

Physics/Science Fiction/Art

By

Mary Ann Gaser

Introduction

I teach fine arts at Pittsburgh Middle Gifted Center to seventh and eighth graders. Pittsburgh Middle Gifted Center provides gifted education to students in grades six, seven and eight who live within the School District of Pittsburgh. Students come to the Center one-day a week from public, private and parochial schools.

P.M.G.C. offers courses in fine arts, language arts, science and technology, and mathematics. The seventh and eighth grade students select one course in each of the four categories. In each of the categories there are four courses. In the 2000-2001 school year I am offering two art courses. One of the courses will be Physics/Science Fiction/Art. It is my intent to emphasize astronomy and cosmology by drawing on the body of knowledge I acquired in the course, Learning Physics through Science Fiction taught by Dr. Richard Holman. Physics/Science fiction/Art revisits a classic theme in art, "Aliens from Outer Space". The physics will be a source of inspiration for the art. The science fiction stories will deal in hard science/physics. The stories exemplify how writers have used hard science as a source for creative expression. The students will gather information, chose a theme, then create their own alien complete with a family tree, biography, fact sheet and stories of adventure.

Why did I choose to connect science fiction, physics and art?

I really didn't. The students did. They have been connecting the three disciplines in my art room for years. Aliens from outer space motivate the middle school child like few other topics. The interest is there. It is not unusual to find drawings of aliens, rocket ships and, space adventures in seventh and eighth graders' sketchbooks I also find these drawings on folded pieces of paper that they carry around to work on in their spare time. The knowledge of astronomy and cosmology is sketchy and self taught. The artwork, whether it be a drawing, painting or sculpture, is always accompanied by a story. I often wished that I had the time and wherewithal to formalize the stories. This course will be a natural progression from their sketches to pen and ink drawings to three-dimensional sculpture to stories of adventure based on hard science.

Dr. Richard Holman's course description intrigued me. After the first class, then reading Neutron Star and Borderlands of Science I knew I was in the right place. It was all there: the science, the art imagery and the story. Presenting physics through science fiction is a fantastic concept.

How does an art teacher incorporate cosmology and astronomy into an art room?

The role of the artist as an educated observer is well defined throughout history. Leonardo da Vinci is the first to come to mind. In order for the students to develop this skill, my role will be to provide as many resources as possible. My education in physics is limited to one course, Learning Physics through Science Fiction taught by Dr. Richard Holman. In this class, Dr. Holman has given me the tools to steer my students in the right direction.

The vocabulary was my first stumbling block. Luckily, many of the words used in physics are also used in art. We will identify the shared vocabulary and then compare and contrast the meanings. Examples of words in common are space, proportion, scale, mass, and symmetry. The science terms, for example black hole, were

familiar but not really understood. In the class, Learning Physics through Science Fiction; Dr. Holman assigned readings that required knowledge of the cosmos. The stories covered four areas: black hole/gravity physics, space travel/relativity, quantum mechanics/parallel universes and time travel. Dr. Holman assigned science fiction stories. He explained the science. We read the stories for homework. The following class, we discussed the stories. Often the science was more interesting than the story. The class discussion allowed for questions and clarification of terms and ideas. We also discussed prominent physicists. We became familiar with cutting edge theories and discoveries. I found it fascinating.

Since the class I teach is an art class, the majority of time will be spent in the studio. I know from experience that I will only be able to cover one story and an art project in the fifteen one-hour classes. I have chosen The Neutron Star as the story. Papier-mâché aliens are the art project. I will show the video *Cosmic Voyage* at the first class to set the tone and to capture the students' imagination. To develop a deeper understanding of the cosmos I have invited the Carnegie Science Center give a "Unisphere" presentation to the class. I have developed resource sheets to add depth to the student's knowledge of the universe. Seeing the video, *Cosmic Voyage*, attending the Carnegie Science Center's "Unisphere" presentation, reading The Neutron Star, and creating a fact sheet should give students a deeper understanding of black holes/gravity physics, quantum mechanics/parallel universes, space travel/relativity, and time travel. Use of the vocabulary of physics in different settings will develop a vocabulary base for future learning. The students will use this knowledge to become discriminating readers of science fiction and creators of science fiction art. I can assist the students by using my newly gained knowledge of astronomy and cosmology to connect disciplines: physics, science fiction, art.

Aliens from outer space, creatures from other worlds, the sun, the heavens, are reoccurring themes in art. We will discuss the iconography of the subject, aliens, sun, moon, and stars. We will compare the icons to recent photographs from outer space. How will pictures from the Hubble Space Telescope change or alter these symbols? Once you see pictures from space will you ever be able to think of it in the same way again?

The students will be exposed to many sources of information. Although the students will read The Neutron Star in class, the stories that I read in Learning Physics through Science Fiction will be available to them. The Internet can be accessed in the artroom. The web site, <http://www.scitechdaily.com/>, offers a comprehensive list of scientific web sites. I am also assembling library of books and videos. Videos such as the "*Cosmic Voyage*", are available through the Discovery Channel and WQED stores. The portable planetarium "Unisphere", is only one of the resources available through the science center. I purchased "Astronomy Fact Pack" cards and glow in the dark "Deep Space " stickers. These are only a few of the commercially prepared visuals that are available. The goal is to strengthen the student's skills as educated observers by presenting the material in a variety of ways. Students will be encouraged to look for newspaper and magazine articles to share with the class. I consider the 2000-01 semester a starting point. The course Physics/Science Fiction/Art is a work in progress.

How does Science Fiction Art relate to the historical and cultural context within which it was created?

Grolier's Encyclopedia defines science fiction as " a form of literature that takes place in an alternative present, a reconceived past or an extrapolated future. All these alterations in time or reality are based on technological changes in the observed, realistic now." Man has dreamed of the heavens since the earliest of times. We call these stories myths. The line between fact and myth seems muddled in the earliest times. As the line between science and myth became more defined the need for a legitimate way to express man's longing for adventures in other worlds was met by science fiction. According to an Internet posting by the Discovery Channel, "Johannes Kepler wrote a fragment of a story, *Somnium*, in which a boy dreams that he traveled to the moon. Over the years the German astronomer added to the story, but it was not until 1634, after his death, that his fantastic tale was published. Considered the first work of science fiction, *Somnium* is credited with influencing future science fiction writers such as Jules Verne and H. G. Wells." Science fiction's mad scientist began with Mary Shelley's Frankenstein in 1818. Jules Verne and H.G. Wells produced science fantasy novels in the late

19th century. Grolier's Encyclopedia continues "Jules Verne's From the Earth to the Moon was the first space adventure based on sound scientific speculation, including the profound effects of weightlessness shown in an engraving in the novel's first edition."

The 1900's saw huge changes in art, physics and literature. Giants appeared. Their work changed the world forever. Max Planck, Sigmund Freud, Pablo Picasso are a few of the names that stand above the rest. Their ideas were controversial then and still are controversial today. In 1926, Hugo Gernsback published the magazine, Amazing Stories. He defined science fiction as "stories based on science that would interest young men in a scientific career."• . One of the purposes of my curriculum is to encourage young women as well as young men to become involved in science.

Science fiction stories may also be precursors of things to come. Many modern technological miracles were science fiction fantasies only twenty-five years ago *at times* science fiction depicts ideas that are too controversial to discuss head on. Ideas intertwined in a science fiction story are more palatable. The stories become a gateway to the imagination. When the ideas are based on scientific fact, they can become a source of knowledge.

What projects will the students create?

The science fiction art that the students will create is a papier-mâché sculpture of an alien who lives in one of the classical science fiction worlds that defy the laws of the earth's nature. The student will create a fact sheet that includes historical and cultural details, a family tree, and a series of adventures that cause havoc. To cause havoc, the students must be familiar with the laws of physics gained through reading science fiction.

Science fiction is a particular American genre. Some science fiction is based on hard science: some science fiction is pure fantasy. This class will produce art inspired by science fiction based on hard science.

Students will construct a giant timeline to organize and present the historical information they have learned about science, physics, art and literature. This will be a class project. I expect this to be an ongoing work in progress. As articles appear in the newspaper and in magazines they can be Xeroxed and attached to the timeline. Xeroxes of historical photographs can be glued to the timeline along with student artwork that depicts events in one or more of the disciplines.

Will there be future projects?

As I read the stories I kept getting ideas for future projects. The short stories from the course Learning Physics through Science Fiction can be used as inspiration and to prompt discussion. I am including these undeveloped ideas. These ideas may develop into a unit or possibly another course in the future.

The first idea came after reading, *Curdled stars, muddled stars, stars that had been stirred with a spoon.*" This quote from Neutron Star conjured up images of Starry Night. I can see this lead to a series of watercolor paintings. The students will compare and contrast Neutron Star by Larry Niven to Starry Night by Vincent Van Gogh. "

Moon Six brought The Little Prince to mind. The Little Prince (by Antoine De Saint-Exupery, Harcourt, Brace and World, New York) and Moon Six (by Stephen Baxter from "Traces" Harper Collins 1998) have a sense of loneliness and longing. You don't have to be trapped in a parallel universe or stranded on a distant asteroid to identify with the feelings of these two characters. The drawings in The Little Prince are inspirational. This could be developed into a drawing and painting unit.

The sculptures of Lippold are inspirational. A class discussion centered around Richard Lippold's Variations within a Sphere could inspire student sculpture of the stars, the sun, and supernovas,

Foggy Night, a story of time travel and parallel universes, would serve as the basis for pen and ink and watercolor paintings.

What is the chronology of the programs and activities developed for Physics/Science Fiction/Art?

The course will consist of 15 one-hour sessions.

Session 1 Introduction to the course: View a Movie

The first session the students will strengthen their knowledge of the cosmos by viewing the video, *Cosmic Voyage*. *Cosmic Voyage* illustrates many of the points discussed in the Learning Physics through Science fiction. Due to the diverse abilities and interest levels of the students, the anticipatory set of the unit will be a fast paced video that covers the material in a very dramatic way. The video is 35 minutes long. This allows for pre and post discussion. The students will be given a handout with a list of terms They will be told that some of the terms may be familiar to them. All of the terms will be described in the video. Look for them. A class discussion will follow the viewing of the video. A preliminary survey shows that the students who are interested in science fiction also are fascinated by physics. They appear to be self-taught. When asked how they have gained so much about the subject they say they read science fiction and watch television. Often there are three or four students in the same class who are unaware that they all share a common interest in this subject. When they find each other, then the discussions begin in earnest. At times those who aren't interested are drawn into the discussion but they lack background information. *Cosmic Voyage* will set the stage for a more intense investigation.

There will be time for class discussion before and after viewing the video. The discussion will cover the video as well as the expectation for the class. I will outline the course. I will ask the students to indicate what their expectations are for the course. With our plan in mind we will set out on a creative adventure.

Session 2

Carnegie Science Center will visit P.M.G.C. with *Unisphere*.

. **The Carnegie Science Center** provides **Traveling Science Programs Science on the Road**. As part of their **Discovery Days**, they have **Unisphere**, a portable planetarium. The planetarium presentation will include as up to discussion of deep space.

I spoke to the presenter about offering information on deep space, black holes and supernovas. He said he could customize the program to meet our needs. The presenter from the Carnegie Science Center said he would address neutron stars, pulsar and black holes when he visits P.M.G.C. with the **Unisphere** traveling exhibit.

A solid understanding of the science should make the story more meaningful to the students. An understanding of science should be apparent in the student's final project, a papier-mâché alien.

Session 3 Read a Story

"The class will read Neutron Star by Larry Nivan. *Curdled stars, muddled stars, stars that had been stirred with a spoon.*"

Neutron Star has an alien, exciting science, vivid imagery, a no account hero with a bit of larceny in his heart and an unsolved double homicide, It takes place at a time when life has been discovered and prospered on other planets. Space travel is a reality. Space still holds great mysteries, one being the neutron star.

The alien is the Puppeteer. "A puppeteer is unique. Imagine a headless, three-legged centaur wearing two Cecil the Seasick Sea Serpent puppets on its arms, and you'll have something like the right picture. But the arms are weaving necks, and he puppets are real heads, flat and brainless, with wide flexible lips. The brain is under the bony hump set between the bases on the necks. This puppeteer wore only its own coat of brown hair, with a mane that extended all the way up its spine to form a thick mat over the brain. I'm told that the way they wear the mane indicates their status in society." This passage is important to the class because we will construct aliens. I want them to note "the way they wear their mane indicates their status in society." I encourage the students to include symbolic elements in their alien to further define the character.

The science is the story. In order to solve the "what dunnit" the reader must have a basic understanding of the current definition of a neutron star, stellar displacement, gravity theory and the effects of tides. I have decided on a multi-media approach to the science. The movie, *Cosmic Voyage*, shows a dramatic representation of a red giant being swallowed by a black hole. *Cosmic Voyage* refers to stars as "nuclear furnaces." The movie graphically depicts how the force of gravity formed the universe. The viewer becomes aware of the vastness of space.

The thought that scientists can locate a neutron star or a blackhole by the effect the star has on its surroundings is stellar displacement. In art students are taught to be aware of the negative space in their compositions. Scientists must also be aware of the negative space in order to "navigate" in outer space.

MSNBC.com has a slide show of pictures taken from the *Hubble Space Telescope*. The slide show includes a photograph of what scientists believe to be a black hole swallowing stars. Neutron stars, pulsar and black holes are thought to be the result of dying stars that keep collapsing. They become gravity traps. It is difficult to imagine the size, the weight, and the force these collapsing stars possess. Our hero is truly in the fight of his life. To travel through a black hole is to be smashed into strings of spaghetti

A more complete illustration of gravity can be found in the May 1989 issue of *National Geographic*. The article is clear and concise in its explanation of gravity. The illustrations are excellent. It is a visual representation of gravity as the geometry of space. It illustrates how massive stars change the shape of space-time. It depicts the rubber sheet analogy in a very clear graphic.

Session 4 Create a Fact Sheet (see appendix)

Students will write a fact sheet that includes accurate scientific information; they should include enough detail to show an understanding of science. The fact sheet answers the basic questions, "Where did the alien come from?" "What is he made of?" "Is the alien's biology different than ours?" "Why did the alien leave his/her home?" "How did he arrive on earth?"

I have included a worksheet on deep space. It is another way to strengthen the student's knowledge of the cosmos. The worksheet is to be completed by applying the appropriate *Glow in the Dark Deep Space Sticker*. (The stickers are available at **Staples**.)

The students are to define terms in the space to the left of the page.

Session 5 Studio

The next class will cover the construction of the alien. A teacher demonstration will provide a springboard for the actual construction of the alien. The demonstration will include basic papier-mâché techniques. The students will be encouraged to include symbolic elements in the creation of their alien to further define their character. The book, the Simple Screamer, appeals to the imagination of the middle school child. This book offers excellent examples of papier mach monsters. It includes step by step photographs. It is an excellent resource for the uninitiated in the art of papier-mâché. It also uses artifacts to develop the character of the sculpture. Meaning in Crafts by Edward L. Mattil is also an excellent resource in the art of papier-mâché. It gives background information. It also tells how to solve different armature problems. Most teachers gather information then create their own way of teaching. I have found these two books particularly helpful.

In the remaining time, the students may begin to build their armature,

Session 6, 7, 8 Studio

Each student will work independently .The students should refer to his/her fact sheet. There are actual lesson plans included in the appendixes.

Session 9 Giant Timeline

Students will create a giant timeline to present information of historical significance in science/physics, science fiction and art. We will start collecting material for the timeline in the beginning of the course. This will be an ongoing project. As the aliens are completed, the students who are finished may begin assembling the timeline.

Session 10 Alien Biography

The students will create a biography after the alien is completed by gathering together the information gained in the readings, and their own understanding of the alien they have created.

Read the chapter in Borderlands of Science "1.3 The good, the bad and the simply awful: an example". Borderlands of Science is a how to write science fiction book. The author is a scientist and a writer. He knows how to navigate through the borderlands. He points out the bridges. He cautions the reader not to ignore the known science. In "the good, the bad and the simply awful an example," he describes an alien. He then points out why this alien is scientifically impossible. He goes further to describe a alien that could exist. The point is made that if you want your audience to accept the science fiction stretch you must anchor it in solid science. Discuss the article with the class. Most of the papier-mâché aliens have probably developed an informal biography. Have the students share their thoughts on their alien. Make connections between the "the good the bad and the simply awful" and the actual biography that the student is writing for his/her alien. Encourage class participation as the students work out the details. To gain authenticity, encourage the student s to refer to the "Astronomy Fact Pack." It is a set of thirty cards. On the front of the card is a photo or diagram; on the back of the card are facts. The card gives concise information. This will give the students correct information and a place to start. *The Time-Life Student Library: The Universe* will be another source of accurate information. I enjoy the "Would You Believe" articles that describe fantastic facts.

The materials needed to complete the biography are a completed papier-mâché alien, sources of correct information, and time to discuss the story with classmates.

Does the student develop a set of rules? Does the biography include accurate scientific information? Does it include enough detail to show an understanding of science?

Does the biography show imagination and humor? Does the biography fit the alien?

Session 11 Construct a Family Tree

The students will be given a chart to complete. The chart may be used to organize characters in their story. It will help the students develop their characters by establishing relationships between characters.

Session 12 Write a Short Story about Your Alien

By the time the aliens are completed, the students will have a story in mind. I have include story prompts that are based on science. Some may need to use a prompt but it is not necessary to do so it they have a story in mind. The story should be built on science.

The prompts that I have included are based on a nugget of fact found in the Student Library book, The Universe. Time Life.

Session 13, 14 Prepare the Exhibit

The artwork and science fiction will be exhibited at the May Open House. The presentation of the artwork is an essential component of the course. Much thought must be given as to how the work will be displayed. Each student is responsible for his/her own presentation. "Is it a table piece?" " Will it be hung?" "Should the work be exhibited as a group installation?" All these questions must be answered to accomplish a striking exhibition.

Session 15 Reflection

The programs and activities developed for this course will cover fifteen one-hour sessions. The last session will involve a discussion of the artwork. Students will volunteer to read their stories aloud to the class. I will ask for suggestions for next year.

The students will have ideas about supplies to be ordered, stories to be told other approaches that might be taken next year.

Appendixes: Examples of Actual Lesson Plans and Resource Sheets

Papier-mâché Alien *Lesson Plan*

Objective:

The students will design a papier-mâché sculpture of an alien

that includes enough detail to show an understanding of science. The goal is twofold. The sculpture must stand alone as a viable piece of art and its premise must be based on accurate scientific information. The scientific information acquired in the last three lessons will be combined with this lesson.

Procedure:

View examples of student and artist work.

After viewing the example and discussing the possibilities, instruct the students to jot down their ideas in the form of *thumbnail sketches*. Draw three *thumbnail sketches* on newsprint.

The Teacher will demonstrate how to build and armature with papier-mâché. Ask the students, "*What is papier mache?*" "*Why is it so strong?*"

Give examples of other building materials that gain strength in the same way. "Why is the structure of the armature so important?"

Sculpture is constructing in three dimensions. Light is very important. The piece must be interesting from all sides in order to draw the viewer in, then walk around it. As the students build, encourage them to incorporate an "s" curve into the sculpture. This will draw the eye around the piece. Lumps and bumps add interest by playing with light and shadow. Definite, defined eyebrows create expression, Symbols and embellishment will add to the development of the character. Refer to the alien's biography. What are the circumstances that led him/her to be on the planet Earth? What compensations should be obvious in this sculpture to account for his/her place of origin?

(Allow four to five classes for construction. Embellishment and detail are well worth the time it takes to do them.)

On **Week 3**, call the class together and demonstrate fingers, feet, horns, and teeth. Little things mean a lot. This is a good time for the students to walk around the room and give a working critique of each other's work.

Examples of Artist's work:

Frank R. Paul, (the first and most highly regarded science fiction illustrator)

Illustrated the covers for Amazing Stories magazines

Ed Emschiller, (cover artist in the 1950's) Amazing Stories magazine

Takashi Murakami, S.M. Pko2 (part I and II) (exhibited in the Carnegie International 99-00)

H.R. Gieger, Necroicon 1976

Books:

Art Synetics by Nicholas Roukes, Davis Publication Inc. Worchester Massachusetts USA 1982?

The Simple Screamer Daniel Reeder,

Star Wars Sketchbook, the Empire Strikes Back, by Joe Johnston and Nilo Rofis-

Jamero, Ballantine Books- New York June 1980

Materials:

Newsprint

Wheat paste

Newspaper

Masking tape

Wire cutters

Arts and Humanities Standard Addressed

4.All students produce and perform, or exhibit their work in the visual art, music, dance or theater, and describe the meanings their work has or them.

Paint an Alien *Lesson Plan*

Objective:

The student will paint the sculpture according to the scientific facts he/she determined at the onset of the project. He/she will be able to justify decisions citing reasonable scientific explanations.

Procedure:

When the class is ready to paint, call the class together to demonstrate how to paint an alien.

Discourage the use of raw colors straight from the bottle. Review mixing techniques. Demonstrate brush techniques.

Tints, add white,

Shades, add black.

Muted tones, add the complement.

Work from large to small.

Use a stippling motion to cover the bumpy surface.

After the alien is painted use dry brush technique to bring out the texture. The alien may be glazed with polymer medium.

Materials:

Paint

Brushes

Water jars

Polymer medium

Arts and Humanities Standard addressed

4. All students produce, perform, or exhibit their work in the visual arts, music, dance or theater, and describe the meaning s their work has for them,

Write a story about your alien. Lesson Plan

Objective:

The student will write a story about his/her alien's adventures that are based on accurate scientific information.

Procedure:

The completed alien has probably gained an informal biography as his/her creator has discussed him with his/her classmates. To set the stage for story writing read Borderlands of Science, 1.3 **The good, the bad and the simply awful. Page 7.** Answer the questions on the **Alien Biography** worksheet. (Present 7th and 8th grade students who attend the P.M.G.C suggested the questions.) Chose one of the story prompts to develop a story or create your own scenario. The story must be based on accurate scientific information. This is science fiction. I expect the "science fiction leap of faith". Beware of free falls.

Be able to justify the story to your peers

The student should gather the information from the fact sheet, family tree and the biography. The next step would be to plan the alien's problem, adventure and the outcome of the adventure. Is the story going to be told by the alien? Is going to be told in the alien's native tongue then translated?

Story Prompts Resource Sheet

The ideas for the story prompts are taken from Time Life Student Library, The Universe.

"Einstein's Cross

Another proof of Einstein's theories of gravity can be found in the odd phenomenon called a 'gravitational lens.' Einstein's theories predict that very massive objects, such as stars or galaxies will bend the light that passes by them. Sometimes the light gets split around both the sides of the massive object and reappears on the other side as two images. In rare cases, known as an Einstein cross, the light might split four ways around the object." *Use the phenomenon of "Einstein's Cross" to develop a story of space travel. (Page 19)*

"Your Local Supergiant.

Betelgeuse, a red supergiant, is probably the largest star in our corner of the Milky Way. The star is 500 light years from Earth but it is so large---1, 000 times wider than the sun---that it is the seventh brightest star in the sky. If the sun were as big as Betelgeuse, it would stretch to Jupiter.

Unlike the sun with its small sunspots, Betelgeuse has one large, bright blotch on its surface. The spot is more than 10 times the size of Earth, but no one knows why it is there." *Why is it there? Could Betelgeuse become a black hole? A neutron star? Build your story around the bright blotch on Betelgeuse. (Page 26)*

"When galaxies Collide

A head-on crash of two galaxies would be an interstellar smash-up of colossal proportions. The Hubble Space Telescope captured just such a collision in 1997, when it took pictures showing the run-in of two galaxies known as the Antennae. The accident was not purely destructive: As the galaxies ram each other, clouds of gas and dust inside them merge to trigger the birth of new stars." *Imagine the collision of two galaxies. Build your story around the havoc caused by such an event. (Page 31)*

"A Runaway Planet!

Scientists would like to believe they are seeing a runaway planet in this Hubble photo, but they are not sure. If it is a planet, it's three times more massive than our biggest planet, Jupiter. And it would be the first picture ever taken of a planet outside of our solar system. The suspected planet is connected to a double star by a long trail of light. Scientists believe that the gravitational forces of the double star gave it the boot and sent it hurtling into space, leaving this glowing trail in its wake." *Imagine that you're alien is from a planet that is being hurled into space. How did the alien escape? (Page 107)*

Deep Space Sticker and Definition Sheet Resource *Sheet*

Place a Glow in the Dark Sticker on your sheet in the following order:

Supernova

Blue Super Giant

Red Giant

Nebula

Clouds of Dust and Gas

Black Hole

Brown Dwarf

Prostar

Protoplanet

Black Dwarf.

White Dwarf.

Neutron Star.

Singularity.

Alien Biography Resource Sheet

Name:

Male or Female:

Age:

Height:

Weight:

When was the alien born?

How was the alien born? Live or egg?

How does the alien age?

What is the alien's expected life span?

What galaxy is the alien from? Give a brief description?

What is the alien population on his planet?

How did the alien travel to earth?

Describe the spaceship.

Does he have a family? If so, describe the relationships.

Describe how the alien is educated.

How does he learn?

What does he do for a living?

Does he have pets?

How does he eat? How does he get nourishment?

What does he breathe?

How did gravity influence his development?

Give a description of his adventures.

TIMELINE *Lesson Plan*

Objective: The students will construct a giant time line. The timeline will begin at 1800 to present time. Include the events listed.

Science

1. Max Plank formulates Quantum Theory (1900)
2. Albert Einstein's Special Theory of Relativity (1905)
3. Edwin Hubble became an astronomer (1914). The universe is full of galaxies and that they are moving away from one another.
4. Subrahmanyan Chandrasekhar won the Nobel Prize in Physics (1983). His work led to the discovery of black holes and neutron stars.
5. Stephen Hawking does work on the theory of "Everything" and wormholes (present day)

Art

1. Artist unknown, engraving from Jules Verne's, the Earth to the Moon (1865)
2. Frank R. Paul, cover of Amazing Stories, April (1926)
3. Richard Lippold, Variations Within a Sphere, (1956)
4. Joe Johnston and NiloRodis-Jamero, Yoda, (1980) The Empire Strikes Back Sketchbook
5. H.R. Gieger, Necromicon, (1976)

Science Fiction

1. Mary Shelley's Frankenstein or the Modern Prometheus, Signet Classic, Penguin Books, New York, New York Dec. 1963 ISBN 0-451-52336-9 (1818) Creating life
2. Jules Vern's From the Earth to the Moon (1865) Space travel
3. H.G. Wells The Time Machine Time Travel and H. G. Wells, The War of the Worlds (1898) Martians invade Earth; Fawcett Premier Book published by Ballantine Books
4. ISBN 0-449-30043-9 (1895)
5. Ray Bradbury, The Martian Chronicles (1950) Bantum Books New York, ISBN 0-553-27822-3 The people of Earth travel to Mars to avoid destruction.

Pittsburgh Content Standard

Arts and Humanities

1. All students describe meanings they find in various works from the visual and performing arts and literature on the basis of aesthetic understanding of the art form.

2. All students evaluate and respond critically to works from the visual and performing arts and literature of various individuals and cultures, showing that they understand the important features of the works.
3. All students relate various works from the visual and performing arts and literature to the historical and cultural context within which they were created.
4. All students produce, perform, or exhibit their work in the visual arts, music, dance or theater, and describe the meanings the work has for them.

This unit addresses standards 3 and 4 by relating the work to the historical and cultural context within which the work was created and by producing and exhibiting the artwork.

Bibliography

Books about science:

Sheffield Charles, Borderlands of Science. Riverdale, NY: Baen Publishing Enterprises, 1999. ISBN 0-671-57836 This book is an excellent resource for both science and science fiction writing.

The Universe, Time Life Student Library, Alexandria, Virginia, Time-Life Books 1998 ISBN 0-7835-1354-2 the Universe offers an enormous amount of information at the student's level. It is interesting reading for adults as well.

Encyclopedia:

Grolier Encyclopedia of Knowledge Danbury Connecticut, Grolier Incorporated. ISBN 0-7172-5316-3(volume 6) pages 348-349 The encyclopedia offers information on the place of science fiction in literature.

Books about Art:

Mattil Edward L., Meaning I Crafts Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1959-1965. An oldie but goodie.

Reeder, Dan, "The Simple Screamer" a guide to the Art of Papier and Cloth Mache, Gibbs. Paperback This is a magnificent book on papier-mâché.

Roukes, Nicholas, Design Synectics. Worcester, Massachusetts: Davis Publications, Inc. 1988 ISBN: 87192-198-7 Offers many possibilities to connect art and physics.

Roukes, Nicholas, Art Synectics Worcester, Massachusetts: Davis Publications, Inc. 1984 ISBN: 0-87192-151-0 This book offers many ideas for connections. Chapter 4, Myth and Mythmaking has a lesson Science Fiction Art.

Johnston, Joe & Rodis=Jamero Nilo, Star Wars, The Empire Strikes Back. New York: Ballantine Books 1980 ISBN0-345-28836-x This book includes actual illustrations of the drawings that were used and the drawings that were rejected in Star Wars.

Janson, H.W. and Anthony F., History of Art for Young People. New York: Harry N. Abrams, Inc IBSN 0-8109-4150-3 This is one of the best art history books for young people.

Periodicals:

The following **National Geographic** articles are very readable. The science is excellent. The illustrations are fabulous.

National Geographic, January 2000, Special Millennium Issue

National Geographic, vol. no. Oct. 1999, "Millennium Map"

National Geographic, vol. 196 (no. 6), December 1999

National Geographic, vol.178 (no. 4), October 1990, "Under the Sun. Is our world warming?"

National Geographic, vol. 170 (no. 6), December 1986, "Halley's Comet Us"

National Geographic, vol.163 (no. 6), June 1983, "The Once Future Universe."

National Geographic, vol. 164 (no. 3), September 1983, "Satellites that Serve Us"

National Geographic, vol.175 (no. 5), May 1989, "Searching for the Secrets of Gravity"

Videos:

[Cosmic Voyage](#) (Imax Experience)

Narrated by Morgan Freeman, a presentation of the Smithsonian Institution National Air and Space Museum and the Motorola Foundation (35 minutes/color)

Video **Cosmic Voyage** is a presentation of the Smithsonian Institution's National Air and Space Museum and the Motorola Foundation. Additional Support from the National Science Foundation. Produced by Cosmic Voyage, Inc. The cover reads, "*Cosmic Voyage, is a "cosmic zoom" based on the powers of ten, extending from the surface of the Earth to the largest observable structures of the universe and, and then back down into the sub nuclear realm – a guided tour across some 42 orders of magnitude. Explore some of the greatest existing scientific theories, some of which have never before been visualized on film, from the birth of the cosmos and the solar system to the nature of black holes and exploding supernovas.*"

Internet Sites

http://www.discovery.com/exp/universe/amazingspace/am_scrap_1634.html Discovery has a lot of information on the universe.

<http://www.msnbc.com/news/201650.asp?cp1=1>"the symphony of everything" An explanation of string theory is posted on this site.

http://www.discovery.com/exp:universe/amazingspace/am_scrap_1634.html

"Cosmic Scrapbook" The scrapbook would be fun for students.

<http://www.scitechdaily.com/> "SciTech daily Review" This is truly a fantastic web site.

It would be worthwhile to check it out for the reference websites alone.

<http://www.newscientist.com/opinion/opinion.jsp?id=ns223228>

<http://www.britannica.com/bcom/eb/article/6/0,5716,115386+8+1086553,00.html>

Physical Science, Quantum mechanics

Other:

Carnegie Science Center: *Traveling Science Programs Science on the Road*

Outreach 412/237-3374 99/00

Deep Space Glow in the Dark Stickers. Burlingame, CA 1998 These are wonderful stickers I bought at Staples.

Astronomy Fact Pack Information Cards. American Greetings Corp.

One American Road Cleveland, Ohio 44144 I purchase the cards at Rite Aide. **Bibliography of Stories read in class:**

Learning Physics Through Science Fiction: *Black holes/Gravity Physics, Space Travel/Relativity, Quantum Mechanics/ Parallel Universes, and Time Travel* were explored through reading a story from each category and discussing the science of each.

Although I feel I can only address one story in a fifteen-week art class, I have started to compile a list of future projects that will combine art and science fiction.

Black hole/Gravity Physics:

Gravity is the geometry of space-time. "Newton figured out every mass-every amount of matter –attracted every other mass. The strength of the attraction depended on the total amount of mass and the distance between the masses. Einstein took the theories of gravity one giant step further. In 1915, he wrote space and time are really part of the same fabric. Massive objects, such as stars, curve the space-time around them. This curve is gravity" "Space is a large stretchy fabric. Massive objects pull the fabric into a deep well. Smaller objects are barely noticeable." Black holes are gravity traps that allow nothing to escape, not even light. We know they exist by the effect they have on the objects around them.

Killing Vector Charles Sheffield from the Mc Andrew Chronicles, Tom Doherty Associated 1983, and ISBN: 48-56-2

Hole Man by Larry Niven, by Larry Niven from "N-Space", Thom Doherty Associates 1990 and ISBN: 0-812-51001-1

Neutron Star by Larry Niven, by Larry Niven from "Neutron Star", Ballantine, and ISBN: 0-345-33694-1

The Planck Dive, by Greg Egan from Luminous, Millennium, ISBN: 1-85798-573-7(1998)

Space Travel/Relativity:

Nothing travels faster than the speed of light. The distances in space are so large that space travel is inconvenient at the present time. However, it is possible that shortcuts exist. If the phenomena of the wormhole do exist, galactic travel may be possible.

Rammer, by Larry Niven from "ahole in Space", Ballantine, ISBN: 345-24011-1-125

Down and Out, by Larry Niven from "Galaxy".

At the Core by Larry Niven from "Neutron Star", Ballantine, ISBN: 0-345-3364-1

Quantum Mechanics/Parallel Universes:

Quantum Mechanics are the physics of the very small. Schrodinger's Cat a paradox, presents the indeterminacy aspect. Heisenberg's uncertainty principle states that we can never know both pairs of a certain variable at the same time. Therefore the classical idea of repeatability is lost. To explain Schrodinger's cat John Wheeler offered the theory of many universes. All outcomes of every decision exist. Dr. Holman made the point, "Are we asking the right questions?" "That seems to be the right question.

All the Myriad of Ways, by Larry Niven from "All the Myriad Ways" Ballantine. 1971 ISBN: 0-345-27133-5-150

For A Foggy Night, by Larry Niven from "All the Myriad of Ways" Ballantine 1971, ISBN

Hidden Variable, by Charles Sheffield from Hidden Variable, Ace Books 1981, and ISBN: 0-441-32991-8

Classical Nightmares and Quantum Paradoxes, by Charles Sheffield from "Dancing with Myself", Baen Books 1993, ISBN: 0-671-7285-2

Nightmares of the Classical Mind, by Charles Sheffield from "Dancing with Myself", Baen Books 1993, ISBN: 0-671-7285-2

Pilgrim 7 by Stephen Baxter from Traces Harper Collins 1998 ISBN: 0-00-649814-0

Moon Six by Stephen Baxter from Traces HarperCollins 1998 ISBN: 0-00649814-

Time travel:

Time travel means to be able to jump ahead in time or tumble back into the past. It is impossible because it would irrevocably change the present. Yet Einstein's special theory of relativity suggest that it is possible if one travels at a speed approaching the speed of light. However, wormholes seem to be a fact of science not science fiction. Will these shortcuts permit time travel? I hope so.

The Theory and Practice of Time Travel by Larry Niven from "All the Myriad Ways" Ballantine. 1971 ISBN: 0-345-27133-5-150

Time and time Again, by Piper

Bird in Hand, by Larry Niven from "Flight of the Horse" Ballantine, 1973 ISBN: 34523487-1-125

Each of the stories poses questions that reflect upon the historical and cultural context of the twentieth and twenty-first centuries. How will the history and the culture of our time translate into the future? How will future inhabitants of the earth regard the scientific achievements of our time? These questions are difficult but science fiction dares to offer answers. Will these answers be relevant or disregarded in the