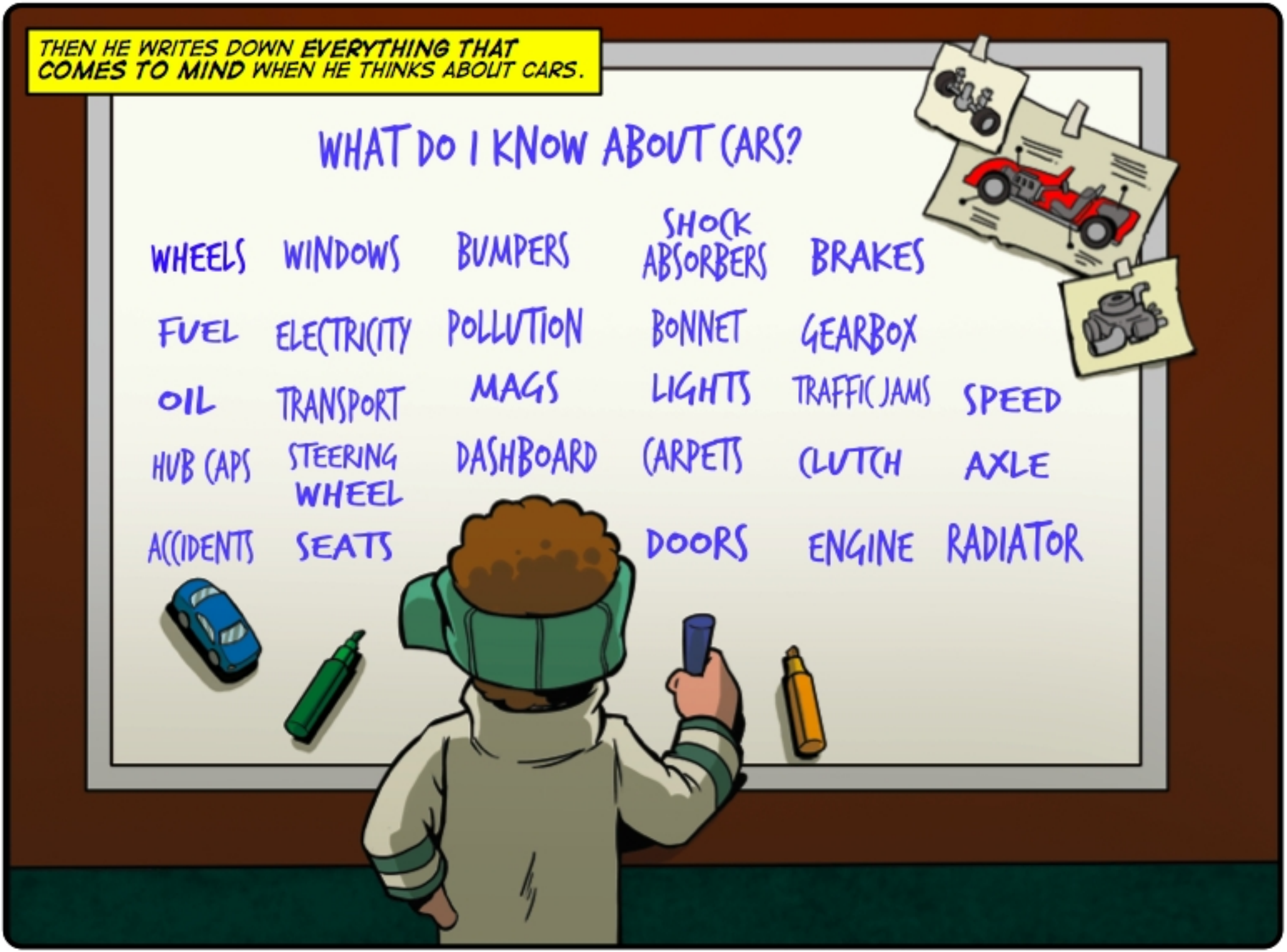

SO, TO RECAP...
RULE 1: USE THE SAME PRINCIPLE TO CREATE ALL GROUPS.
RULE 2: USE A FUNDAMENTAL PRINCIPLE.
RULE 3: DON'T LET GROUPS OVERLAP!
ANIMAL
AND DON'T FORGET A GROUP THAT ALL THE OTHER GROUPS CAN BELONG TO.
SO RULE 4 IS TO MAKE SURE THERE IS A BIG GROUP FOR ALL THE SMALLER GROUPS.


FISH
MAMMALS
INSECTS
BIRDS
REPTILES
AMPHIBIAN
THOSE ARE ALL THE RULES. AND YOU CAN KEEP USING THEM TO MAKE MORE AND MORE SPECIFIC CATEGORIES CRUCNH MAPS.
YOU MEAN LIKE A WHOLE CATEGORIES CRUNCH MAP FOR BIRDS? COOL!

Concept Mapping


ONE DAY, AT A CAR SHOW, TOM DECIDES HE WANTS TO **DESIGN** HIS VERY OWN SPORTS CAR.
DO YOU MIND IF I TAKE ONE OF THESE?
MXII SPEEDER


LATER, IN FRONT OF THE DRAWING BOARD.
TOM STARTS BUILDING A CONCEPT MAP TO CAPTURE WHAT HE KNOWS ABOUT CARS.
HE BEGINS BY WRITING A FOCUS QUESTION.
WHAT DO I KNOW ABOUT CARS?


THEN HE WRITES DOWN EVERYTHING THAT COMES TO MIND WHEN HE THINKS ABOUT CARS.
WHAT DO I KNOW ABOUT CARS?
WHEELS
WINDOWS
BUMPERS
SHOCK ABSORBERS
BRAKES
FUEL
ELECTRICITY
POLLUTION
BONNET
GEARBOX
OIL
TRANSPORT
MAGS
LIGHTS
TRAFFIC JAMS
SPEED
HUB CAPS
STEERING WHEEL
DASHBOARD
CARPETS
CLUTCH
AXLE
ACCIDENTS
SEATS
DOORS
ENGINE
RADIATOR

NEXT, HE **GROUPS TOGETHER IDEAS THAT ARE RELATED** TO EACH OTHER.

WHAT DO I KNOW ABOUT CARS?

STEERING WHEEL

WINDOWS

BUMPERS

SHOCK ABSORBERS

FUEL

ELECTRICITY

AXLE

BONNET

CLUTCH

POLLUTION

TRANSPORT

MAGS

BRAKES

BODY SHELL

HUB CAPS

WHEELS

DASHBOARD

ACCIDENTS

SEATS

GEARBOX

ENGINE

RADIATOR

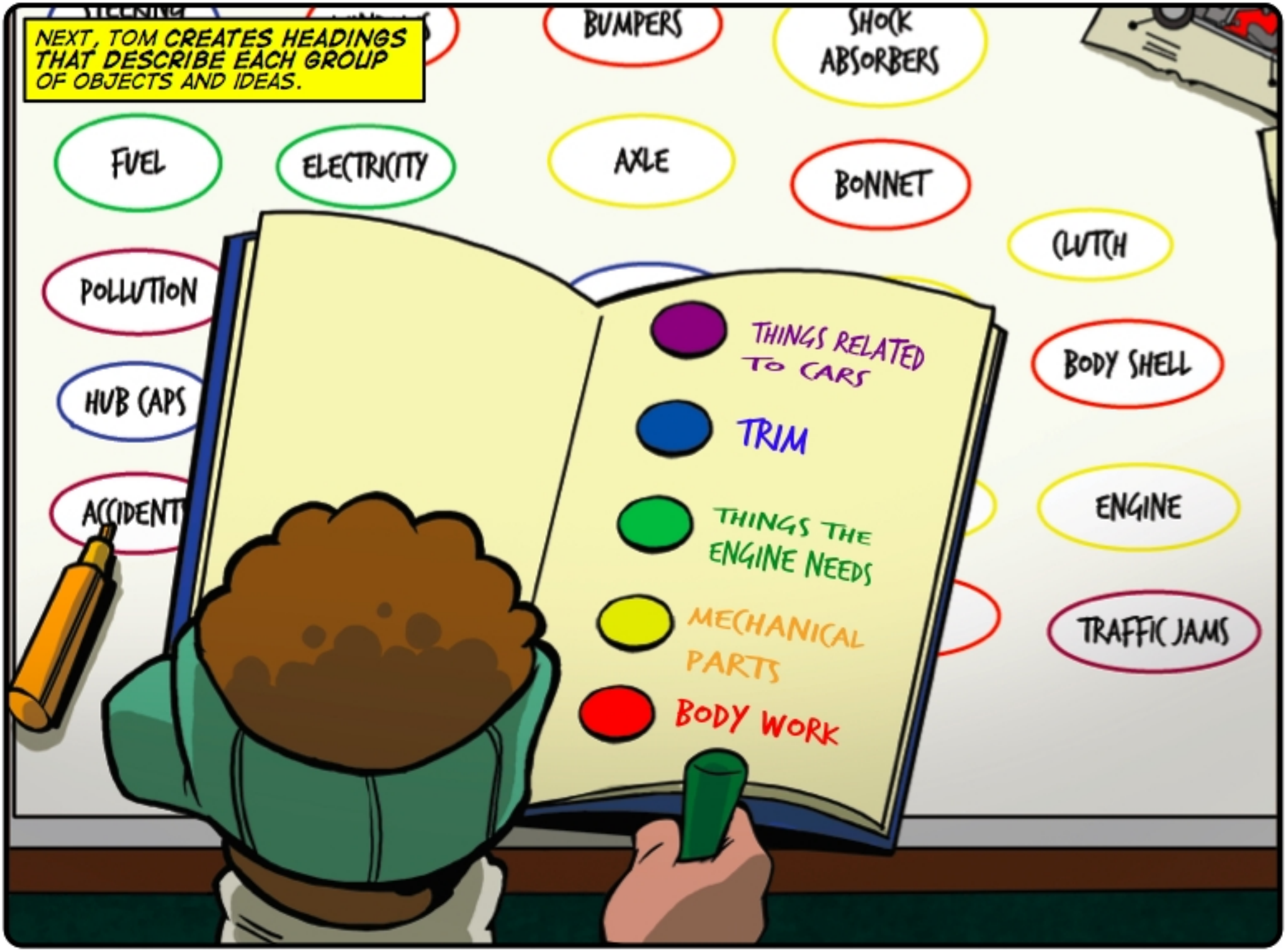
DOORS

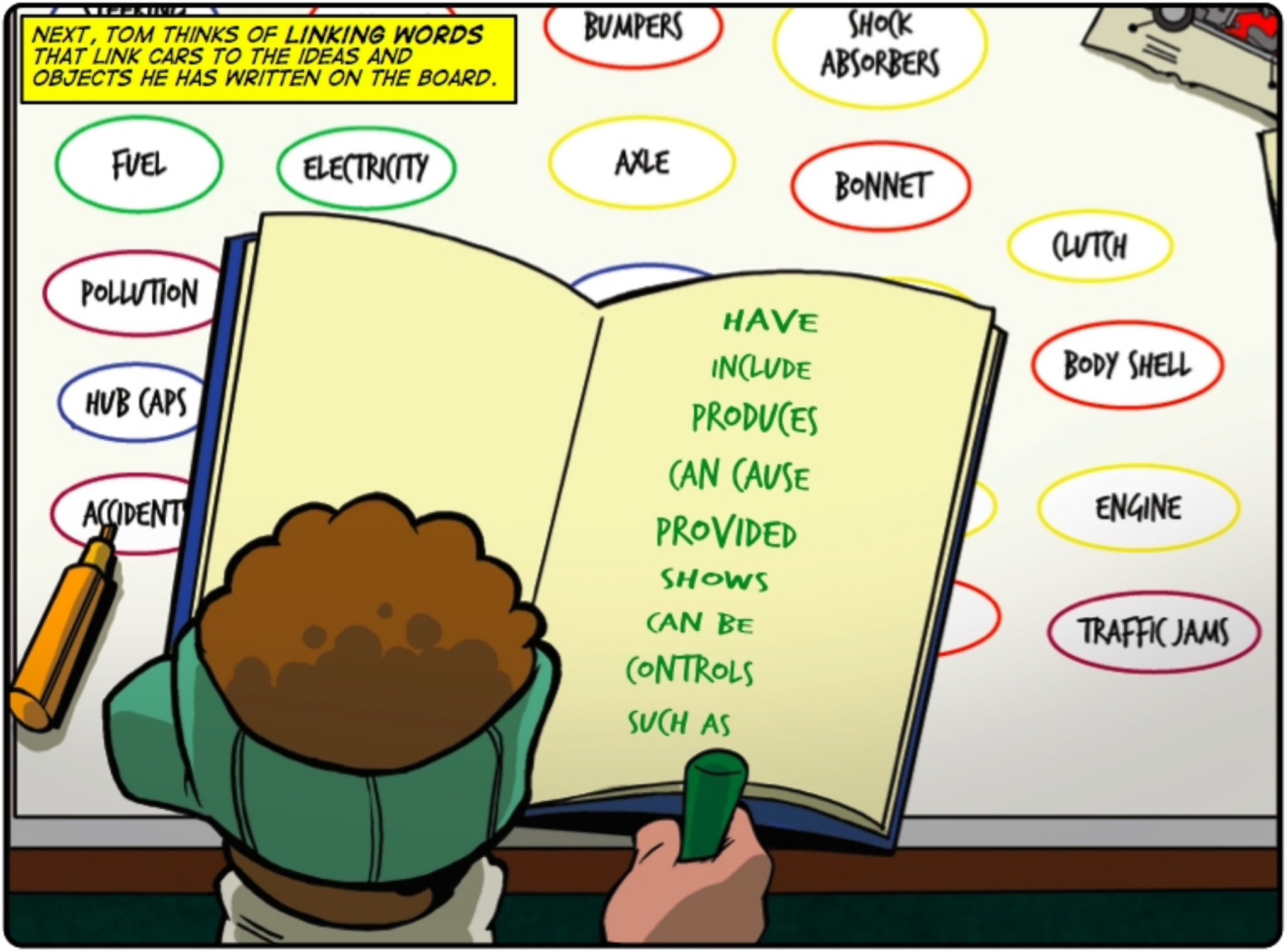
TRAFFIC JAMS

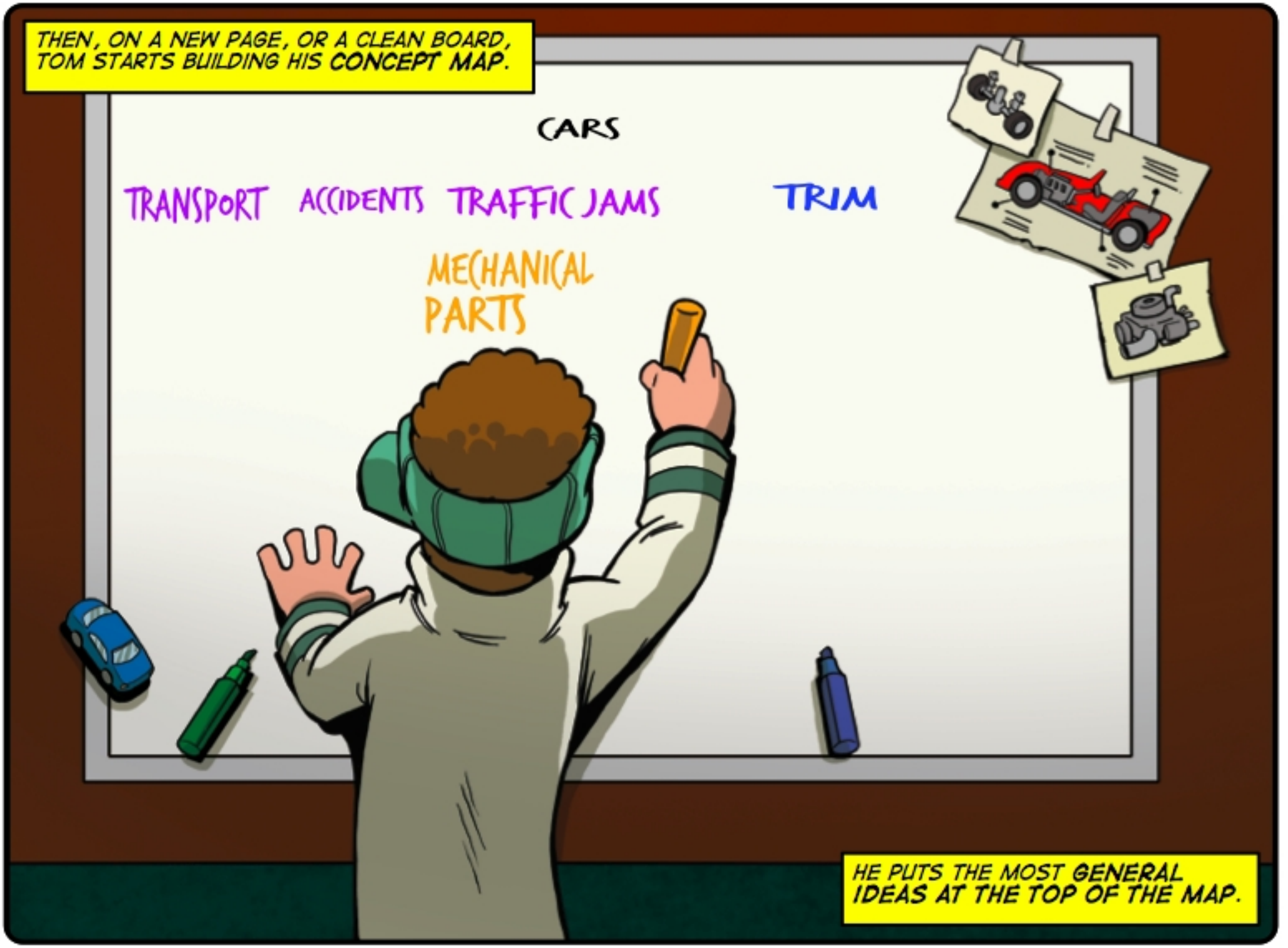
OIL

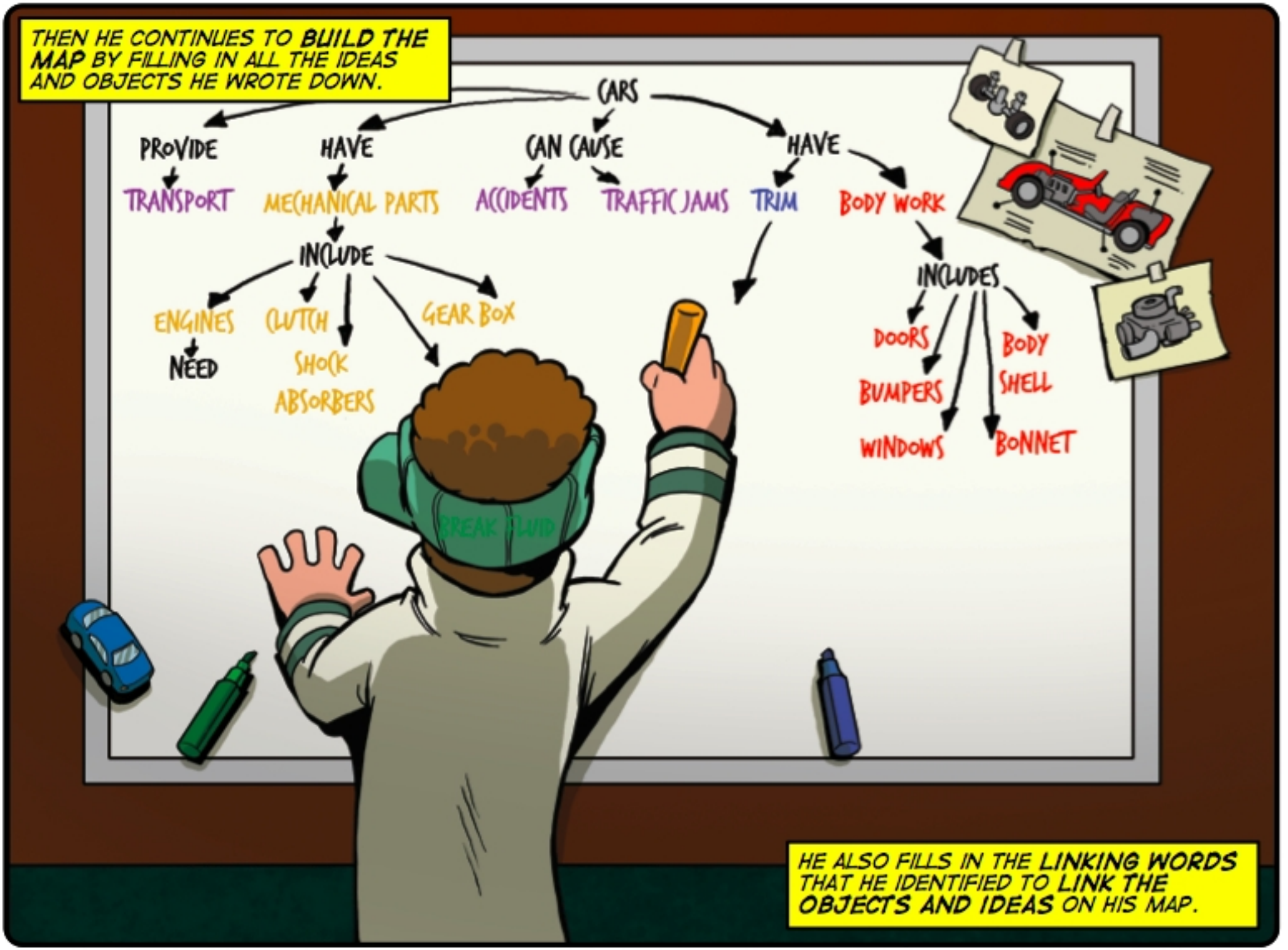
CARPETS

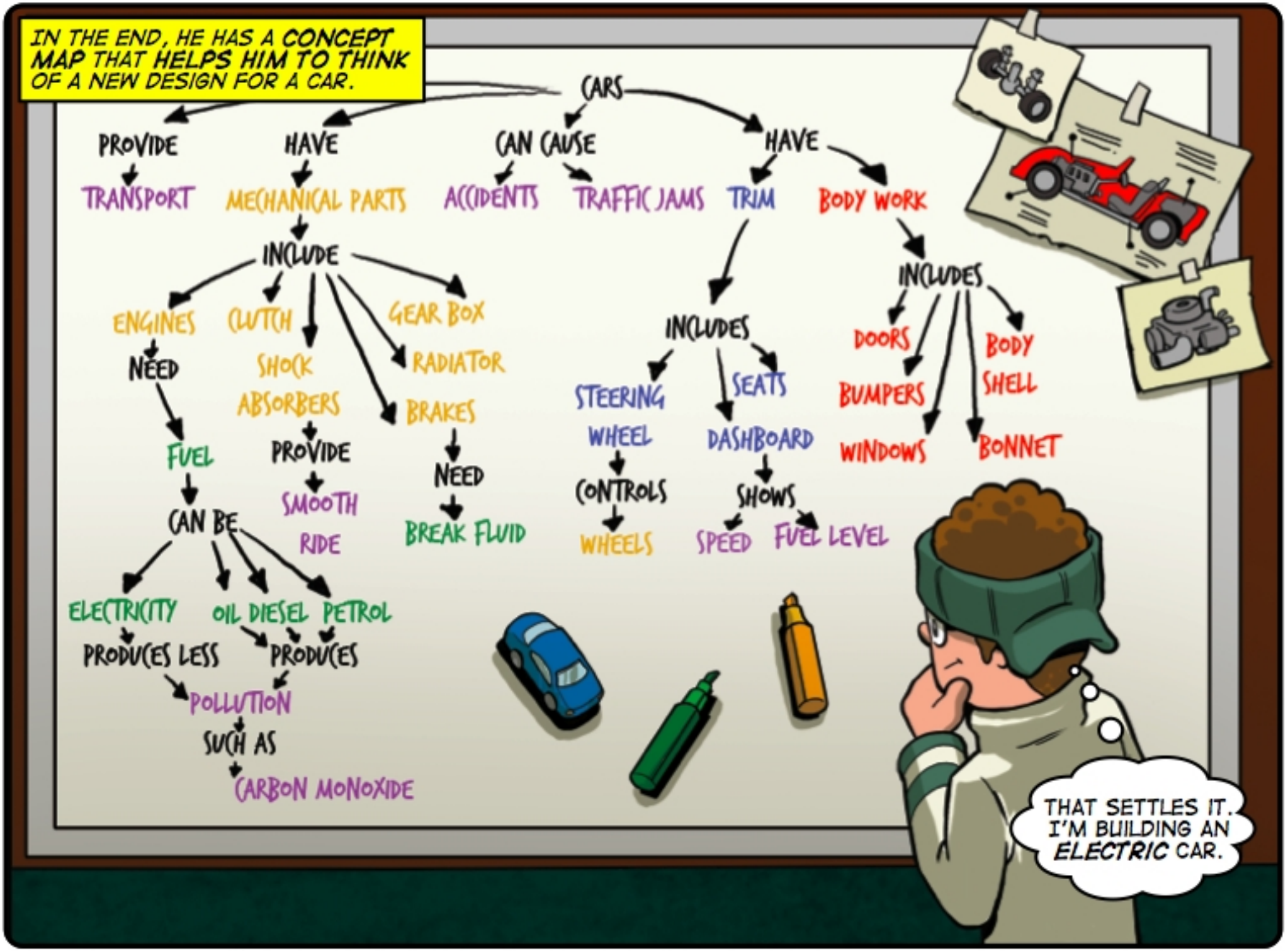
SPEED


NEXT, TOM CREATES HEADINGS THAT DESCRIBE EACH GROUP OF OBJECTS AND IDEAS.
BUMPERS
SHOCK ABSORBERS
FUEL
ELECTRICITY
AXLE
BONNET
CLUTCH
POLLUTION
HUB CAPS
ACCIDENTS
BODY SHELL
ENGINE
TRAFFIC JAMS
THINGS RELATED TO CARS
TRIM
THINGS THE ENGINE NEEDS
MECHANICAL PARTS
BODY WORK

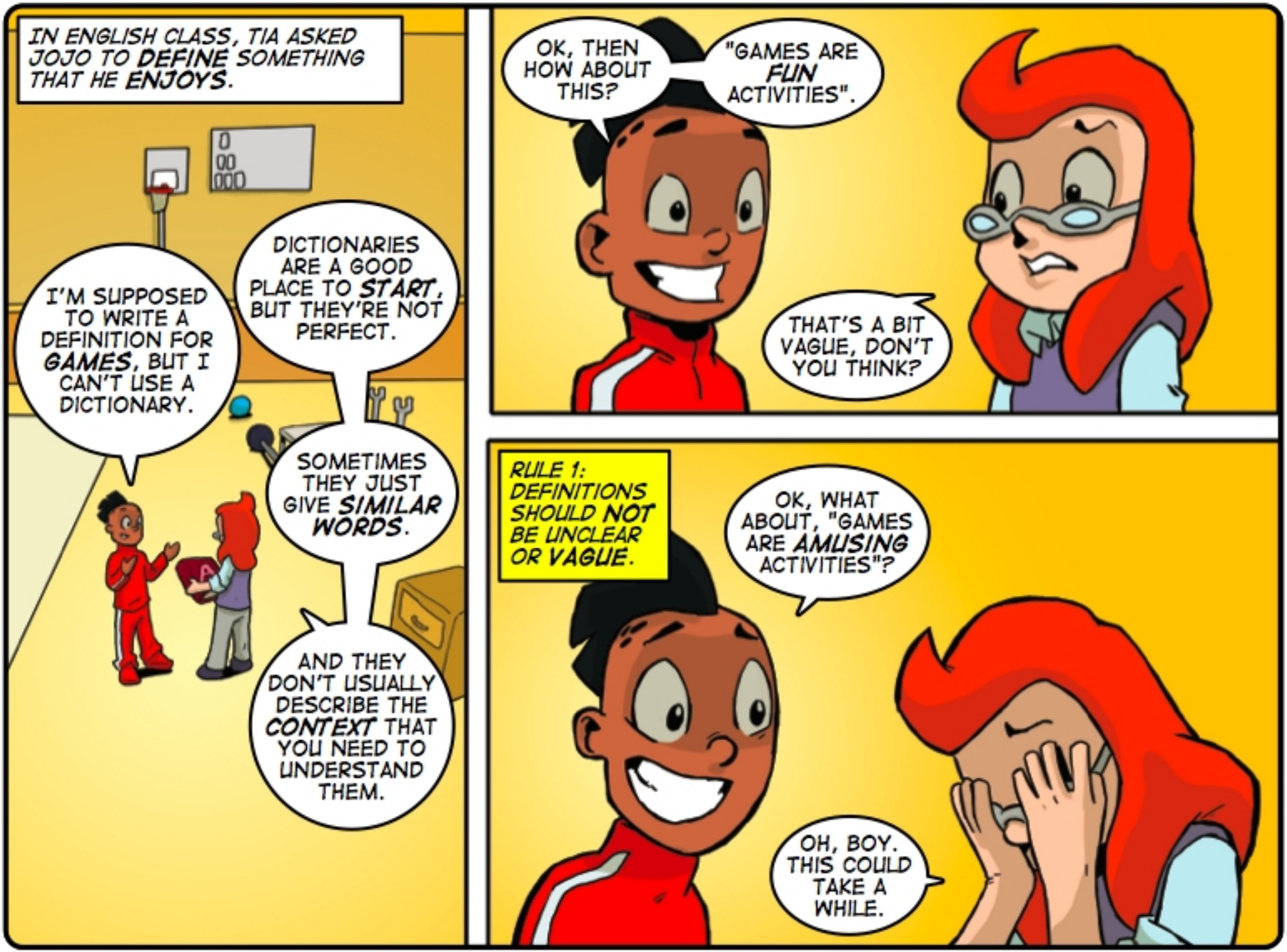

NEXT, TOM THINKS OF LINKING WORDS THAT LINK CARS TO THE IDEAS AND OBJECTS HE HAS WRITTEN ON THE BOARD.
BUMPERS
SHOCK ABSORBERS
FUEL
ELECTRICITY
AXLE
BONNET
CLUTCH
POLLUTION
HUB CAPS
ACCIDENTS
BODY SHELL
ENGINE
TRAFFIC JAMS
HAVE
INCLUDE
PRODUCES
CAN CAUSE
PROVIDED
SHOWS
CAN BE
CONTROLS
SUCH AS

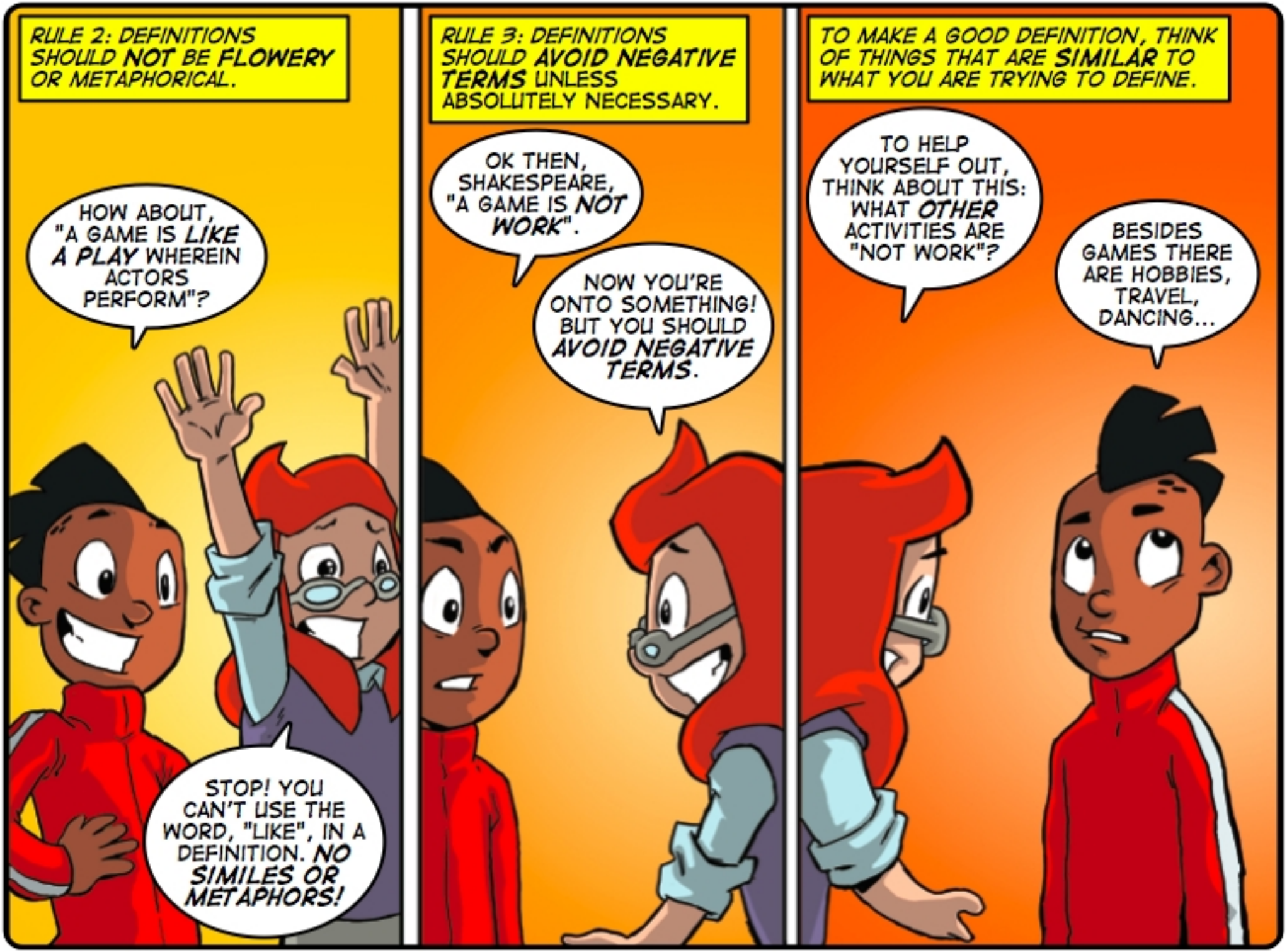

THEN, ON A NEW PAGE, OR A CLEAN BOARD, TOM STARTS BUILDING HIS CONCEPT MAP.
CARS
TRANSPORT
ACCIDENTS
TRAFFIC JAMS
TRIM
MECHANICAL PARTS
HE PUTS THE MOST GENERAL IDEAS AT THE TOP OF THE MAP.

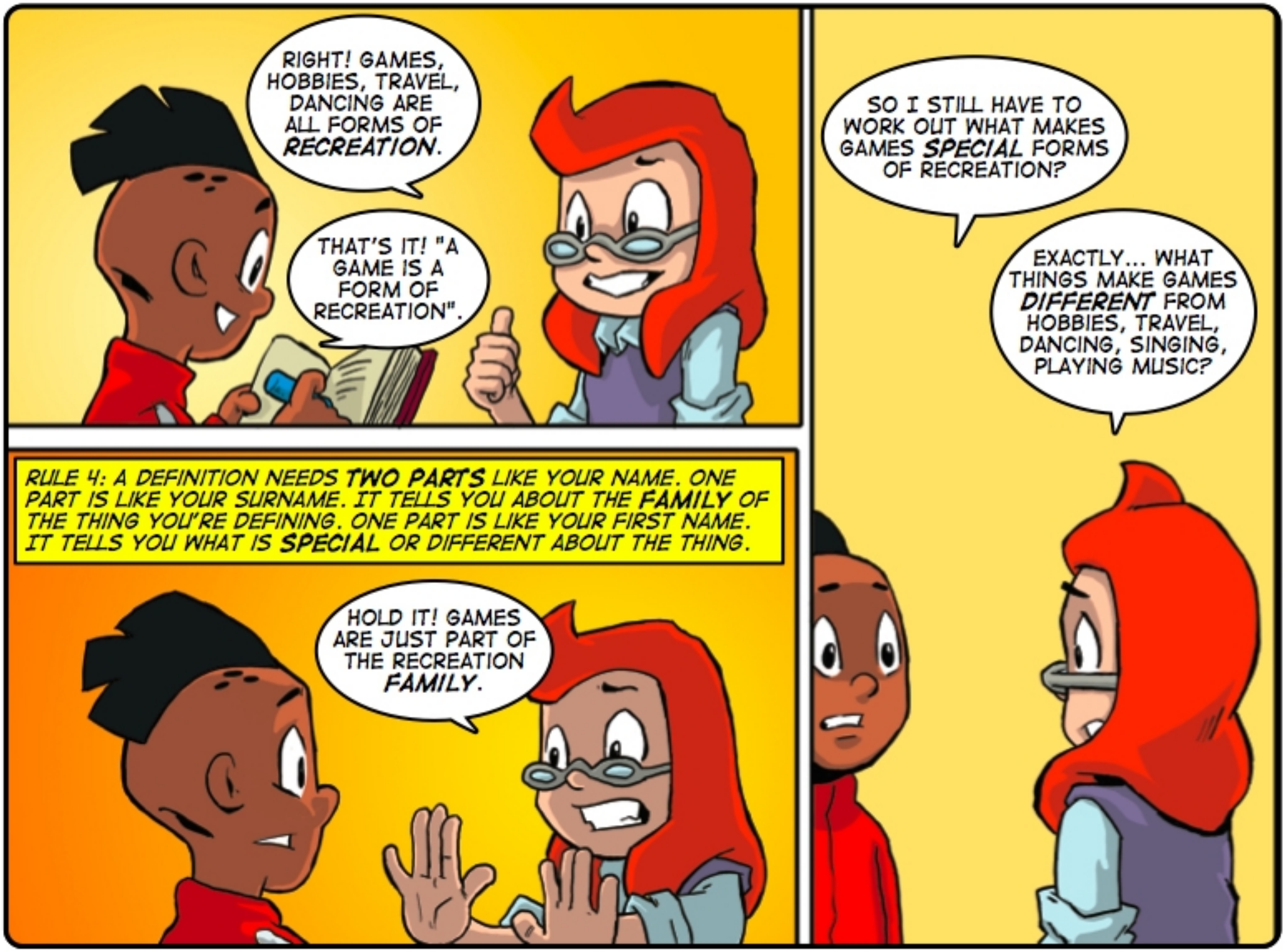

THEN HE CONTINUES TO BUILD THE MAP BY FILLING IN ALL THE IDEAS AND OBJECTS HE WROTE DOWN.
CARS
PROVIDE
HAVE
CAN CAUSE
HAVE
TRANSPORT
MECHANICAL PARTS
ACCIDENTS
TRAFFIC JAMS
TRIM
BODY WORK
INCLUDE
INCLUDES
ENGINES
CLUTCH
GEAR BOX
DOORS
BODY SHELL
NEED
SHOCK ABSORBERS
BUMPERS
WINDOWS
BONNET
BREAK FLUID
HE ALSO FILLS IN THE LINKING WORDS THAT HE IDENTIFIED TO LINK THE OBJECTS AND IDEAS ON HIS MAP.

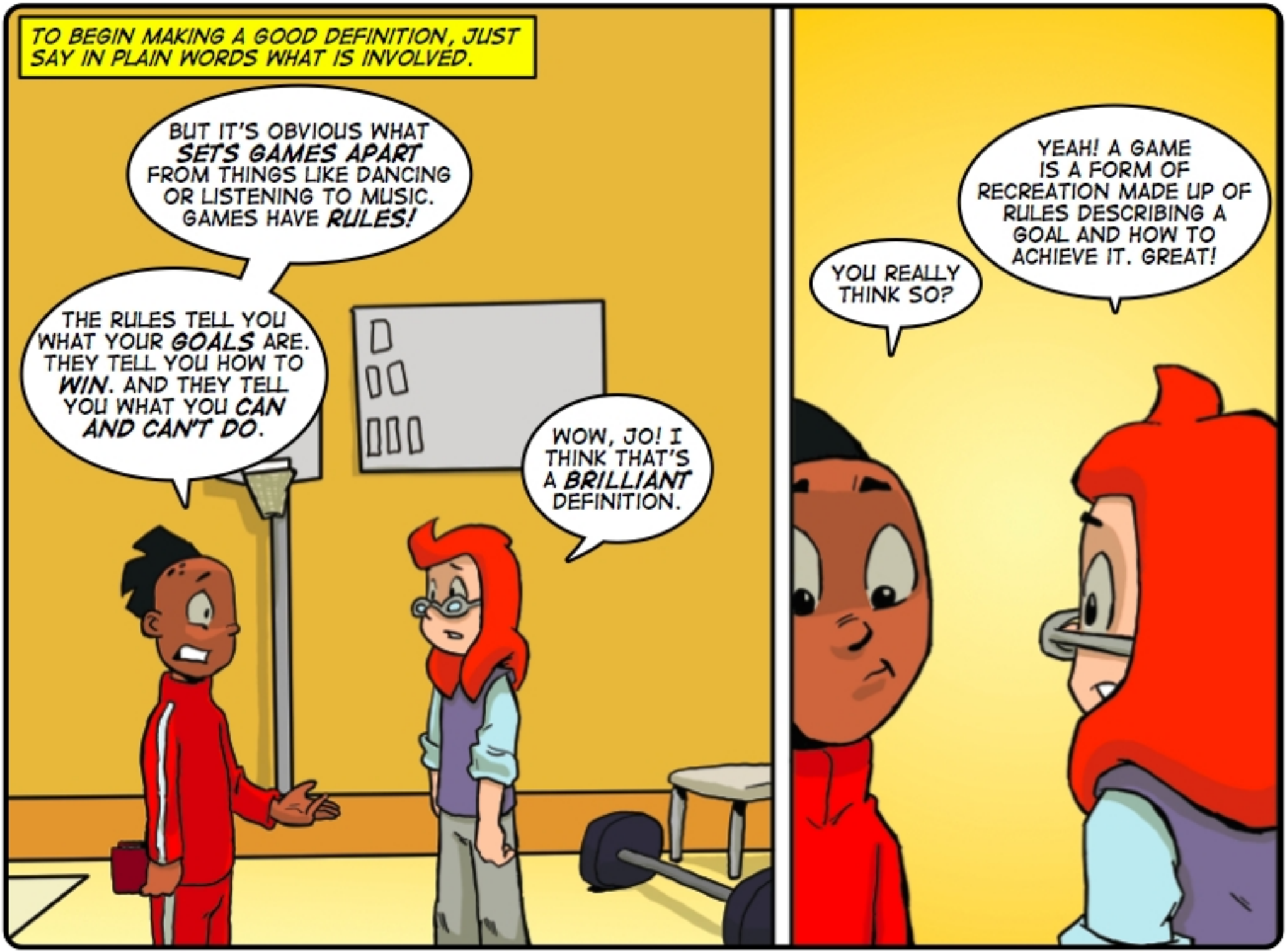

IN THE END, HE HAS A CONCEPT MAP THAT HELPS HIM TO THINK OF A NEW DESIGN FOR A CAR.
CARS
PROVIDE
TRANSPORT
HAVE
MECHANICAL PARTS
INCLUDE
ENGINES
NEED
FUEL
CAN BE
ELECTRICITY
PRODUCES LESS
OIL DIESEL PETROL
PRODUCES
POLLUTION
SUCH AS
CARBON MONOXIDE
CLUTCH
SHOCK ABSORBERS
PROVIDE
SMOOTH RIDE
GEAR BOX
RADIATOR
BRAKES
NEED
BREAK FLUID
CAN CAUSE
ACCIDENTS
TRAFFIC JAMS
HAVE
TRIM
INCLUDES
STEERING WHEEL
CONTROLS
WHEELS
SEATS
DASHBOARD
SHOWS
SPEED
FUEL LEVEL
BODY WORK
INCLUDES
DOORS
BUMPERS
WINDOWS
BODY SHELL
BONNET
THAT SETTLES IT. I'M BUILDING AN ELECTRIC CAR.

Defining things


IN ENGLISH CLASS, TIA ASKED JOJO TO DEFINE SOMETHING THAT HE ENJOYS.
I'M SUPPOSED TO WRITE A DEFINITION FOR GAMES, BUT I CAN'T USE A DICTIONARY.
DICTIONARIES ARE A GOOD PLACE TO START, BUT THEY'RE NOT PERFECT.
SOMETIMES THEY JUST GIVE SIMILAR WORDS.
AND THEY DON'T USUALLY DESCRIBE THE CONTEXT THAT YOU NEED TO UNDERSTAND THEM.
OK, THEN HOW ABOUT THIS?
"GAMES ARE FUN ACTIVITIES".
THAT'S A BIT VAGUE, DON'T YOU THINK?
RULE 1: DEFINITIONS SHOULD NOT BE UNCLEAR OR VAGUE.
OK, WHAT ABOUT, "GAMES ARE AMUSING ACTIVITIES"?
OH, BOY. THIS COULD TAKE A WHILE.

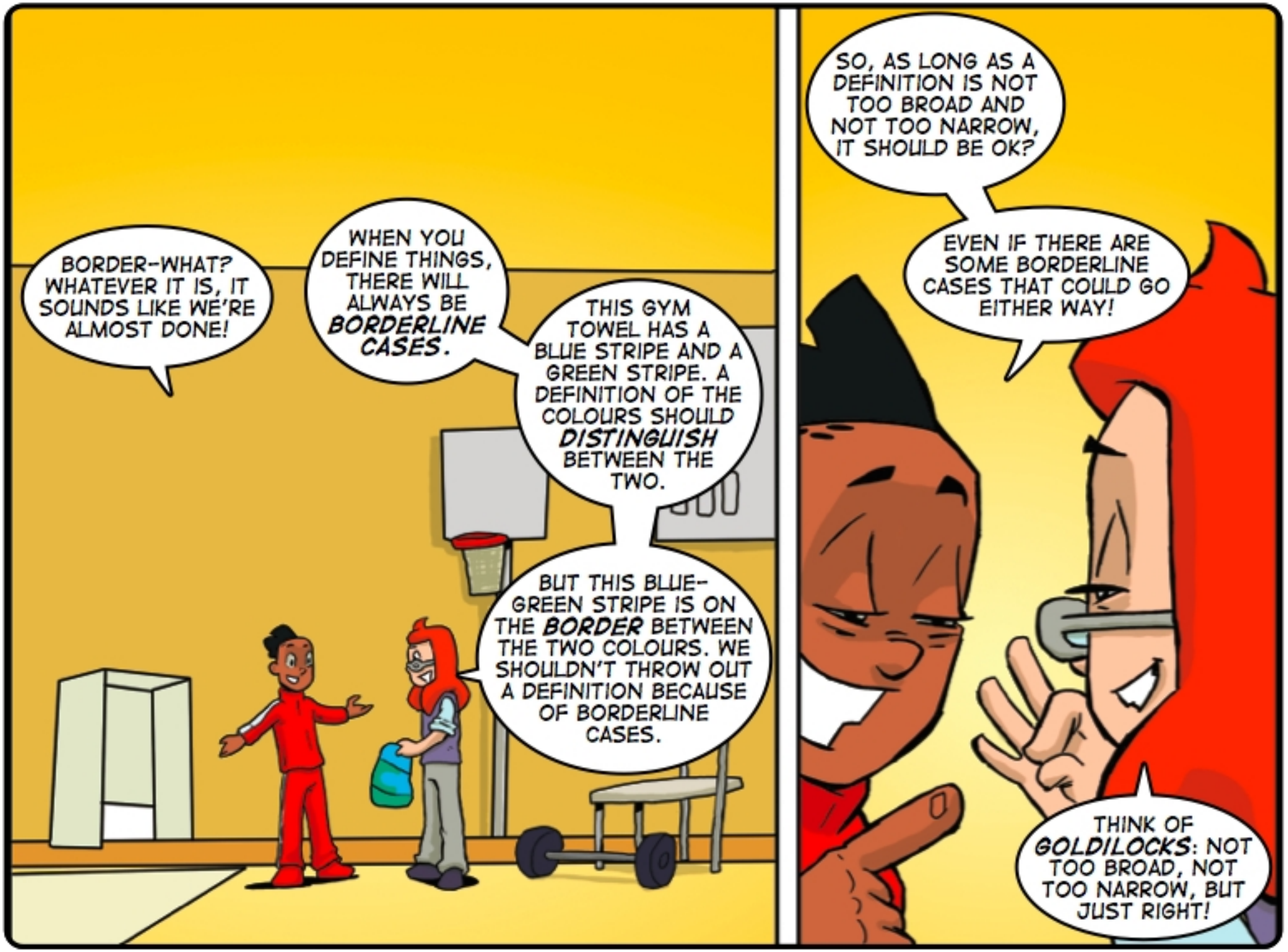

RULE 2: DEFINITIONS SHOULD NOT BE FLOWERY OR METAPHORICAL.
HOW ABOUT, "A GAME IS LIKE A PLAY WHEREIN ACTORS PERFORM"?
STOP! YOU CAN'T USE THE WORD, "LIKE", IN A DEFINITION. NO SIMILES OR METAPHORS!
RULE 3: DEFINITIONS SHOULD AVOID NEGATIVE TERMS UNLESS ABSOLUTELY NECESSARY.
OK THEN, SHAKESPEARE, "A GAME IS NOT WORK".
NOW YOU'RE ONTO SOMETHING! BUT YOU SHOULD AVOID NEGATIVE TERMS.
TO MAKE A GOOD DEFINITION, THINK OF THINGS THAT ARE SIMILAR TO WHAT YOU ARE TRYING TO DEFINE.
TO HELP YOURSELF OUT, THINK ABOUT THIS: WHAT OTHER ACTIVITIES ARE "NOT WORK"?
BESIDES GAMES THERE ARE HOBBIES, TRAVEL, DANCING...


RIGHT! GAMES, HOBBIES, TRAVEL, DANCING ARE ALL FORMS OF RECREATION.
THAT'S IT! "A GAME IS A FORM OF RECREATION".
SO I STILL HAVE TO WORK OUT WHAT MAKES GAMES SPECIAL FORMS OF RECREATION?
EXACTLY... WHAT THINGS MAKE GAMES DIFFERENT FROM HOBBIES, TRAVEL, DANCING, SINGING, PLAYING MUSIC?
RULE 4: A DEFINITION NEEDS TWO PARTS LIKE YOUR NAME. ONE PART IS LIKE YOUR SURNAME. IT TELLS YOU ABOUT THE FAMILY OF THE THING YOU'RE DEFINING. ONE PART IS LIKE YOUR FIRST NAME. IT TELLS YOU WHAT IS SPECIAL OR DIFFERENT ABOUT THE THING.
HOLD IT! GAMES ARE JUST PART OF THE RECREATION FAMILY.

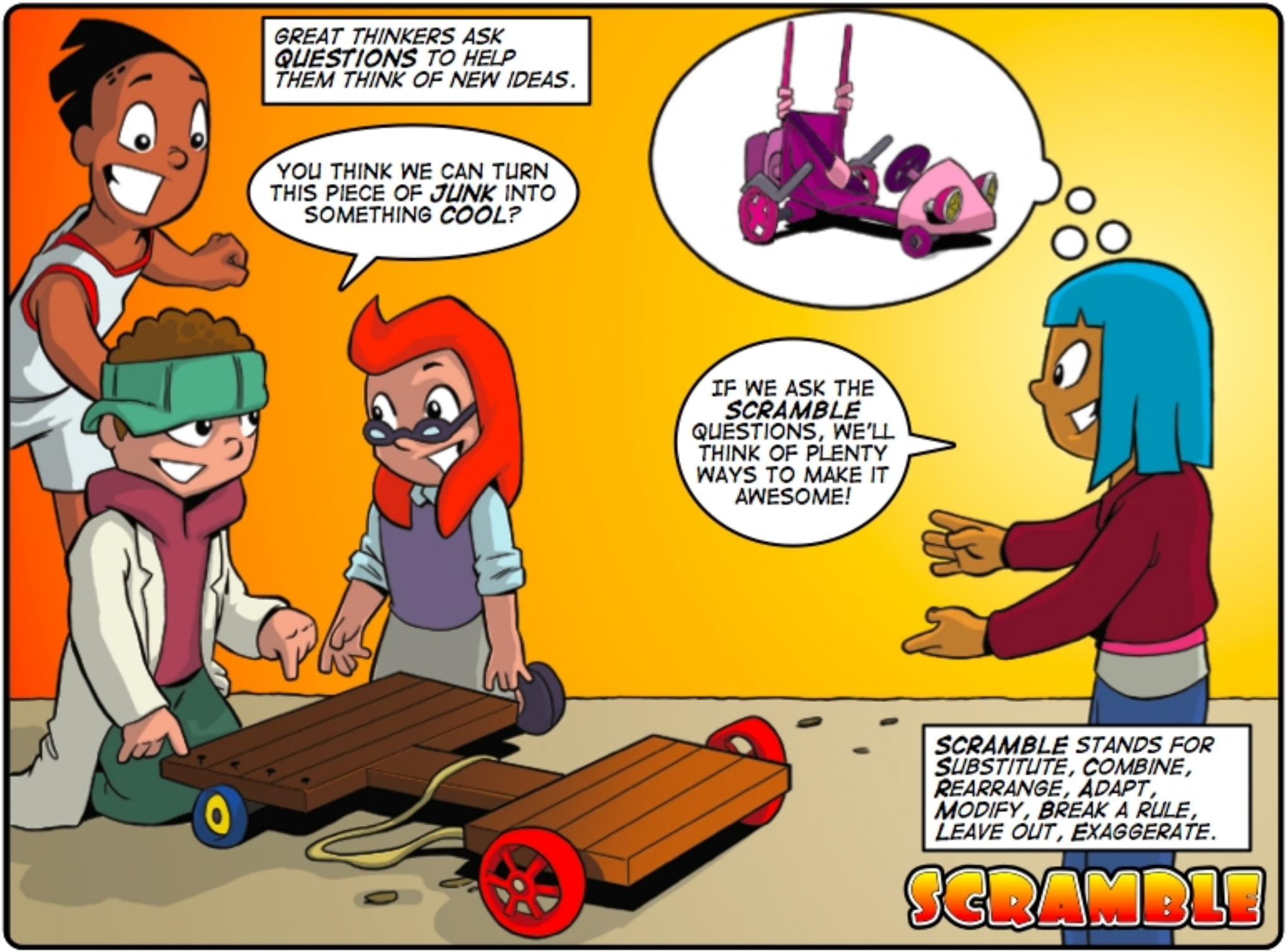

TO BEGIN MAKING A GOOD DEFINITION, JUST SAY IN PLAIN WORDS WHAT IS INVOLVED.
BUT IT'S OBVIOUS WHAT SETS GAMES APART FROM THINGS LIKE DANCING OR LISTENING TO MUSIC. GAMES HAVE RULES!
THE RULES TELL YOU WHAT YOUR GOALS ARE. THEY TELL YOU HOW TO WIN. AND THEY TELL YOU WHAT YOU CAN AND CAN'T DO.
WOW, JO! I THINK THAT'S A BRILLIANT DEFINITION.
YOU REALLY THINK SO?
YEAH! A GAME IS A FORM OF RECREATION MADE UP OF RULES DESCRIBING A GOAL AND HOW TO ACHIEVE IT. GREAT!


ONCE YOU HAVE A WORKING DEFINITION, YOU SHOULD CHECK IF IT IS TOO BROAD.
BEFORE WE SETTLE ON THE DEFINITION, WE JUST NEED TO TEST IT.
TEST IT?! HOW DO YOU TEST WORDS?
YOU ASK QUESTIONS, OF COURSE!
LIKE, IS IT TOO BROAD? THAT IS, DOES IT INCLUDE THINGS THAT AREN'T GAMES?
LIKE WHAT?!
LIKE JOGGING, OR SINGING, OR PLAYING MUSIC. THEY ALL HAVE CERTAIN RULES.
OK, I SUPPOSE THEY DO.
BUT YOU CAN STILL DO THOSE THINGS WITHOUT FOLLOWING RULES. SO THE RULES DON'T MAKE THEM WHAT THEY ARE.

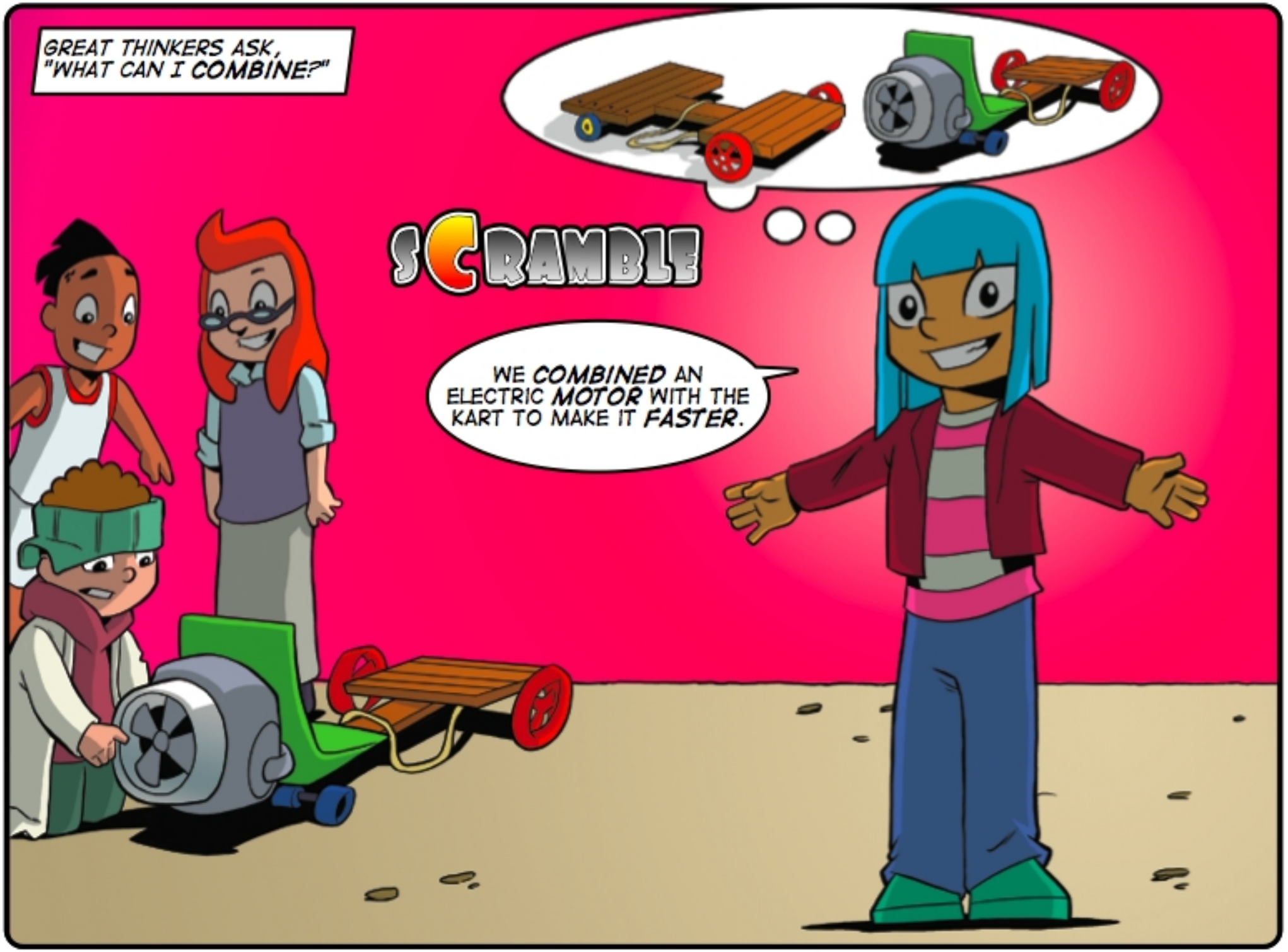

ALWAYS CHECK IF YOUR DEFINITION IS TOO NARROW.
ARE WE DONE YET?
NO, SPEEDY. THE DEFINITION DOESN'T SEEM TO BROAD. BUT WE MUST STILL ASK IF ITS TOO NARROW.
YOU MEAN, HAVE WE MISSED ANYTHING?
YEAH. DOES THE DEFINITION COVER CRICKET, BASEBALL, MONOPOLY?
I RECKON IT'S PERFECT FOR ALL OF THOSE!
BUT WHAT ABOUT SOMETHING LIKE THROWING A BALL AGAINST A WALL?
THERE AREN'T REALLY RULES FOR THAT, BUT I SUPPOSE IT IS A GAME. DAMN!
DON'T WORRY, JO. IT'S NOT MUCH OF A GAME, IS IT? IT'S A BORDERLINE CASE.

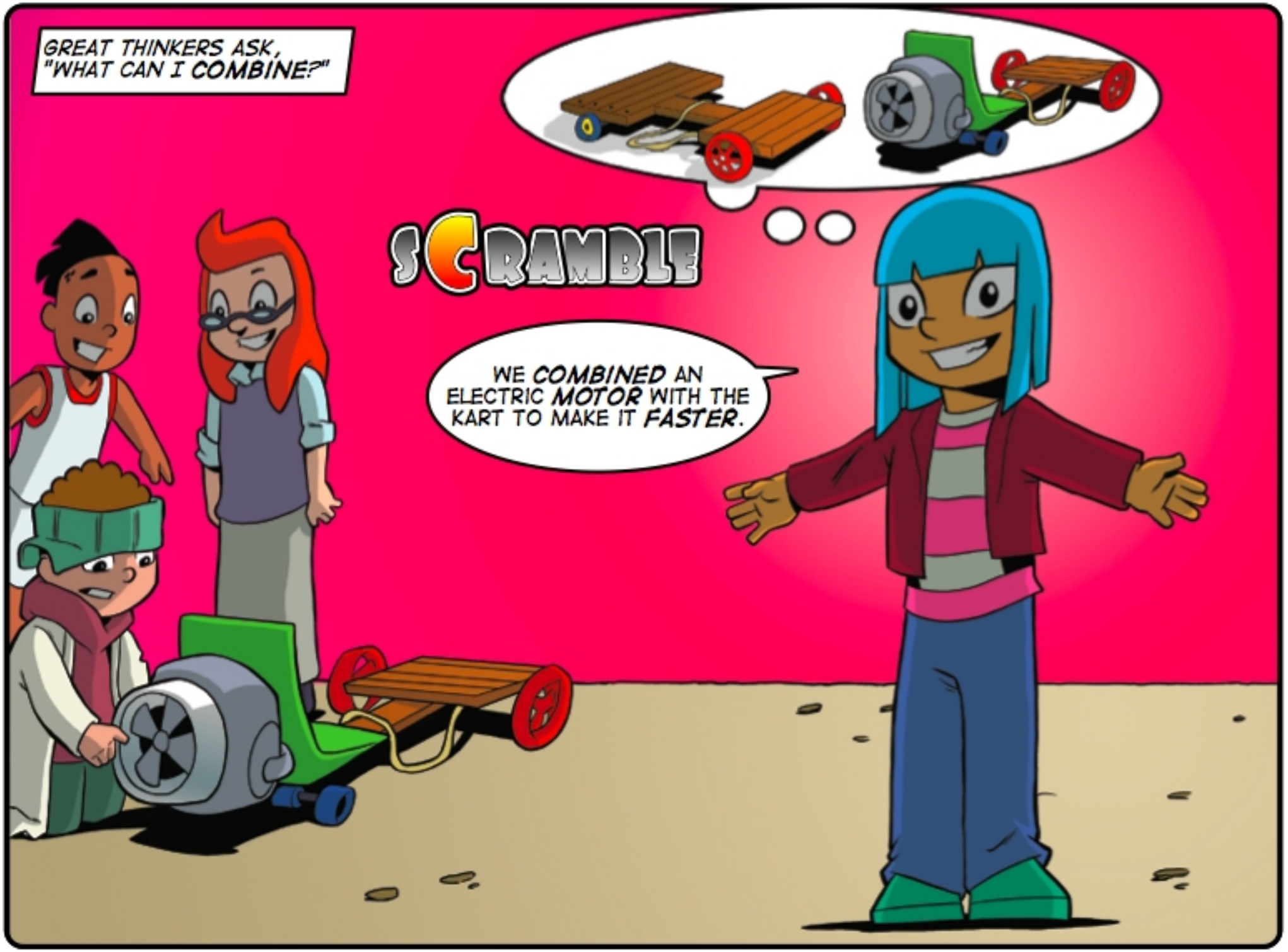

BORDER-WHAT? WHATEVER IT IS, IT SOUNDS LIKE WE'RE ALMOST DONE!
WHEN YOU DEFINE THINGS, THERE WILL ALWAYS BE BORDERLINE CASES.
THIS GYM TOWEL HAS A BLUE STRIPE AND A GREEN STRIPE. A DEFINITION OF THE COLOURS SHOULD DISTINGUISH BETWEEN THE TWO.
BUT THIS BLUE-GREEN STRIPE IS ON THE BORDER BETWEEN THE TWO COLOURS. WE SHOULDN'T THROW OUT A DEFINITION BECAUSE OF BORDERLINE CASES.
SO, AS LONG AS A DEFINITION IS NOT TOO BROAD AND NOT TOO NARROW, IT SHOULD BE OK?
EVEN IF THERE ARE SOME BORDERLINE CASES THAT COULD GO EITHER WAY!
THINK OF GOLDILOCKS: NOT TOO BROAD, NOT TOO NARROW, BUT JUST RIGHT!

Generating New Ideas


GREAT THINKERS ASK QUESTIONS TO HELP THEM THINK OF NEW IDEAS.
YOU THINK WE CAN TURN THIS PIECE OF JUNK INTO SOMETHING COOL?
IF WE ASK THE SCRAMBLE QUESTIONS, WE'LL THINK OF PLENTY WAYS TO MAKE IT AWESOME!
SCRAMBLE STANDS FOR SUBSTITUTE, COMBINE, REARRANGE, ADAPT, MODIFY, BREAK A RULE, LEAVE OUT, EXAGGERATE.
SCRAMBLE

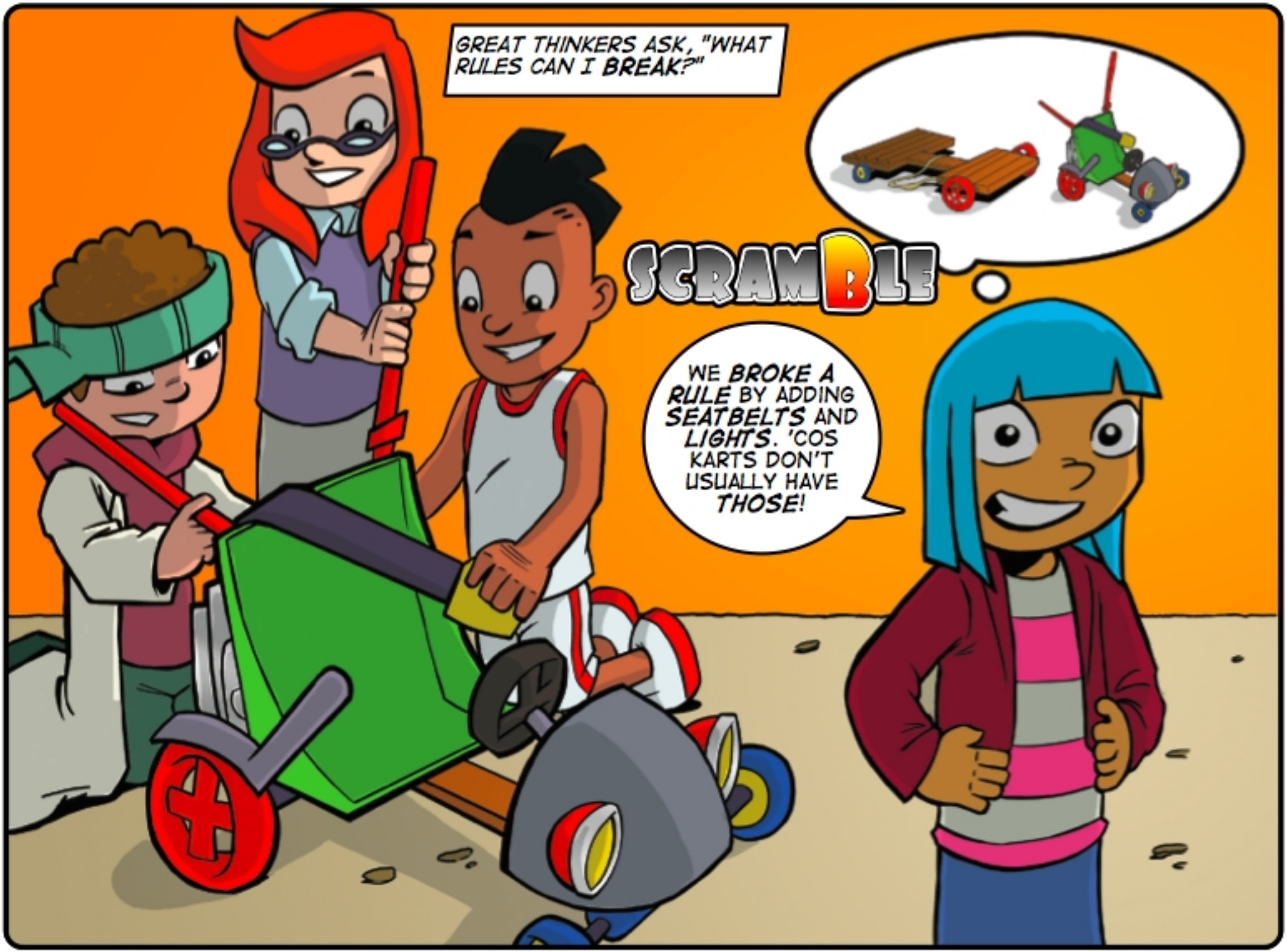

GREAT THINKERS ASK, "WHAT CAN I SUBSTITUTE?"
SCRAMBLE
WE SUBSTITUTED A CHAIR FOR THE SITTING PLANK, WHICH IS MUCH MORE COMFORTABLE!


GREAT THINKERS ASK, "WHAT CAN I COMBINE?"
SCRAMBLE
WE COMBINED AN ELECTRIC MOTOR WITH THE KART TO MAKE IT FASTER.


GREAT THINKERS ASK, "WHAT CAN I COMBINE?"
SCRAMBLE
WE COMBINED AN ELECTRIC MOTOR WITH THE KART TO MAKE IT FASTER.


GREAT THINKERS ASK, "WHAT CAN I REARRANGE?"
SCRAMBLE
WE REARRANGED THE WHEELS SO THAT THE BIGGER ONES WERE AT THE BACK.


GREAT THINKERS ASK, "WHAT CAN I MODIFY?"
SCRAMBLE
WE MODIFIED THE BRAKES TO MAKE THEM EASIER TO CONTROL

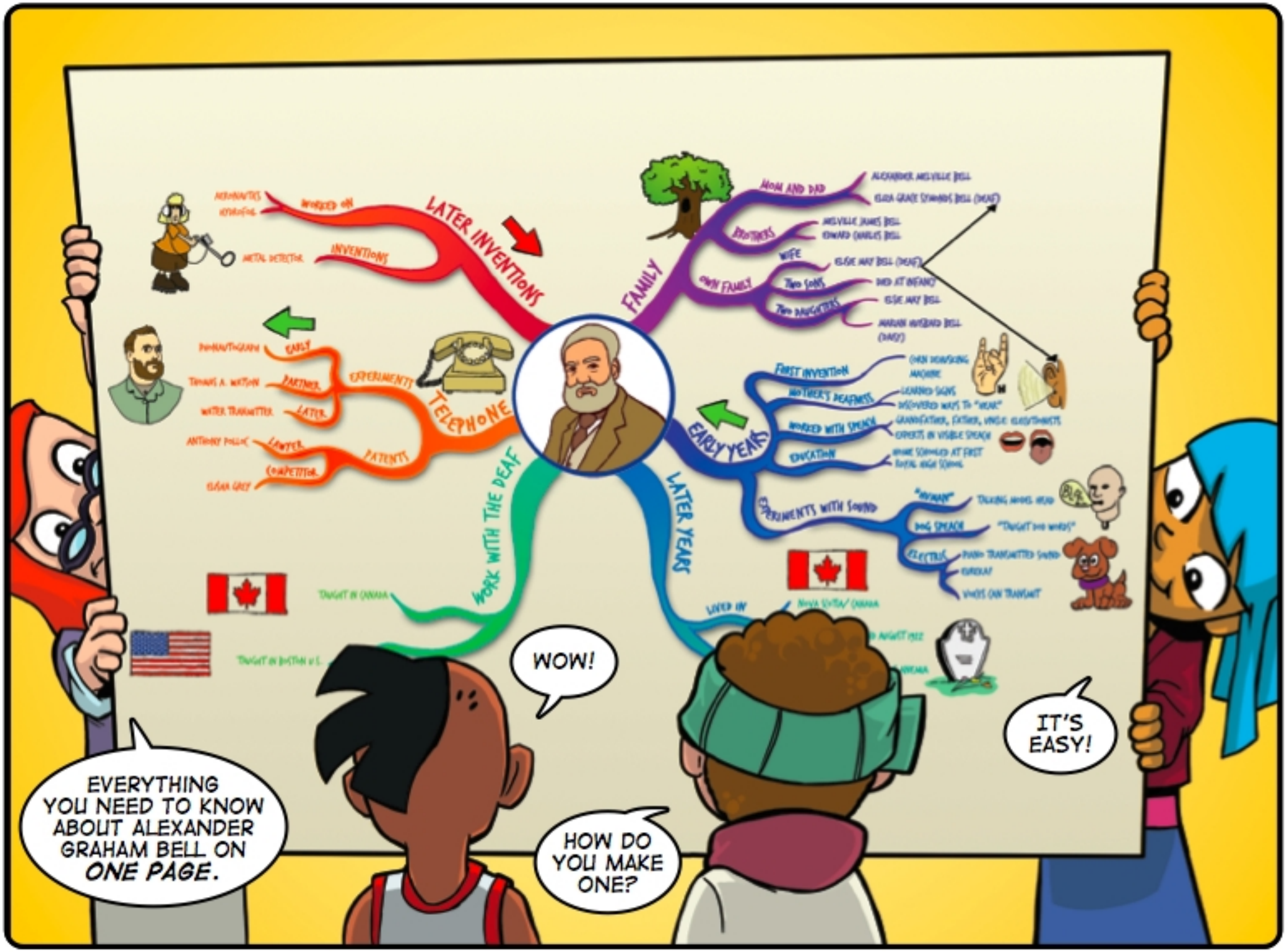

GREAT THINKERS ASK, "WHAT RULES CAN I BREAK?"
SCRAMBLE
WE BROKE A RULE BY ADDING SEATBELTS AND LIGHTS. 'COS KARTS DON'T USUALLY HAVE THOSE!


GREAT THINKERS ASK, "WHAT CAN I LEAVE OUT?"
WE LEFT OUT THE FOOT PLANK. IT'S REALLY NOT NECESSARY.
SCRAMBLE


GREAT THINKERS ASK, "WHAT CAN I EXAGGERATE?"
WE EXAGGERATED THE WAY THE KART LOOKS BY GIVING IT A PAINT JOB.
SCRAMBLE

Mind Mapping

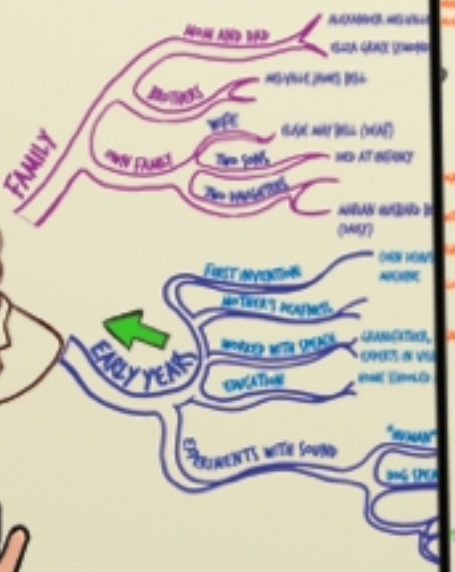

ONE AFTERNOON, THE DAY BEFORE A TEST.
WHY DO YOU LOOK SO TIRED, JO?
ALEXANDER GRAHAM BELL. THAT'S WHY...
WE'VE BEEN READING BOOKS ABOUT HIM FOR HOURS. BUT WE CAN'T SEEM TO REMEMBER ANYTHING WE READ.
WHY DON'T YOU MAKE A MIND MAP?

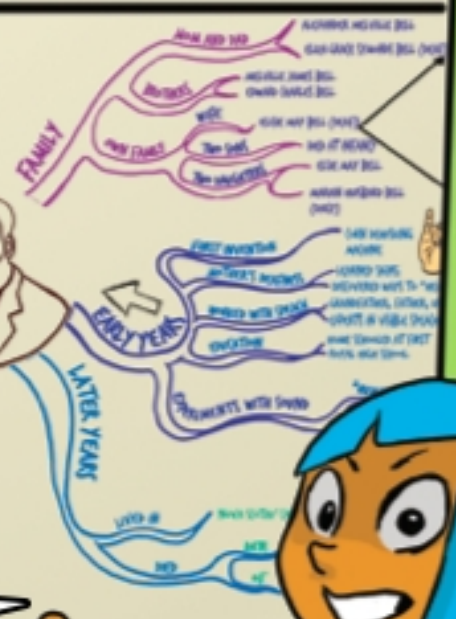

LATER INVENTIONS
INVENTIONS
METAL DETECTOR
TELEPHONE
EXPERIMENTS
EARLY
PARTNER
LATER
PATENTS
LAWYER
COMPETITOR
FAMILY
MOM AND DAD
ALEXANDER MELVILLE BELL
ELIZA GRACE SYMMONDS BELL (DEAF)
BROTHERS
MELVILLE JAMES BELL
EDWARD CHARLES BELL
OWN FAMILY
WIFE
ELSIE MAY BELL (DEAF)
Two sons
DIED AT INFANCY
Two daughters
ELSIE MAY BELL
MARIAN HUSBAND BELL (DAISY)
EARLY YEARS
FIRST INVENTION
MOTHER'S DEAFNESS
WORKED WITH SPEECH
EDUCATION
EXPERIMENTS WITH SOUND
"MAMAN"
DOG SPEACH
ELECTRIC
WORK WITH THE DEAF
LATER YEARS
LIVED IN
WOW!
HOW DO YOU MAKE ONE?
IT'S EASY!
EVERYTHING YOU NEED TO KNOW ABOUT ALEXANDER GRAHAM BELL ON ONE PAGE.

AND SO THE GIRLS EXPLAIN...

STEP 1: TURN YOUR PAGE HORIZONTAL AND WRITE YOUR MAIN IDEA IN THE MIDDLE. INSTEAD OF WRITING, THE GIRLS DREW A PICTURE OF BELL.

STEP 2: DRAW BRANCHES IN NEW COLOURS FOR EACH NEW MAIN IDEA. YOU DON'T HAVE TO COMPLETE ONE IDEA BEFORE GOING TO THE NEXT. FILL UP YOUR MAP AS YOU GO.





WHEN YOU READ ABOUT A NEW IDEA, WRITE SOMETHING ON THE MAP THAT WILL ***TRIGGER*** A MEMORY OF IT.

YOU WILL FIND A PLACE FOR MOST IDEAS ON A FEW MAIN BRANCHES.

STEP 3: ADD PICTURES OR PHOTOS OR DRAWINGS THAT HELP TRIGGER MEMORIES ABOUT DIFFERENT IDEAS.

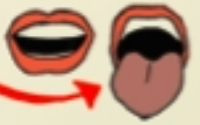
EARLY YEARS

FIRST INVENTION — CORN DEHUSKING MACHINE

MOTHER'S DEAFNESS — LEARNED SIGNS; DISCOVERED WAYS TO "HEAR"

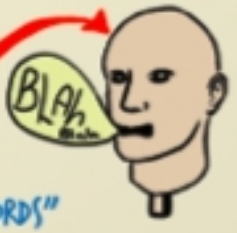
WORKED WITH SPEACH — GRANDFATHER, FATHER, UNCLE: ELECUTIONISTS; EXPERTS IN VISIBLE SPEACH

EDUCATION — HOME SCHOOLED AT FIRST; ROYAL HIGH SCHOOL



EXPERIMENTS WITH SOUND

"HUMAN" — TALKING MODEL HEAD



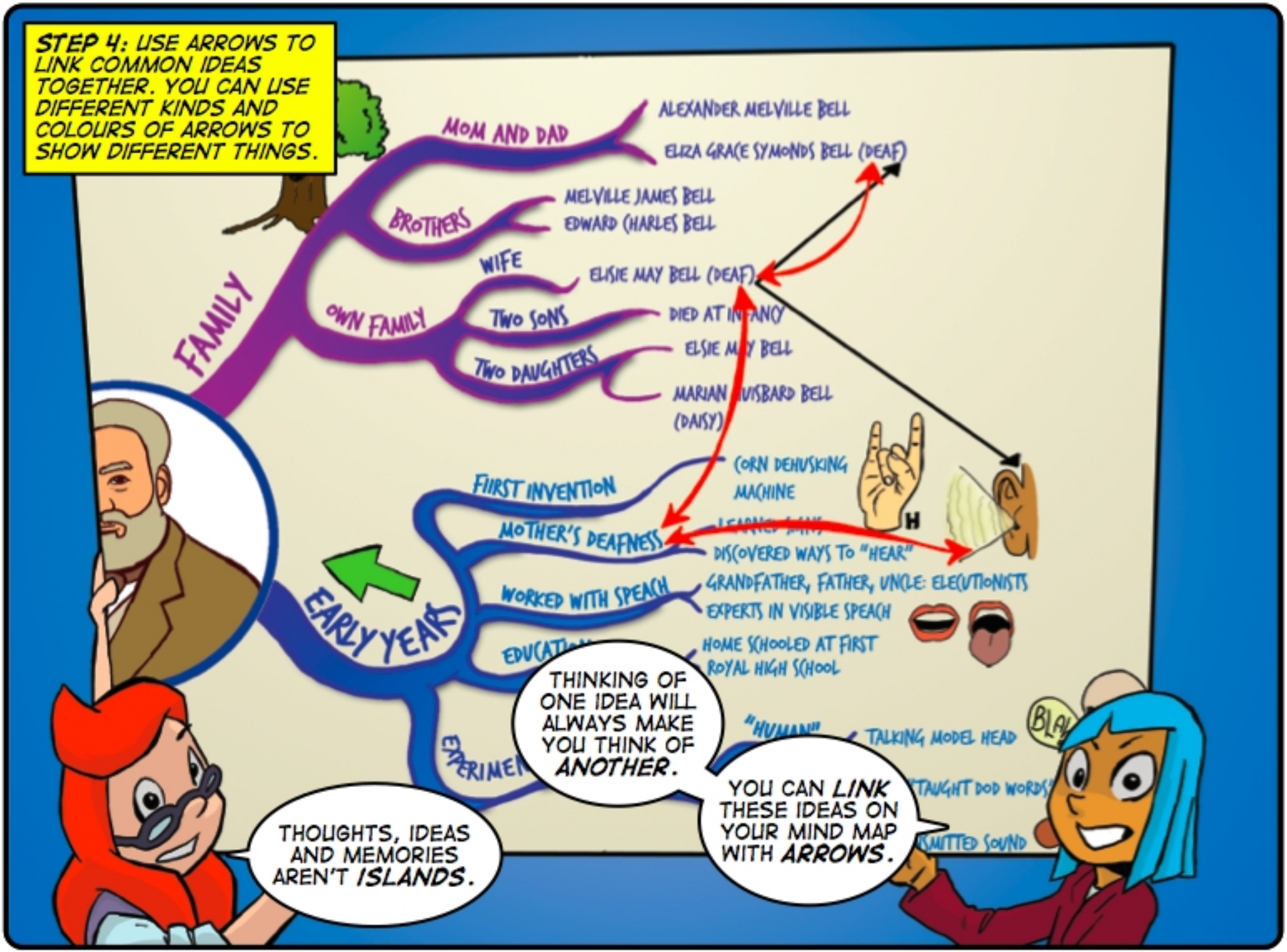
DOG SPEACH — "TAUGHT DOD WORDS"

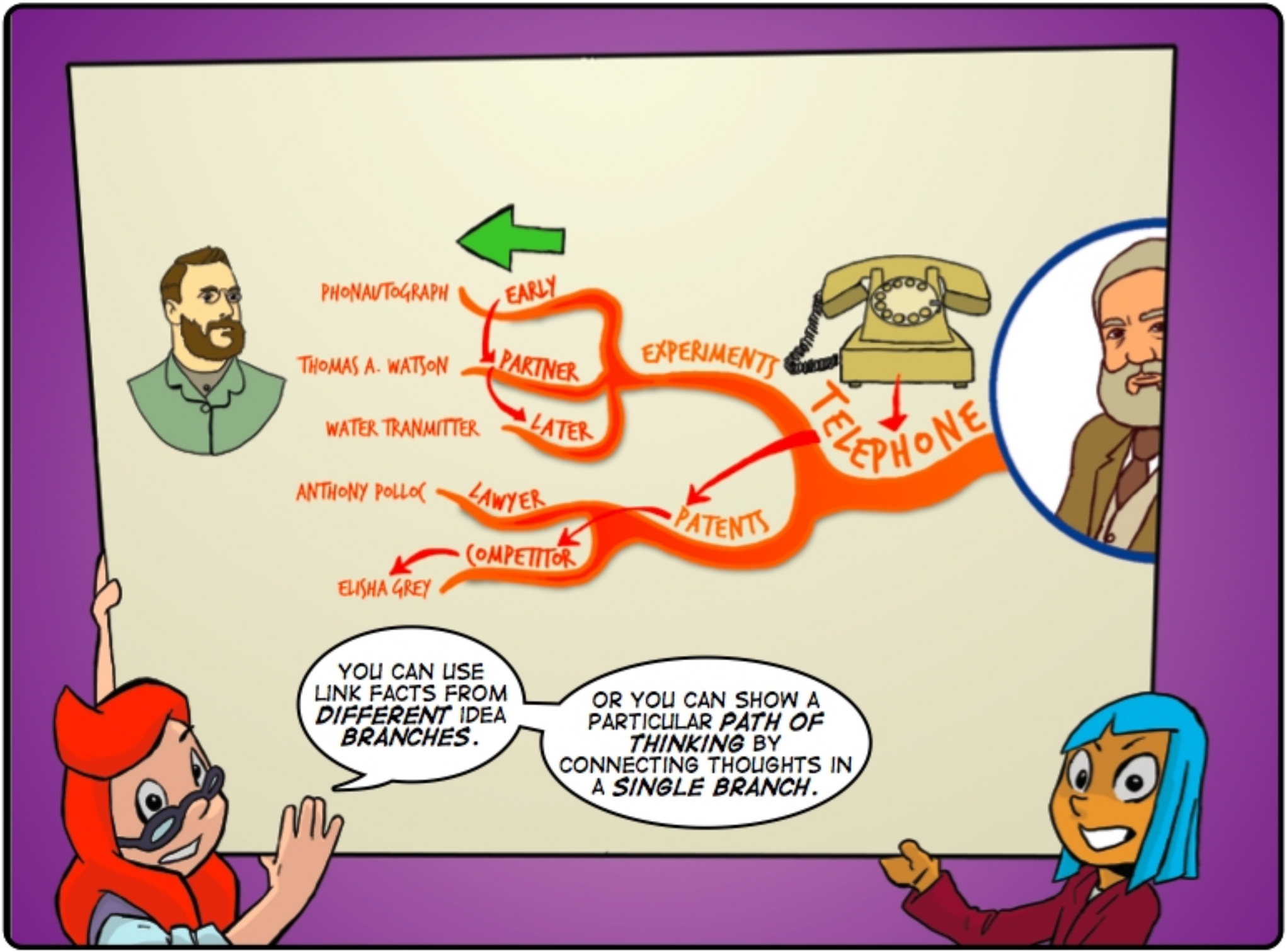
ELECTRIC — PIANO TRANSMITTED SOUND; EUREKA!; VOICES CAN TRANSMIT

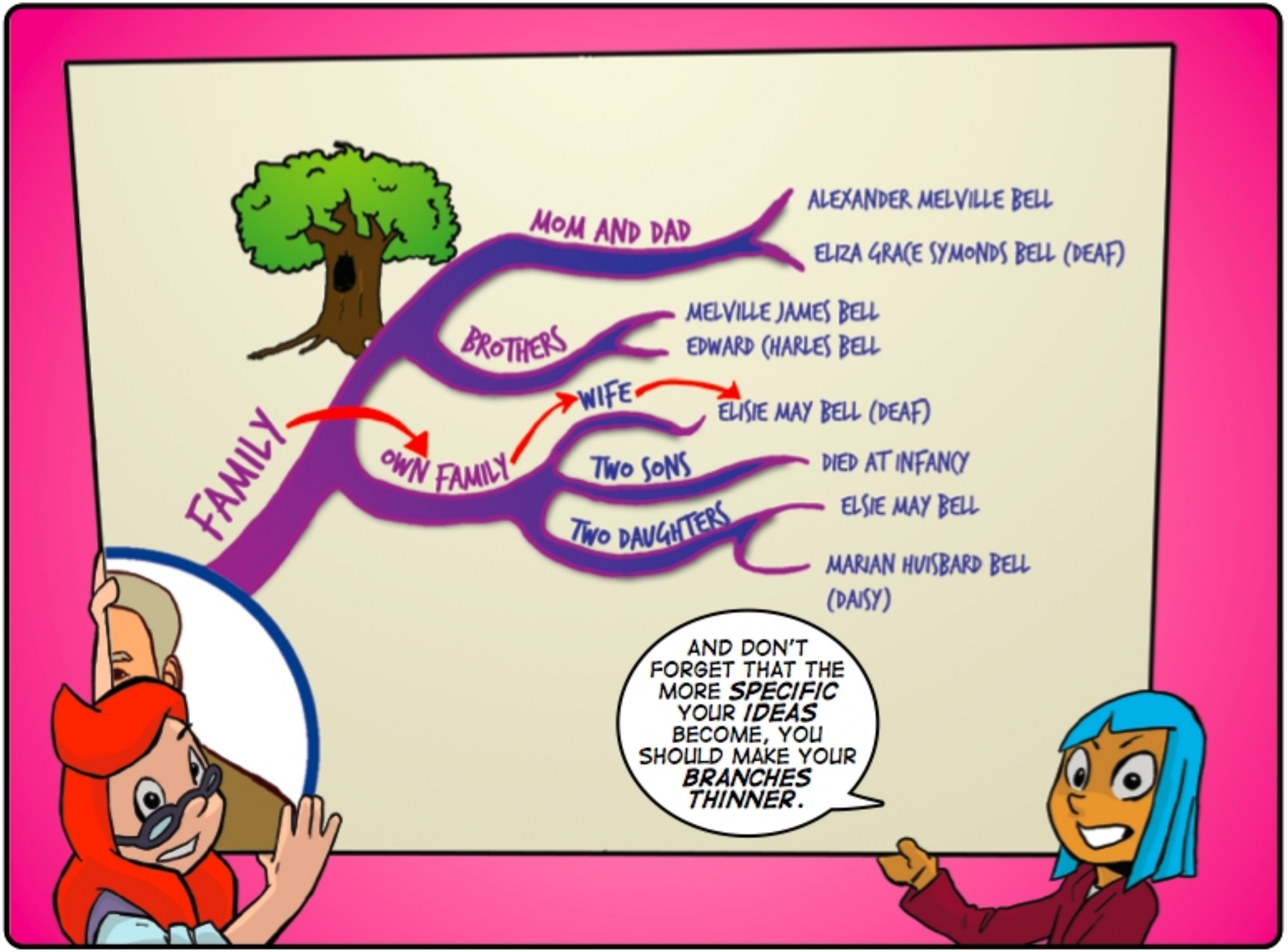
THE BRANCHES AREN'T EVERYTHING. BECAUSE YOU DON'T THINK ONLY IN ***WORDS***.

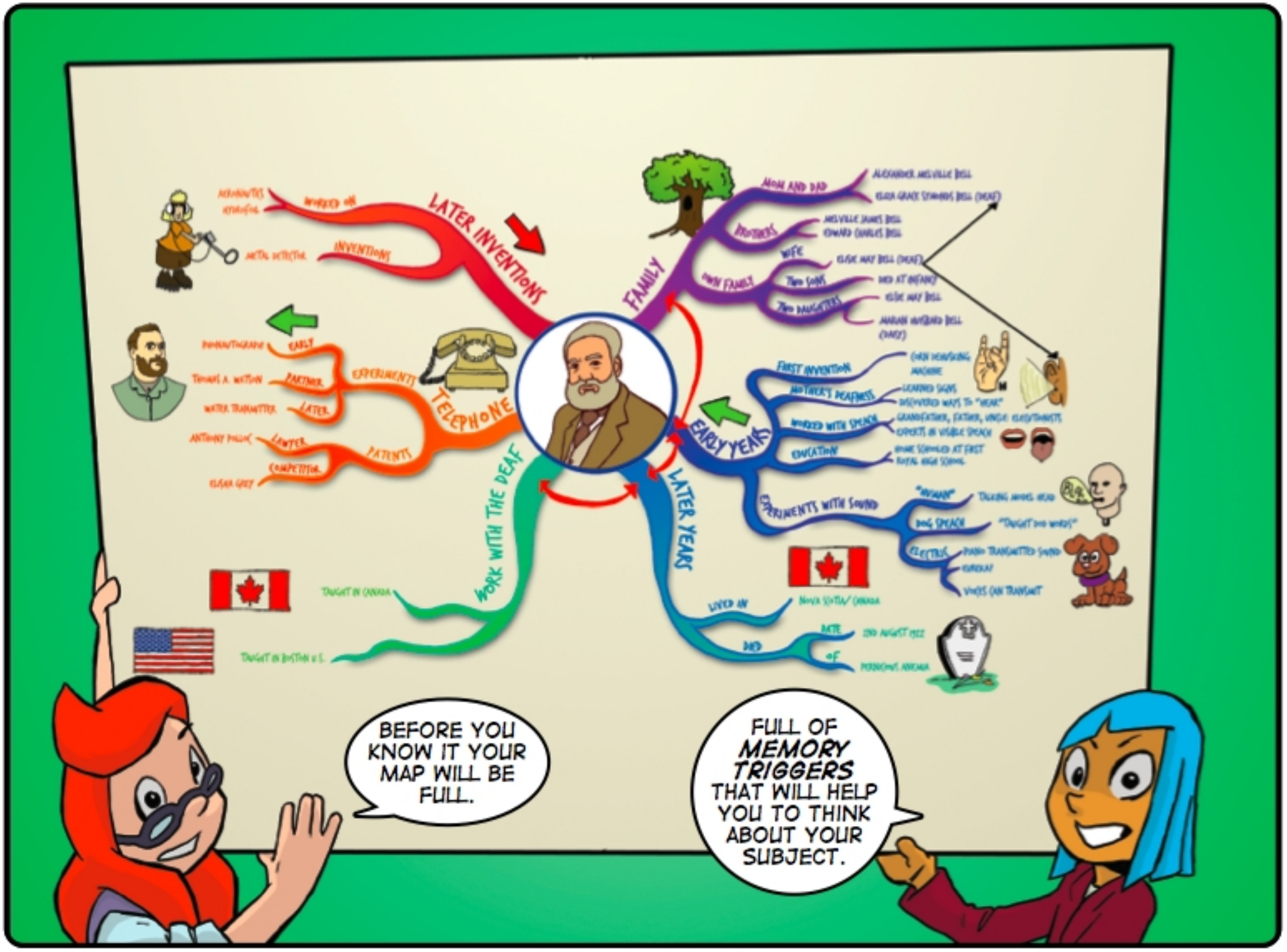
YOU THINK IN ***PICTURES*** TOO. SO FILL YOUR MAP WITH DRAWINGS. OR CUT OUT ***PHOTOS*** AND STICK THEM ON.

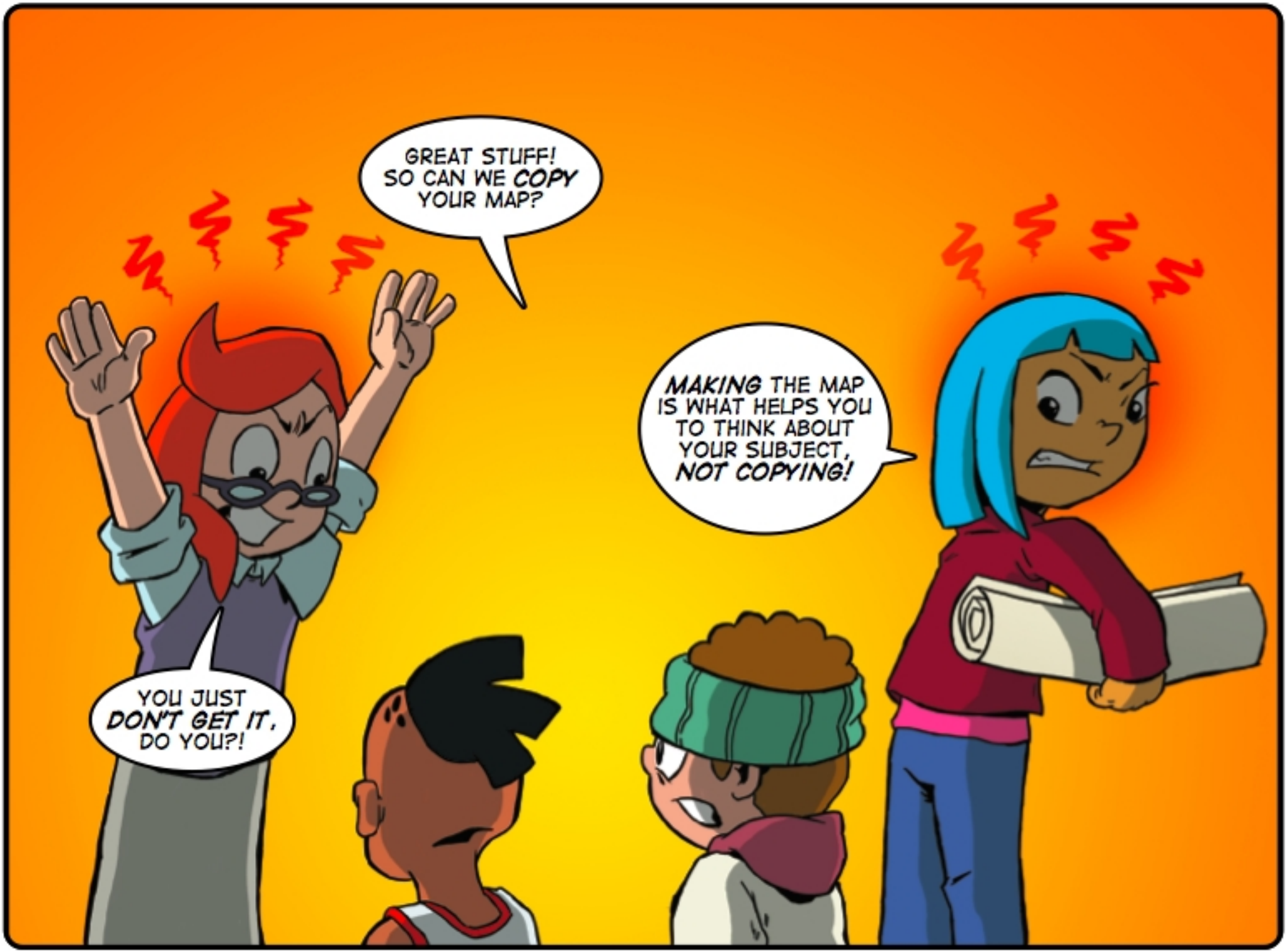
ANYTHING THAT HELPS YOU THINK ABOUT YOUR SUBJECT HAS A PLACE ON YOUR MIND MAP.


STEP 4: USE ARROWS TO LINK COMMON IDEAS TOGETHER. YOU CAN USE DIFFERENT KINDS AND COLOURS OF ARROWS TO SHOW DIFFERENT THINGS.
FAMILY
MOM AND DAD
ALEXANDER MELVILLE BELL
ELIZA GRACE SYMONDS BELL (DEAF)
BROTHERS
MELVILLE JAMES BELL
EDWARD CHARLES BELL
OWN FAMILY
WIFE
ELSIE MAY BELL (DEAF)
TWO SONS
DIED AT INFANCY
TWO DAUGHTERS
ELSIE MAY BELL
MARIAN HUBBARD BELL (DAISY)
EARLY YEARS
FIRST INVENTION
CORN DEHUSKING MACHINE
MOTHER'S DEAFNESS
DISCOVERED WAYS TO "HEAR"
WORKED WITH SPEACH
GRANDFATHER, FATHER, UNCLE: ELECUTIONISTS
EXPERTS IN VISIBLE SPEACH
HOME SCHOOLED AT FIRST
ROYAL HIGH SCHOOL
EXPERIMEN
"HUMAN"
TALKING MODEL HEAD
TAUGHT DOD WORDS
SMITTED SOUND
THOUGHTS, IDEAS AND MEMORIES AREN'T ISLANDS.
THINKING OF ONE IDEA WILL ALWAYS MAKE YOU THINK OF ANOTHER.
YOU CAN LINK THESE IDEAS ON YOUR MIND MAP WITH ARROWS.
BLA

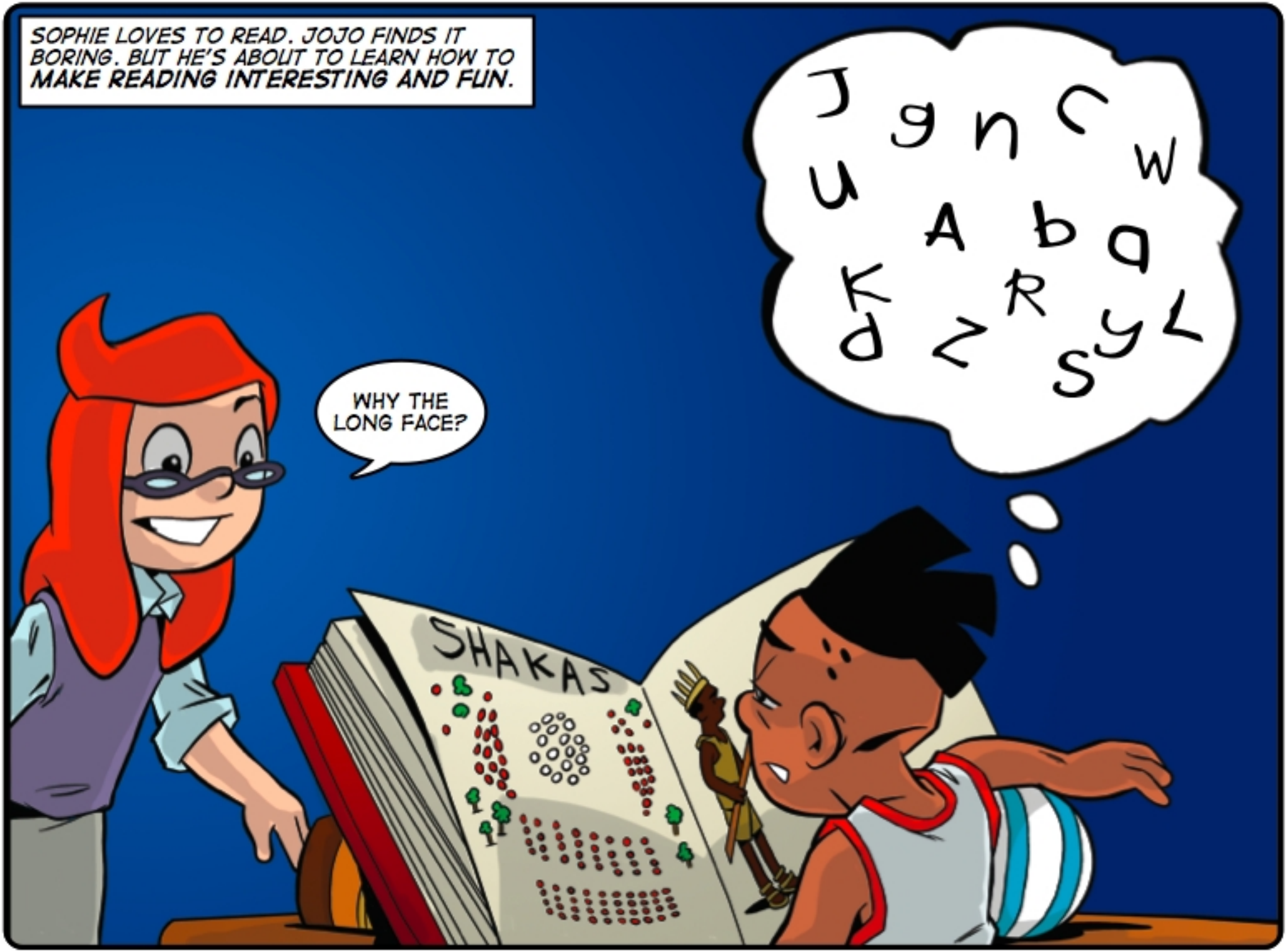

PHONAUTOGRAPH
EARLY
THOMAS A. WATSON
PARTNER
EXPERIMENTS
WATER TRANMITTER
LATER
TELEPHONE
ANTHONY POLLOC
LAWYER
PATENTS
COMPETITOR
ELISHA GREY
YOU CAN USE LINK FACTS FROM DIFFERENT IDEA BRANCHES.
OR YOU CAN SHOW A PARTICULAR PATH OF THINKING BY CONNECTING THOUGHTS IN A SINGLE BRANCH.

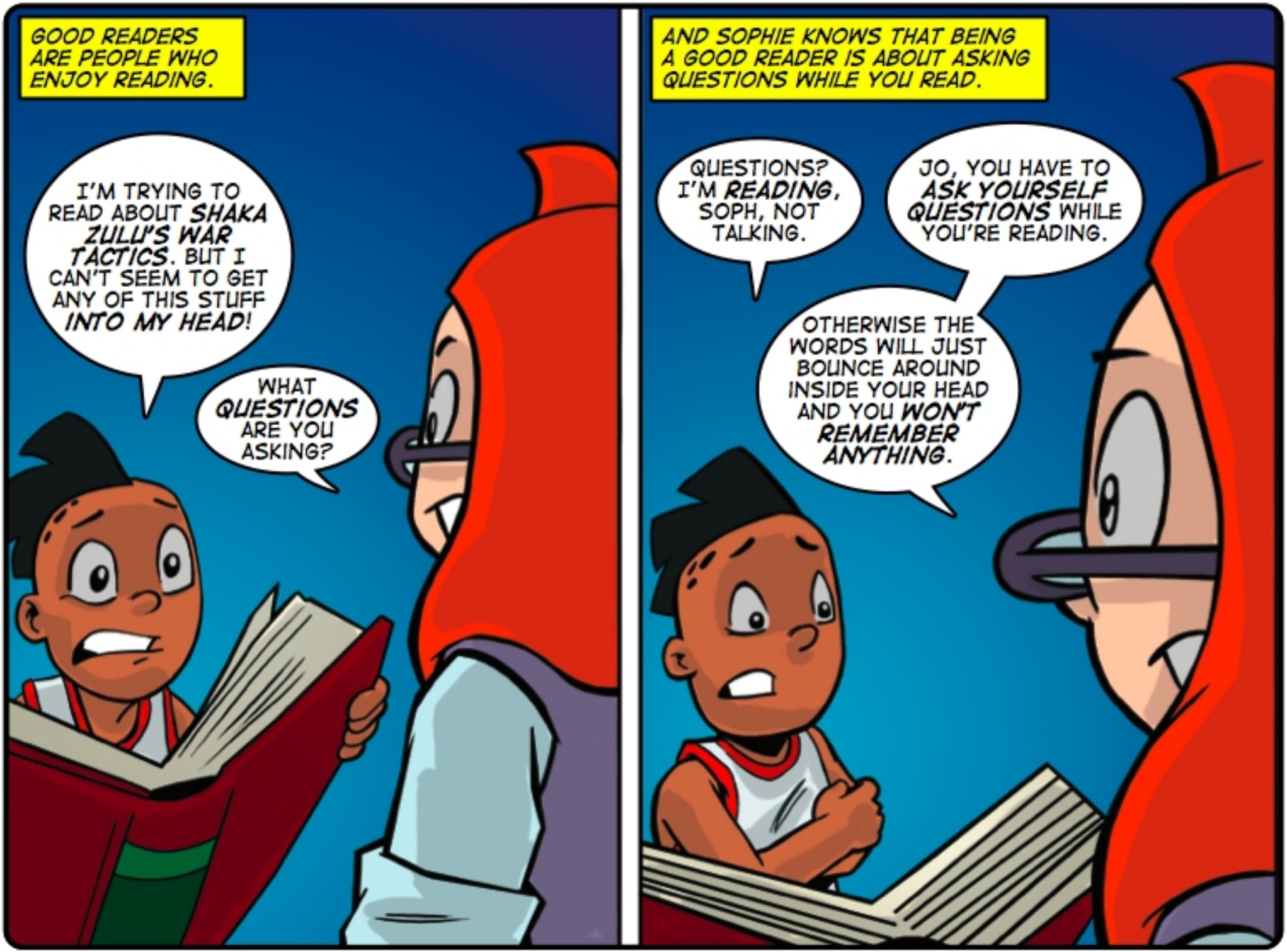

FAMILY
MOM AND DAD
ALEXANDER MELVILLE BELL
ELIZA GRACE SYMONDS BELL (DEAF)
BROTHERS
MELVILLE JAMES BELL
EDWARD CHARLES BELL
OWN FAMILY
WIFE
ELISIE MAY BELL (DEAF)
TWO SONS
DIED AT INFANCY
TWO DAUGHTERS
ELSIE MAY BELL
MARIAN HUBBARD BELL (DAISY)
AND DON'T FORGET THAT THE MORE SPECIFIC YOUR IDEAS BECOME, YOU SHOULD MAKE YOUR BRANCHES THINNER.

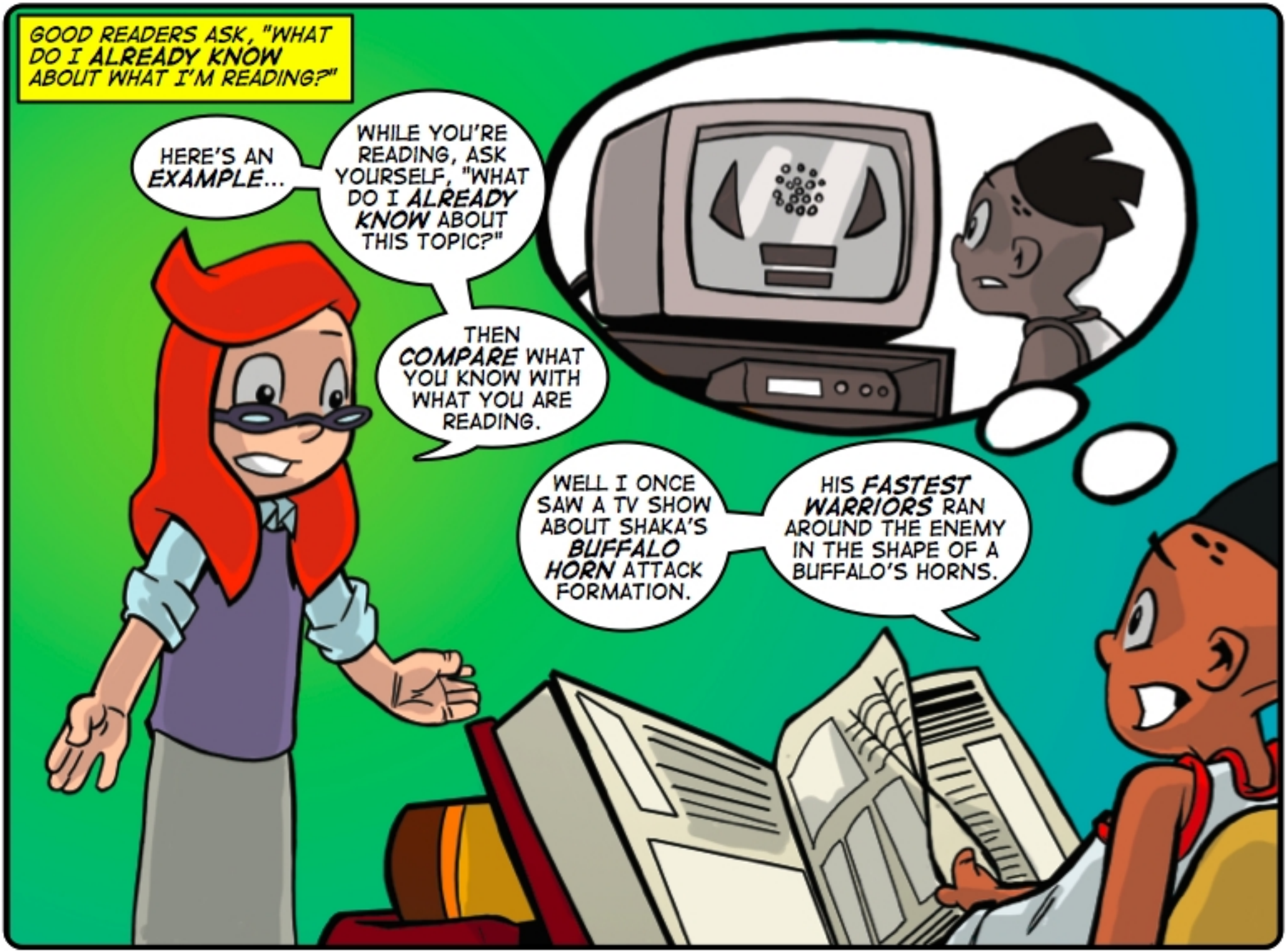

FAMILY
MOM AND DAD
ALEXANDER MELVILLE BELL
ELIZA GRACE SYMMONDS BELL (DEAF)
BROTHERS
MELVILLE JAMES BELL
EDWARD CHARLES BELL
OWN FAMILY
WIFE
ELSIE MAY BELL (DEAF)
TWO SONS
DIED AT INFANCY
ELSIE MAY BELL
TWO DAUGHTERS
MARIAN HUBBARD BELL (DAISY)
EARLY YEARS
FIRST INVENTION
HOUSEHOLD MACHINE
MOTHER'S DEAFNESS
LEARNED SIGNS
DISCOVERED WAYS TO "HEAR"
WORKED WITH SPEECH
GRANDFATHER, FATHER, UNCLE ELOCUTIONISTS
EXPERTS IN VISIBLE SPEECH
EDUCATION
HOME SCHOOLED AT FIRST
ROYAL HIGH SCHOOL
EXPERIMENTS WITH SOUND
"HEARING"
TALKING MACHINE HEAD
DOG SPEECH
"TAUGHT DOG WORDS"
ELECTRICITY
BRAIN TRANSMITTED SOUND
EUREKA!
VOICES CAN TRANSMIT
LATER YEARS
LIVED IN
NOVA SCOTIA/ CANADA
DIED
DATE
23RD AUGUST 1922
OF
PEMBROKE, ANNACHA
WORK WITH THE DEAF
TAUGHT IN CANADA
TAUGHT IN BOSTON U.S.
TELEPHONE
EXPERIMENTS
EARLY
PARTNER
LATER
PATENTS
LAWYER
COMPETITOR
ELISHA GREY
LATER INVENTIONS
INVENTIONS
METAL DETECTOR
BEFORE YOU KNOW IT YOUR MAP WILL BE FULL.
FULL OF MEMORY TRIGGERS THAT WILL HELP YOU TO THINK ABOUT YOUR SUBJECT.

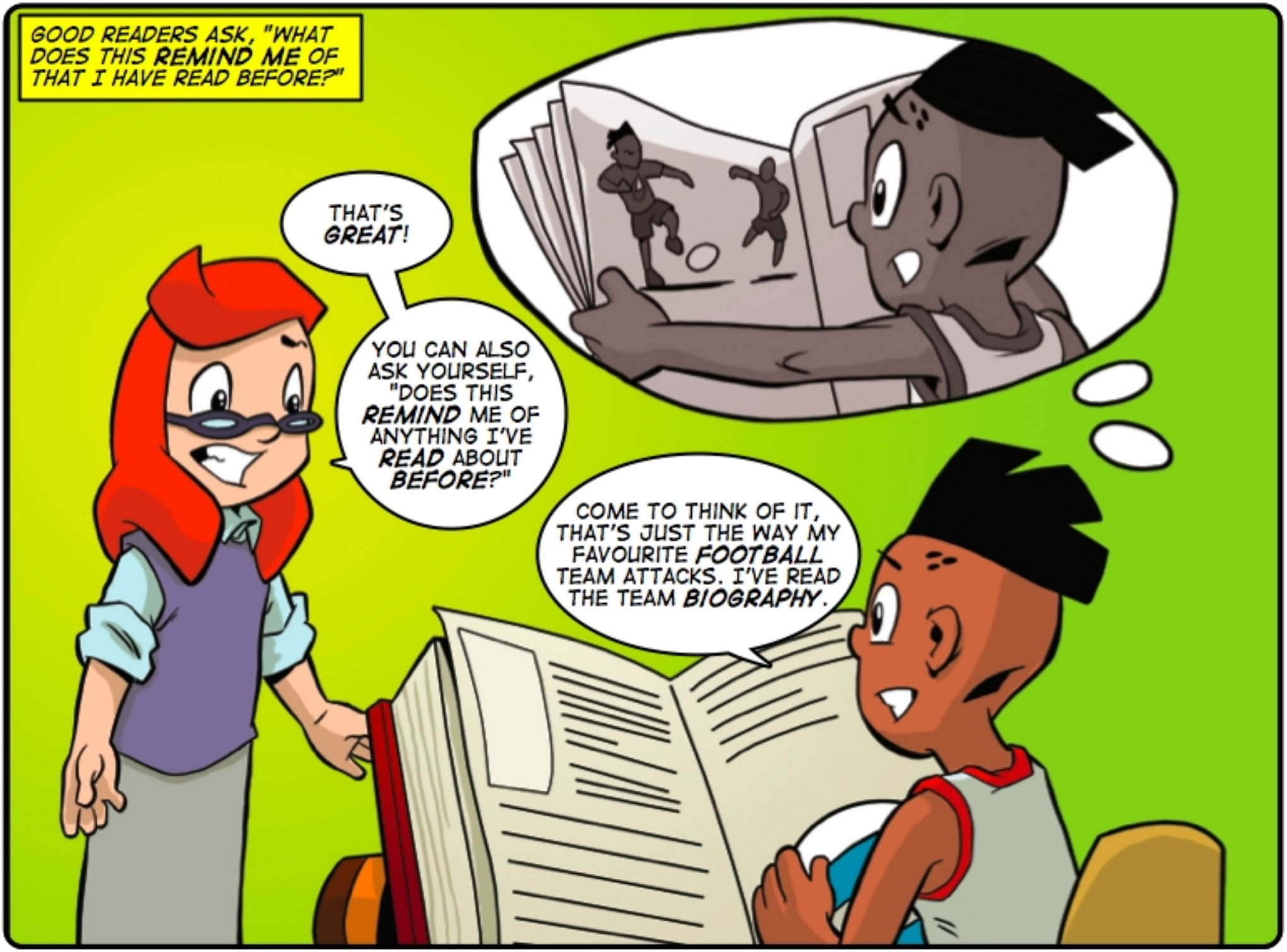

GREAT STUFF! SO CAN WE COPY YOUR MAP?
YOU JUST DON'T GET IT, DO YOU?!
MAKING THE MAP IS WHAT HELPS YOU TO THINK ABOUT YOUR SUBJECT, NOT COPYING!

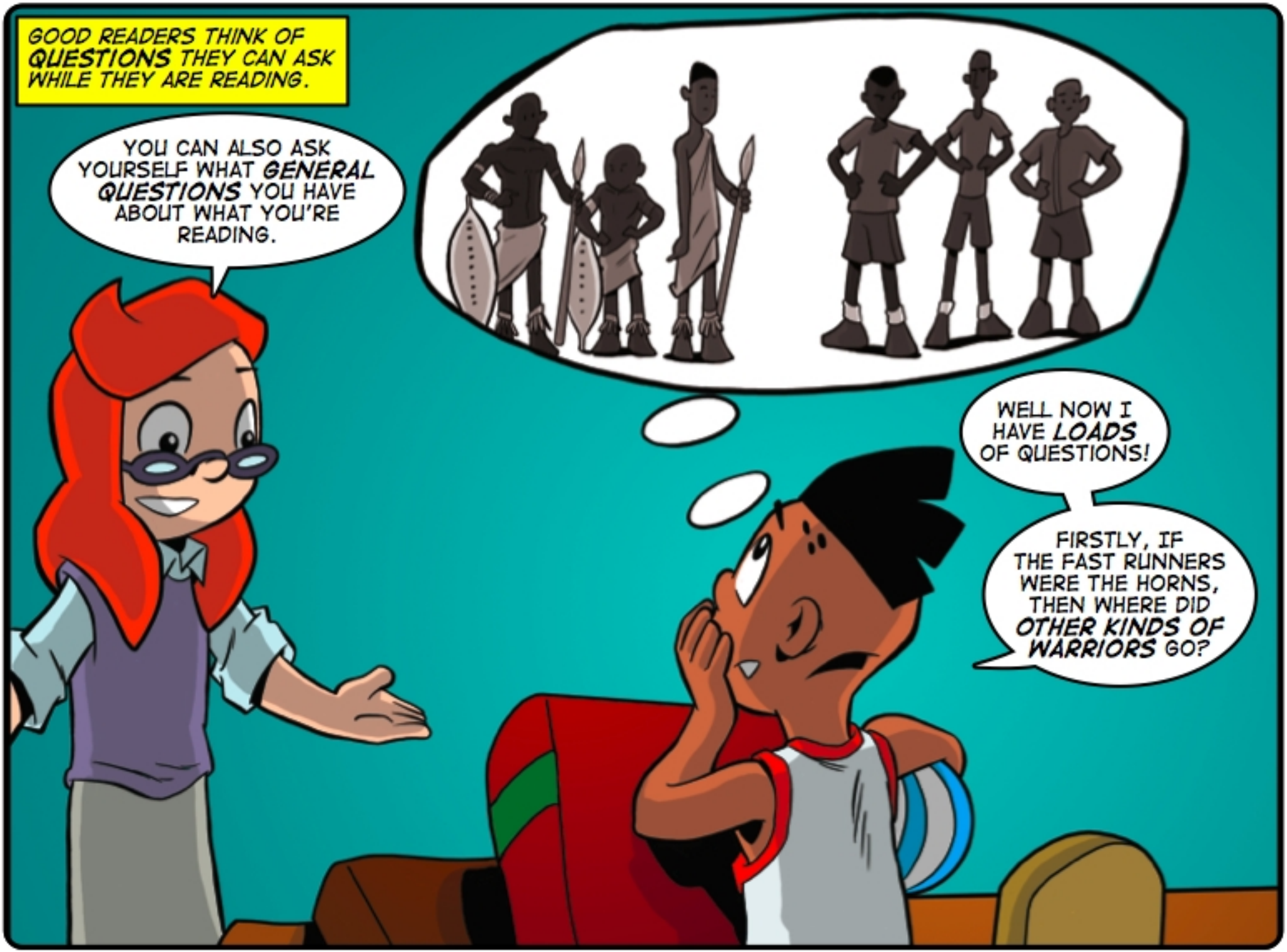
Reading appreciation

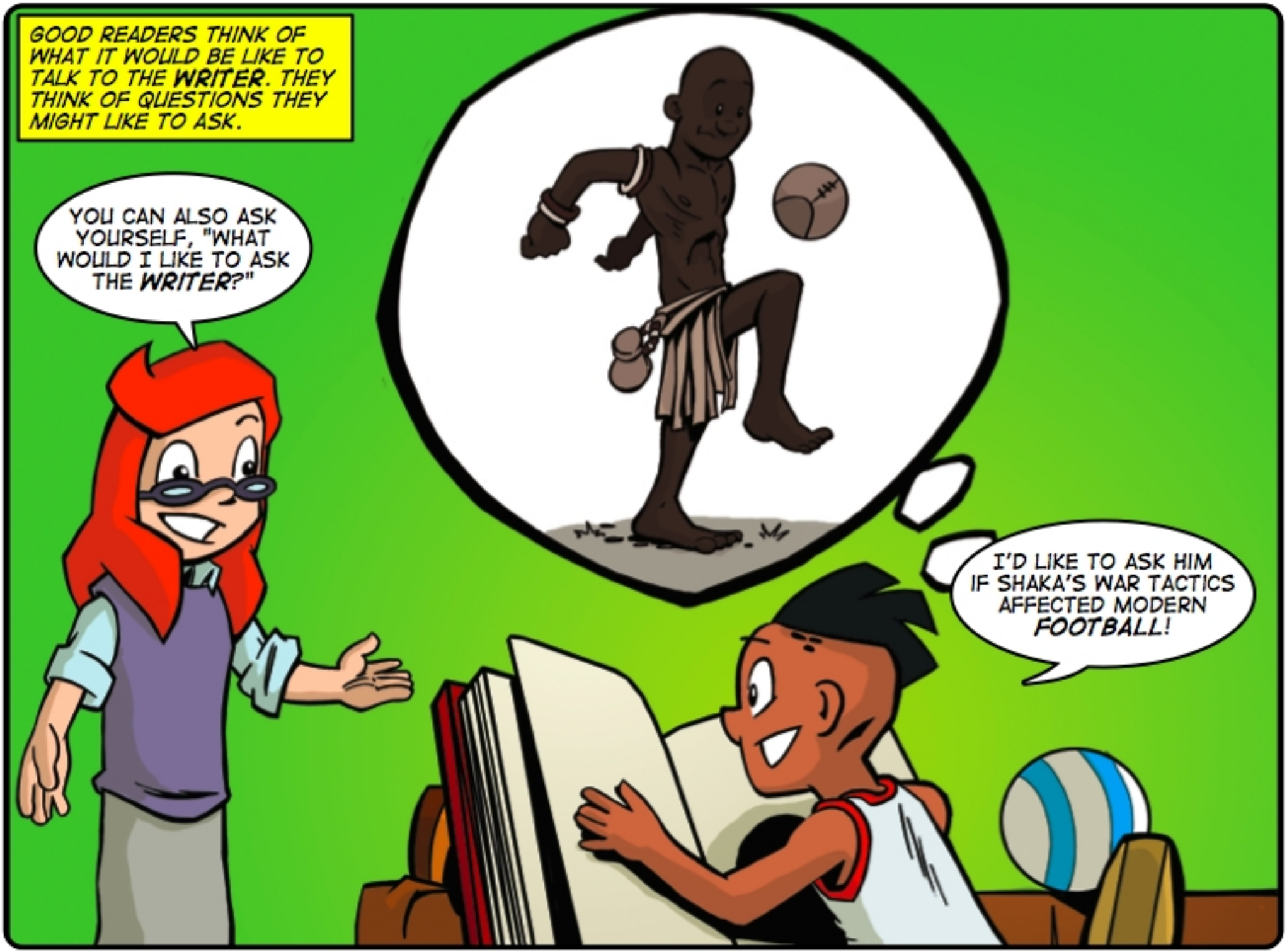

SOPHIE LOVES TO READ. JOJO FINDS IT BORING. BUT HE'S ABOUT TO LEARN HOW TO MAKE READING INTERESTING AND FUN.
WHY THE LONG FACE?
SHAKAS


GOOD READERS ARE PEOPLE WHO ENJOY READING.
I'M TRYING TO READ ABOUT SHAKA ZULU'S WAR TACTICS. BUT I CAN'T SEEM TO GET ANY OF THIS STUFF INTO MY HEAD!
WHAT QUESTIONS ARE YOU ASKING?
AND SOPHIE KNOWS THAT BEING A GOOD READER IS ABOUT ASKING QUESTIONS WHILE YOU READ.
QUESTIONS? I'M READING, SOPH, NOT TALKING.
JO, YOU HAVE TO ASK YOURSELF QUESTIONS WHILE YOU'RE READING.
OTHERWISE THE WORDS WILL JUST BOUNCE AROUND INSIDE YOUR HEAD AND YOU WON'T REMEMBER ANYTHING.


GOOD READERS ASK, "WHAT DO I ALREADY KNOW ABOUT WHAT I'M READING?"
HERE'S AN EXAMPLE...
WHILE YOU'RE READING, ASK YOURSELF, "WHAT DO I ALREADY KNOW ABOUT THIS TOPIC?"
THEN COMPARE WHAT YOU KNOW WITH WHAT YOU ARE READING.
WELL I ONCE SAW A TV SHOW ABOUT SHAKA'S BUFFALO HORN ATTACK FORMATION.
HIS FASTEST WARRIORS RAN AROUND THE ENEMY IN THE SHAPE OF A BUFFALO'S HORNS.


GOOD READERS ASK, "WHAT DOES THIS REMIND ME OF THAT I HAVE READ BEFORE?"
THAT'S GREAT!
YOU CAN ALSO ASK YOURSELF, "DOES THIS REMIND ME OF ANYTHING I'VE READ ABOUT BEFORE?"
COME TO THINK OF IT, THAT'S JUST THE WAY MY FAVOURITE FOOTBALL TEAM ATTACKS. I'VE READ THE TEAM BIOGRAPHY.

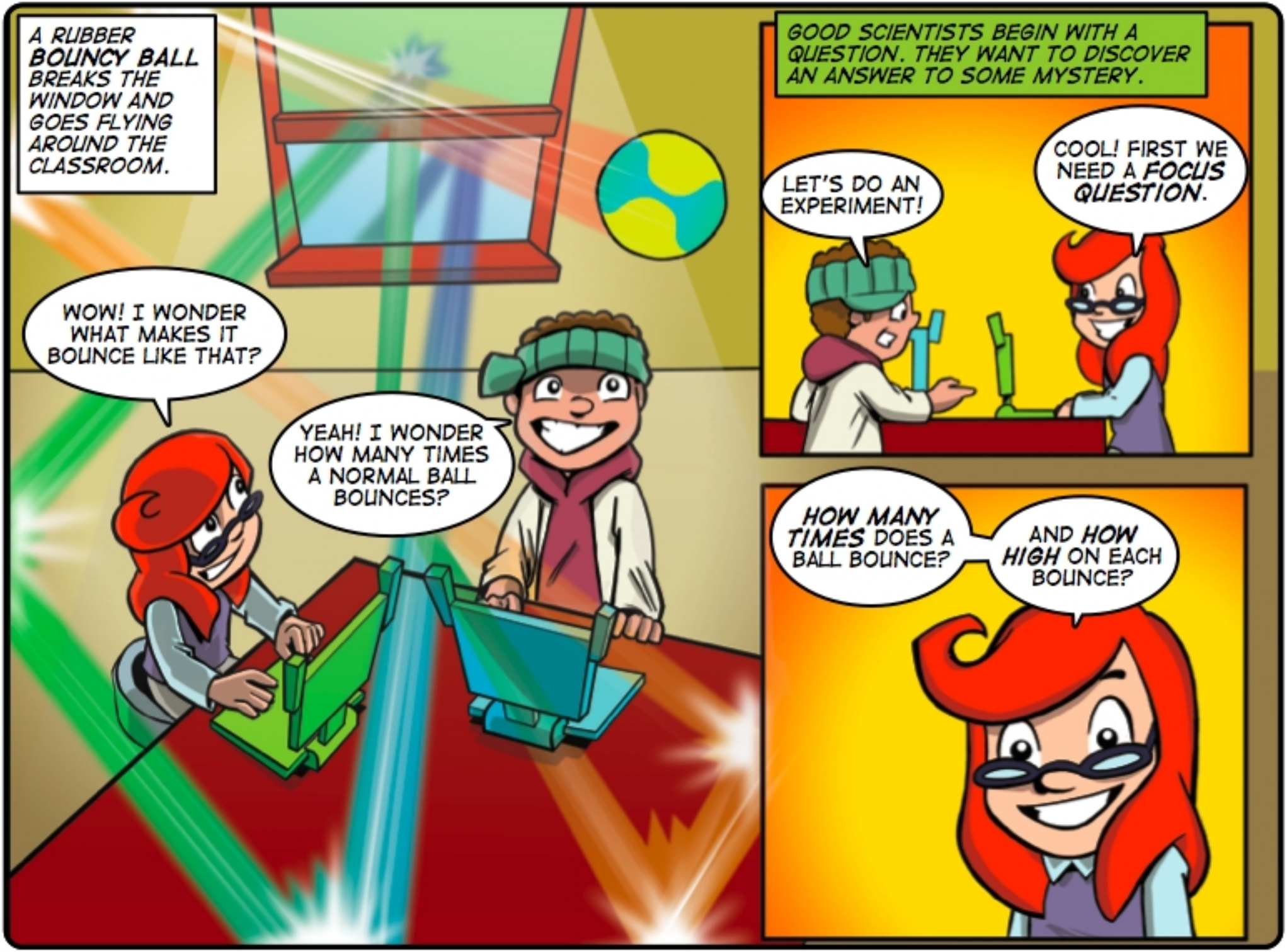

GOOD READERS THINK OF QUESTIONS THEY CAN ASK WHILE THEY ARE READING.
YOU CAN ALSO ASK YOURSELF WHAT GENERAL QUESTIONS YOU HAVE ABOUT WHAT YOU'RE READING.
WELL NOW I HAVE LOADS OF QUESTIONS!
FIRSTLY, IF THE FAST RUNNERS WERE THE HORNS, THEN WHERE DID OTHER KINDS OF WARRIORS GO?

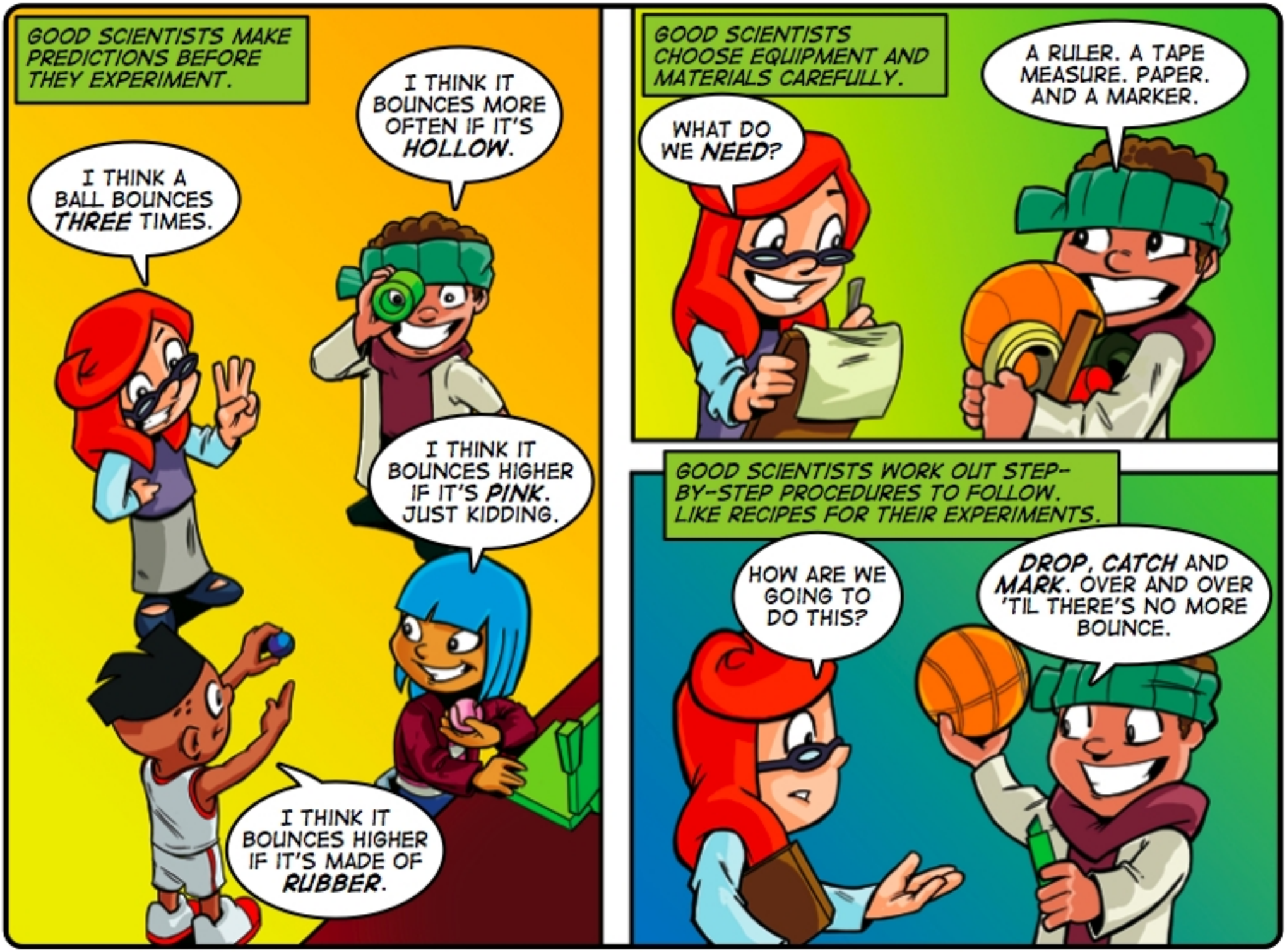

GOOD READERS THINK OF WHAT IT WOULD BE LIKE TO TALK TO THE WRITER. THEY THINK OF QUESTIONS THEY MIGHT LIKE TO ASK.
YOU CAN ALSO ASK YOURSELF, "WHAT WOULD I LIKE TO ASK THE WRITER?"
I'D LIKE TO ASK HIM IF SHAKA'S WAR TACTICS AFFECTED MODERN FOOTBALL!


SO DOES THAT HELP YOU?
LIKE YOU WON'T BELIEVE, SOPH!
BECAUSE NOW I HAVE AN IDEA FOR MY HISTORY PROJECT!

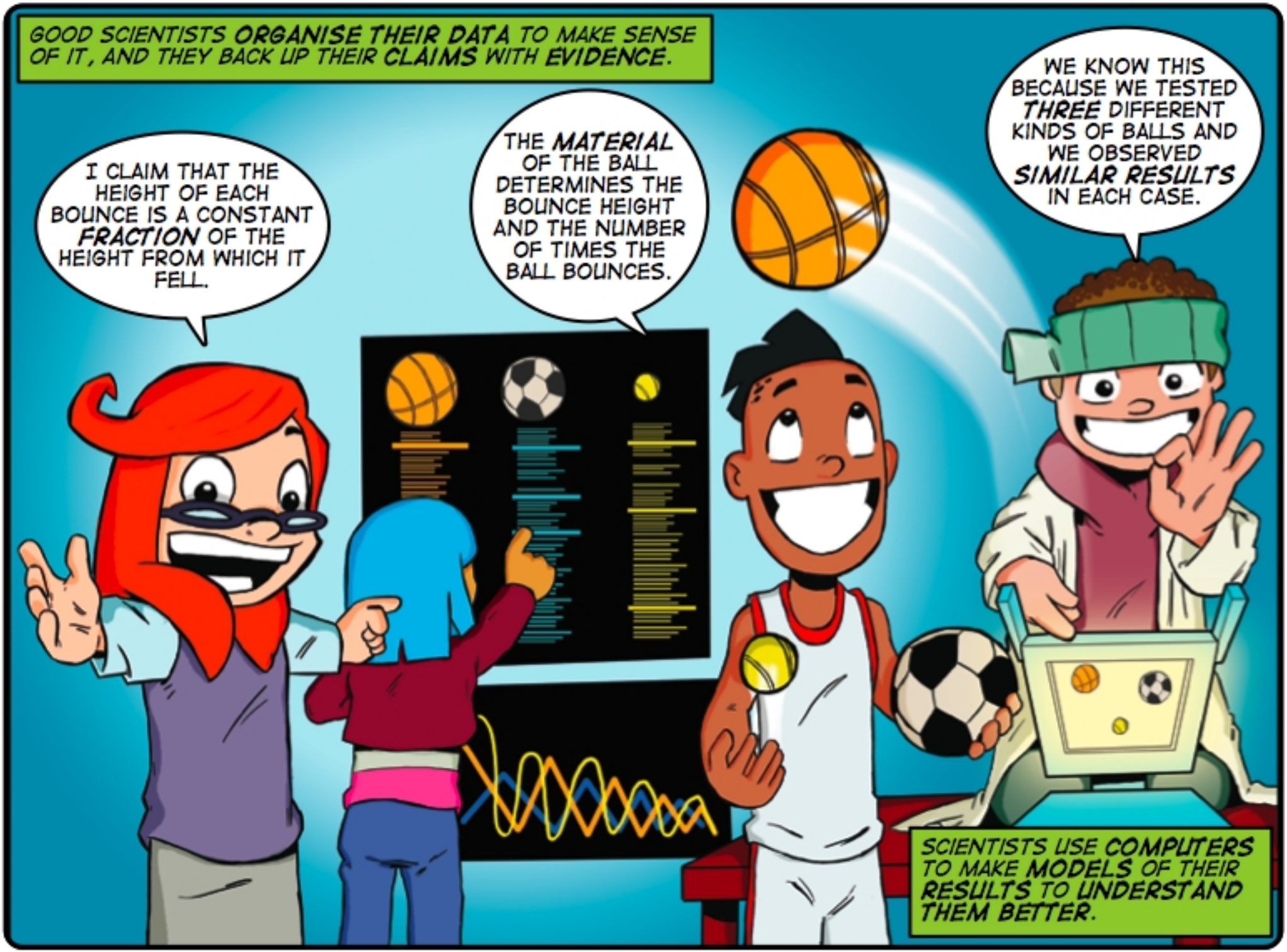

WHILE I WAS READING, I KEPT ASKING MYSELF HOW SHAKA'S ATTACK FORMATION COMPARES WITH MY FAVOURITE FOOTBALL TEAM.

Scientific Method

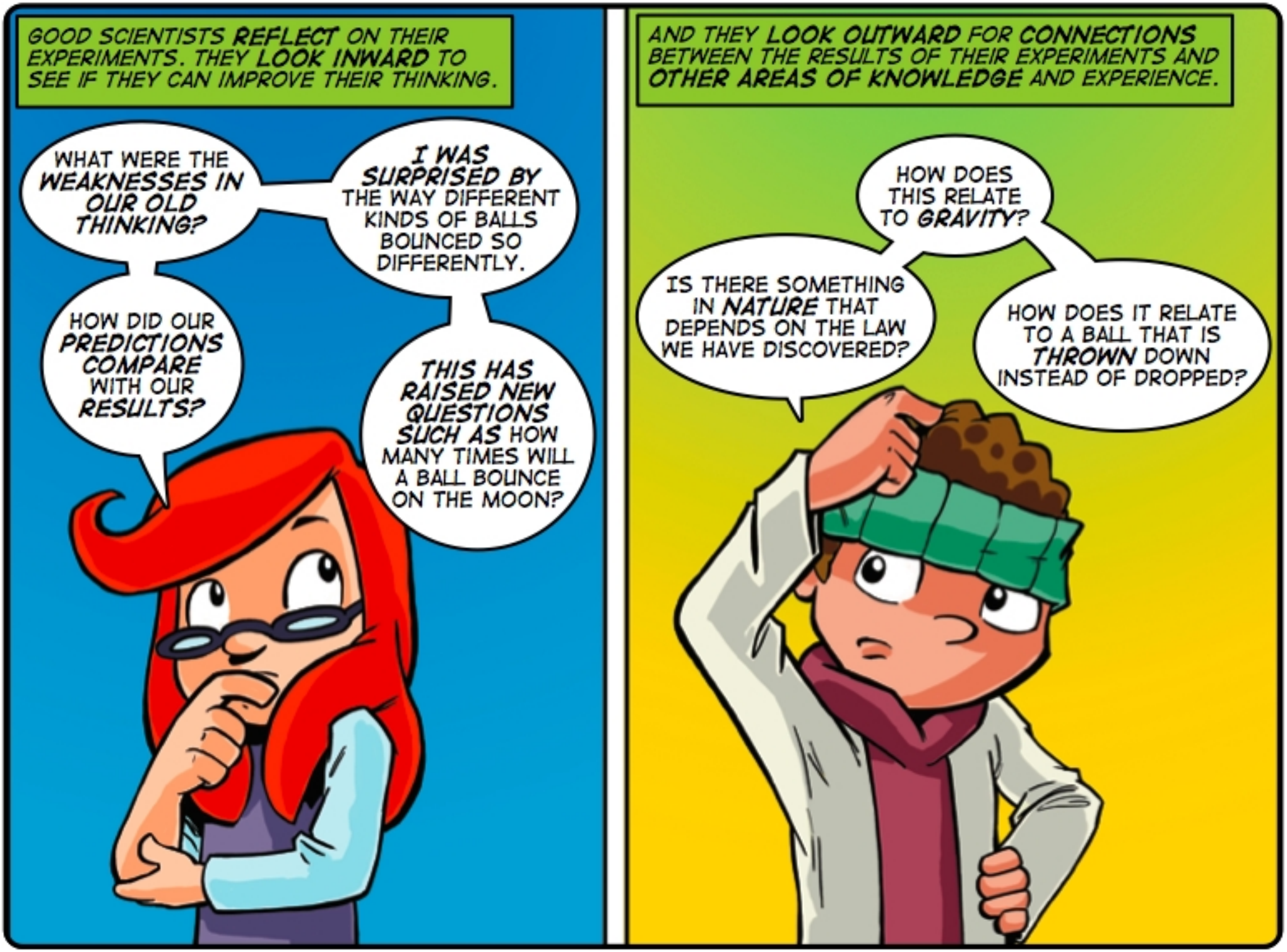

A RUBBER BOUNCY BALL BREAKS THE WINDOW AND GOES FLYING AROUND THE CLASSROOM.
WOW! I WONDER WHAT MAKES IT BOUNCE LIKE THAT?
YEAH! I WONDER HOW MANY TIMES A NORMAL BALL BOUNCES?
GOOD SCIENTISTS BEGIN WITH A QUESTION. THEY WANT TO DISCOVER AN ANSWER TO SOME MYSTERY.
LET'S DO AN EXPERIMENT!
COOL! FIRST WE NEED A FOCUS QUESTION.
HOW MANY TIMES DOES A BALL BOUNCE?
AND HOW HIGH ON EACH BOUNCE?


GOOD SCIENTISTS MAKE PREDICTIONS BEFORE THEY EXPERIMENT.
I THINK A BALL BOUNCES THREE TIMES.
I THINK IT BOUNCES MORE OFTEN IF IT'S HOLLOW.
I THINK IT BOUNCES HIGHER IF IT'S PINK. JUST KIDDING.
I THINK IT BOUNCES HIGHER IF IT'S MADE OF RUBBER.
GOOD SCIENTISTS CHOOSE EQUIPMENT AND MATERIALS CAREFULLY.
WHAT DO WE NEED?
A RULER. A TAPE MEASURE. PAPER. AND A MARKER.
GOOD SCIENTISTS WORK OUT STEP-BY-STEP PROCEDURES TO FOLLOW. LIKE RECIPES FOR THEIR EXPERIMENTS.
HOW ARE WE GOING TO DO THIS?
DROP, CATCH AND MARK. OVER AND OVER 'TIL THERE'S NO MORE BOUNCE.


GOOD SCIENTISTS OBSERVE, MEASURE AND RECORD THEIR MEASUREMENTS ACCURATELY.


GOOD SCIENTISTS ORGANISE THEIR DATA TO MAKE SENSE OF IT, AND THEY BACK UP THEIR CLAIMS WITH EVIDENCE.
I CLAIM THAT THE HEIGHT OF EACH BOUNCE IS A CONSTANT FRACTION OF THE HEIGHT FROM WHICH IT FELL.
THE MATERIAL OF THE BALL DETERMINES THE BOUNCE HEIGHT AND THE NUMBER OF TIMES THE BALL BOUNCES.
WE KNOW THIS BECAUSE WE TESTED THREE DIFFERENT KINDS OF BALLS AND WE OBSERVED SIMILAR RESULTS IN EACH CASE.
SCIENTISTS USE COMPUTERS TO MAKE MODELS OF THEIR RESULTS TO UNDERSTAND THEM BETTER.


GOOD SCIENTISTS SUMMARISE THEIR CONCLUSIONS.
WE LEARNED THAT THERE IS A LAW THAT GOVERNS THE BOUNCE OF A BALL.
NOW WE CAN MAKE BETTER PREDICTIONS ABOUT THE BOUNCE OF A BALL BECAUSE WE KNOW MORE ABOUT GRAVITY.
GOOD SCIENTISTS ARE SKEPTICAL ABOUT THEIR CONCLUSIONS.
HOW CAN WE BE SURE WE'RE NOT FOOLING OURSELVES?
WHAT WERE THE WEAKNESSES IN OUR EXPERIMENT?
DID WE REPEAT THE EXPERIMENT ENOUGH TIMES?


GOOD SCIENTISTS **REFLECT** ON THEIR EXPERIMENTS. THEY **LOOK INWARD** TO SEE IF THEY CAN IMPROVE THEIR THINKING.
WHAT WERE THE **WEAKNESSES IN OUR OLD THINKING?**
I WAS SURPRISED BY THE WAY DIFFERENT KINDS OF BALLS BOUNCED SO DIFFERENTLY.
HOW DID OUR **PREDICTIONS COMPARE** WITH OUR **RESULTS?**
THIS HAS RAISED NEW QUESTIONS SUCH AS HOW MANY TIMES WILL A BALL BOUNCE ON THE MOON?
AND THEY **LOOK OUTWARD** FOR **CONNECTIONS** BETWEEN THE RESULTS OF THEIR EXPERIMENTS AND **OTHER AREAS OF KNOWLEDGE** AND EXPERIENCE.
HOW DOES THIS RELATE TO **GRAVITY?**
IS THERE SOMETHING IN **NATURE** THAT DEPENDS ON THE LAW WE HAVE DISCOVERED?
HOW DOES IT RELATE TO A BALL THAT IS **THROWN** DOWN INSTEAD OF DROPPED?