Teaching Science with Science Fiction

Kelly McCullough
Laura McCullough
Introductions

- Kelly: author, professional communicator
- Laura: professor, professional teacher
Welcome

Experiences with SF and teaching science

Ideas for using SF as a teaching tool

Examples of SF use in the classroom
Introduction—How does an SF writer get involved in science education?

- **Continuity Editor:** CPU project (Funded by NSF)
- **Staff SF writer:** CIPS project (Funded by NSF)
- **Co-author/Co-editor:** Science Comic (Funded by NASA/Hubble)

Hanny and the Mystery of the Voorwerp
CPU Project

- Helping Laura deal with grad student workload
- Hired to clean up/unify voice of project
- Units written by 6 different authors
- That led to being hired for CIPS
Staff Writer

• SF as part of original grant application
• Easier to put in grant than produce
• Develop SF world and characters for project
• Write short fiction to illustrate science concepts
• Working with academics
CIPS project

Constructing Ideas in Physical Science

NSF-funded

Full year middle school curriculum

Research-based, student-centered

Scaffolded-inquiry pedagogy
• CIPS designed to use science fiction as a hook and as a teaching tool
• Created an SFnal world for project
• Short stories illustrating specific science
• 1,000 word short on speakers: 2 hour notice
• Working with academics
Storyline

Focus on 4 aliens from spaceship stranded in near-Earth space by catastrophic accident

Contact Earth to try to get help

Ship suffered extensive damage and now has problems with all on-board systems, especially power delivery
CIPS Project Story

- Testing suggested increased engagement from low SES
- Initial printing included SF context
- Chronicles of Wandering Star
- Workbook/Illustrated Serial Novel
- Text book company ultimately removed SF
Chronicles of the Wandering Star
CIPS Aliens

• CIPS Aliens

• Represent 4 modes of scientific thinking
  • Systems centered
  • Energy centered
  • Interactions centered
  • Forces centered
One example

Is The Buzzing In My Ears Bothering You?

Modulas suit malfunction

Character development piece

Diagnosis and repair of suit

Ends with ship’s buzzer - emergency
Hanny & the graphic novel

- Approached by Pamela Gay, astronomer
- Citizen science—Galaxy Zoo
- Crowd-sourced classification of galaxies
- 2007—Hanny van Arkel (Dutch schoolteacher)
- Classifying galaxies for the project
- Strange colored blob of gas
• Hanny not first to see the blob
• First to ask about it
• Curiosity (this is important!)
• Evidence says quasar illuminating a gas cloud!
• Closest thing to actually seeing a quasar
• How to publicize/popularize information
Creating the comic

• Storytelling as a way of garnering interest
• Crowd-sourcing comic itself
• Workshop at science fiction convention
• Divide up narrative
• Different writers
• Free PDF for download
My job

- Writing a few pieces
- Continuity editor (like CPU)
- Create an overarching narrative
- Character of cat science/curiosity (am I crazy)
- Curiosity as narrative hook
- Working with academics (astronomers!)
SCIENCE IS DRIVEN BY THAT MOST BASIC OF HUMAN IMPULSES, CURiosity.

WE WANT TO KNOW WHAT’S ON THE OTHER SIDE OF THE NEXT HILL.

OR INSIDE THIS SHELL.

OR HANGING IN THE SKY ABOVE US.

THE STORY OF HANNY AND THE VOICEMAIL SPEAKS TO THAT LAST CURiosity: WHAT’S OUT THERE?

IT’S A STORY THAT STARTED LONG AGO WITH ANOTHER PROTAGONIST, STEPHANIE JOUVELLE, AND THAT ENDS WITH AN AMAZING DISCOVERY USING ONE OF THE MOST SOPHISTICATED TOOLS EVER BUILT BY HUMAN HANDS, THE HUBBLE SPACE TELESCOPE.

Come with me and see where curiosity can lead.

SCIENCE IS A PROCESS. IT’S DRIVEN BY CURiosity AS AN IDEA AND BY THE CURiosity OF THE MANY PEOPLE WHO ACTUALLY DO THE WORK AND LOOK FOR THE ANSWERS. BUT SCIENCE DOESN’T STOP WHEN WE FIND THOSE ANSWERS. AN IMPORTANT PART OF THE PROCESS IS SHARING WHAT WE’VE LEARNED WITH THE WORLD SO THAT WE CAN HELP OTHER PEOPLE SATISFY THEIR CURiosity AND MAYBE INSPIRE A NEW GENERATION OF SCIENTISTS. AND MAYBE SOMEDAY, ONE OF THOSE PEOPLE WILL BE YOU.
SF in the classroom

• Idea has been around for a while

• The Physics Teacher 1968: “Try Science Fiction as a Teaching Aid”

• 10 other articles in TPT about science fiction and the classroom
Books available

1. *Teaching Science Fact with Science Fiction*
   Written and illustrated by Gary Raham

2. *The Science of Supervillains*
   With an Introduction by Chris Claremont
   By Lois H. Gresh and Robert Weinberg

3. *The Physics of Superheroes*
   Spectacular Second Edition
   By James Kakalios
SF shaping science

• Star Trek communicator
• Scientists who fell in love with science via SF
• New generations of writers falling in love with science and SF
Reasons to use SF

• Teach science content
• Teach science language
• Teach science methods
• Model science culture
• Address reading/writing standards
• Hook an audience
• Build enthusiasm about science
Ways to use SF

- Use extant SF (written/cinematic/games)
- Writing SF for the classroom
- Student writing of SF
Using extant SF

- Readings in SF with good/bad examples
- Bad/good movie science—examine films
- Video games—content/physics engines
- Television—examine science/portrayal of scientists
Insultingly Stupid Movie Physics

- www.intuitor.com/moviephysics/

Movie physics rating system:

- GP = good physics in general
- PGP = pretty good physics
- PGP13 = children under 13 might be tricked into believing the physics
- RP = retch
- XP = obviously physics from an unknown universe
SF written for the classroom

Written by SF authors to teach science

Often comes with teacher guides/resources

Tales from the Wonder Zone

Constructing Ideas in Physical Science
Student writing

Assign SF writing to students

Final projects

In-class assignments

Assessments

Write SF story predicting technology

Write SF poem to test science vocabulary

Write SF story to complete idea
Julie Czerneda

- Tales from the Wonder Zone
- Science Fiction Classroom Resources
- Why Use Science Fiction?
Communities/conferences dedicated to science education & science fiction
Useful links

- http://cpucips.sdsu.edu/web/cpu/default.html
- http://cpucips.sdsu.edu/web/cips/aliens.html
- http://www.galaxyzoo.org/
- http://hannysvoorwerp.zooniverse.org/
- http://www.scifieducation.org
Further Exploration 1

- Exploring the physics of science fiction, Ted Spickler Phys. Teach. 21, 416 (1983)
- Using Science Fiction Movies in Introductory Physics, Marta L. Dark Phys. Teach. 43,
Further Exploration II

- TPT NOTES: Try Science Fiction as a Teaching Aid, Isaac Asimov Phys. Teach. 6, 416 (1968)
- Wizards, Aliens and Starships: Physics and Math in Fantasy and Science Fiction, John L. Hubisz Phys. Teach. 52, 447 (2014); http://dx.doi.org/10.1119/1.4895383
Some Resources

- Astronomical Society of the Pacific releases updated resource guide to science fiction with good astronomy, Dan MacIsaac


• Thank you!
More Student Writing

Final project option

Write a short story set in a near future

Revolves around new technology or product

What if - pick any SFnal what if

3 things that the “what if” would change
Other art/science ideas

Science songs

The Galaxy Song (Monty Python or Jim Post)
First and Second Law (Flanders & Swann)
NaCl song (Michael Cooney)
The Elements (Tom Lehrer)
The Physics Chanteuse (Lynda Williams)