Space Oddities

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Introduction

There is a fifth dimension beyond which is known to man.
It is a dimension as vast as space and as timeless as infinity.
It is the middle ground between light and shadow, between science and superstition
and it lies between the pit of man's fears,
and the summit of his knowledge.
This is the dimension of imagination.
It is an area we call…..
SCI-PHI
(Science Centers Involving Physic Hands-on Investigations)
(Twilight Zone)

Who said you cannot learn science using science fiction? Science fiction movies and books always seem to talk about life on different planets, vehicles racing from planet to planet, one eye, four toed creatures lurking, strange plants that produce life saving agents, large cold steel structures that are home to aliens and waking up at the rise of dozens of moons.

In many ways, science fiction books and movies act as a permanent ongoing science and technological exposition. This is where the audience gets regular doses of the scientific enterprise. According to Terence and Catherine Cavanaugh, "Science Fiction books and movies creates a tangible image of abstract ideas. It also gives the audience a glimpse of the future and a nudge towards making it real and even expanding on the issue." In order to write science fiction you need current science issues. Joan Slonczewski (a science fiction writer) said that her freshest ideas came from experience in an actual scientific laboratory. She regularly experiences natural phenomena: super conducting magnets suspending paper clips in the room next door, bacteria generating thousands of mutations overnight, chemicals that magically turns colors every few seconds. The following shows have all used true and close to true science: X Files (cloning), Star Trek (space travel), Star Wars (life forms), Battlefield Earth, Quantum Leap (time travel), Men In Black (life forms), Back to the Future (time travel) and The Jetsons (futuristic earth). Why not take the stories children may be interested in and use them to capture the attention of the children? These films open opportunities to engage students and encourage greater understanding and interest. Consider the film Mission to Mars. It provided educators with countless lessons of space and travel. Questions can be asked of the theoretical science within the confines of the film as well as of the practical science that went into making the special effects. Opportunities can be made to compare and contrast two drastically different eras of life on this planet. It also addresses the ethics of technological advancement.

Primary aged children display extreme curiosity and are excited about scientific events. This curiosity diminishes greatly by high school age. Students are convinced that physics and chemistry are incomprehensible to developed fears of science. The use of science fiction in science curriculum can greatly inspire students. This is a new, different and exciting approach to teaching science. Nurturing this excitement is crucial because of the need for scientific knowledge has never been greater. "Technology is racing along at warp factor six and in order to succeed in the new millennium, all students are going to need a better

understanding of the sciences." Science is a vehicle for comprehension. It allows us to better understand ourselves and our surroundings. It teaches us how to make decisions and consider the future consequences of our actions.

One comprehensive definition of science fiction does not seem to exist. Science fiction seems to have different meanings according to who you ask. While surfing the internet very interesting definitions were found:

The touchstone for science fiction, then, is that it describes an imaginary invention or discovery in natural science. The most serious pieces of this fiction arises from speculation about what may happen if science makes an extraordinary discovery. The romance is an attempt to anticipate this discovery and its impact upon society, and to foresee how mankind may adjust to the new condition.

Piligrims through Space and Time (New York 1947)

Science fiction is the branch of literature that deals with the effects of change on people in the real world as it can be projected into the past, the future or to distant places. It often concerns itself with scientific or technological change , and it usually involves matters whose importance is greater than the individual or the community: often civilization or the race itself is in danger. Introduction, The Road to Science Fiction Vol. 1, NEL, New York 1977

Science fiction is that class of fiction which contains the currents of change in science and society. It concerns itself with the critique, extension, revision, and conspiracy of revolution, all directed against static scientific paradigms. Its goal is to prompt a paradigm shift to a new view that will be more responsive and true to nature. The Cosmic Dancer (New York, 1983)

No matter the wording of the definition of science fiction, they all have something in common. Each definition states, a past current or future scientific change whether real or fantasy.

Interest in science can be increased and developed using science fiction. It can help improve negative attitudes towards science. In reading science fiction books, abstract concepts such as mutations, radiation, space travel and planets are experienced. It is a way for students to encounter concepts in a new context. Students are more likely to remember information with in an entertaining way. A far broader spectrum of students can be motivated using this method compared to traditional methods. Reading science fiction books increases scientific vocabulary. They allow students to imagine abstract topics. Discussion of science fiction books develops an understanding of science processes and the interconnectedness of science disciplines.

Target Group

This unit is designed to encourage children ages 9 to12 to develop a love of science using sci-fi books and movies.

Objective

This unit called Space Oddities will teach children basic astronomy and physics facts. It will begin with the use of some literature that will engage the children to think about space. We will then study facts about space.

Again, through the use of literature and a movie, we will begin to critically look at scientific concepts (such as gravity, force, time etc.). This will hopefully allow the students to think about and realize the relationship between the stories.

Space Oddities will allow students to use higher order thinking strategies. The students will:

Compare: looking for similarities and differences.
Observe: making visual, auditory, and tactile observations.
Classify: examining an assortment of items, sorting them and categorizing.
Hypothesize: coming up with a variety of appropriate explanations for particular questions.
Identify Assumptions: differentiating between what is observably true and what is taken for granted.
Summarize: Condensing the essential meaning from a body of data.
Interpret: explaining meanings of an experience.
Design Problems and Investigations: Identifying problems, hypothesizing, collecting and organizing data, testing and evaluating results.
Make Decisions: Examining one's beliefs, attitude, and feelings that lie behind the choices we make and examine the consequences of personally made choices.

The unit will be friendly to both teacher and students allowing maximum flexibility. The activities in this unit will range from object manipulation to reading, writing and data collection. All of these activities will involve group work. Throughout the unit, background information will be provided.

Pittsburgh District Content Standards

Mathematics, Communication and Science and Technology standards will be incorporated into this unit. This unit will focus on the following standards:

Mathematics

2. All students compute, measure, and estimate to solve theoretical and practical problems, using appropriate tools , including modern technology such as calculators and computers.

3. All students apply the concepts of pattern, functions and relation to solve theoretical and practical problems.

6. All students will draw appropriate conclusions from charts, tables and graphs showing the relationships between data and real world situations.

1. All students will make decisions and predictions based upon the collection, organization, analysis and interpretation of statistical data and the application of probability.

Communication.

2. All students read and use a variety of methods to make sense of various kinds of complex text.
3. All students respond orally and in writing to information and ideas gained by reading narrative and informational text and use the information and ideas to make decisions and solve problems.
4. All students write for a variety of purposes, including to narrate, inform , and persuade, in all subject areas.
5. All students analyze and make critical judgments about all forms of communication separating facts from opinion, recognizing inconsistencies and judging the validity of evidence.
6. All students compose and make oral presentations for each academic area of study that are design to persuade, inform, or describe.

Science and Technology

7. All students explain how scientific principles of chemical, physical and biological phenomena have developed and relate them to real world situations.
8. All students demonstrate knowledge of basic concepts and principles of physical, chemical, biological and earth science.
9. All students develop and apply skills of observation, data collection, analysis, pattern recognition prediction and scientific reasoning in designing and conducting experiments and solving technological problems.
7. All students evaluate advantages, disadvantages and implications associated with the impact of science and technology on current and future life.

Suggested Activities

Activity 1 – Introduction

Before reading literature, students and the teacher should assess their knowledge of science fiction. The teacher should create a web for the word science fiction. The children will attempt to list movies and books that are consider science fiction. The student should then list ways these stories are similar. An example would be if they chose Deep Impact and Mission to Mars. They should list similarities such as: looks into the future, impact on human race, problems experienced, futuristic space travel, etc. Students should also write questions they have about space. At the end of this unit, these questions will be re-examined to help students assess what they have learned.

The children should also be introduced to the word wall. This exposes the children to the verbal word as well as the written word. This wall should be visible throughout the unit so during any journal writing and/or discussions children are able to use the correct vocabulary. Any unfamiliar word can be added to this wall. **(ST #6, COM. #5)**

Activity 2

To gain knowledge, the students will read alone, out loud, and in the classroom A Wrinkle in Time by Madeleine L'Engle. As they read each selection, students should keep a journal of observations, thoughts, ideas, associations and questions. **(COM. #2, 4)**

Book Synopsis

A Wrinkle in Time by Madeleine L'Engle

This book was about a young girl, Meg, who did not think she fit in anywhere and her little brother, Charles, who had a special gift. On a dark and stormy night while Meg, her brother and their mom were in the kitchen for a midnight snack a visitor knocks on the door. The unearthly visitor, Mrs. Whatsit, makes herself at home while explaining why she was out in the rain. Out of the blue, she says, "Speaking of ways, by the way, there is

such a thing as a tesseract." This truly upset Meg's mom. There is no way that any one could know what a tesseract.

When Meg woke the next day she had hope it was all a dream. She wanted to know what made her mother so upset but her twin brothers kept interrupting her. That day Charles and Meg decided to walk their dog Fortibras. While on their walk they bumped into a little boy by the name of Calvin. Like Meg, Calvin felt like an outcast in his family. They quickly became friends. They decided to introduce Calvin to Mrs. Whatsit. On their visit, they found Mrs. Who who was a friend of Mrs. Whatsit. Mrs. Who told the children "the time was not ripe". The children became hungry and went home to eat.

While eating supper, Mrs. Murray began to express her feeling for their father. Meg also became upset. She began to tell Calvin about her father. Charles Wallace suddenly interrupted their conversation. He was very excited and told them to get ready to go. Charles took them to Mrs. Whatsit, Mrs. Who and Mrs. Which.

Though Meg did not know, their journey was about to begin. Something strange happened to Meg and when she came to, she was in a strange new world. The children questioned how they got on the planet Uriel. Mrs. Whatsit explained they tesser. Meg began to make connections. She knew this somehow involved her father. Slowly she found out her father was working on a special project and disappeared. He had been experimenting with this fifth dimension of time travel when he mysteriously disappeared.

Meg realized that it was their job to rescue father. On their journey, they came through strange new worlds meeting very interesting creatures. They discovered a dark force trying to take over the universe…and earth was next. They knew now that they not only had to save their father but they also had to save the world.

Finally, they reach their destination. Mrs. Who, Mrs. Whatsit and Mrs. Which could not survive on the planet and had to quickly leave. The children began their search. They came across a very large building hoping to find their answer there. There they revealed a man with the power to communicate directly into their brains. Charles Wallace's curiosity rose because he too had this special power. He wanted to know what was this special force. In trying to find out, the special force hypnotized Charles.

Meg struck a deal with It to see her father. Charles led them to their father. There she found her dad in a tiny room looking shabby. She found a way into the room and embraced her father. Charles still under the spell became very upset with Meg and turned them into It. It tried to get into the minds of everyone so father decided to tesser to another planet leaving young Charles behind.

Though Meg had her father, she found that she still was not content. Her brother was still under the power of It. When she was ready she went back to Camazotz to find Charles Wallace. She knew exactly where to find him…with It. She went directly to him and fought It with simple love. She broke the spell that Charles was under and quickly tesser back to earth. She saved her father, brother and the earth from It.

Activity 3

Galaxies

Galaxies are huge groups containing hundreds of billions of stars. Ancient astronomers who studied these stars noticed a hazy glow that extends across the sky. Galileo began in 1610 when he found that he could see a large number of stars with the aid of his telescope. William Herchel built the modern picture by counting how many stars he could actually see in different parts of the Milky Way. As technology improved, Charles Messier began to plot out hazy patches that were visible in the sky, which resulted in the Messier Catalog. Today there is an estimated hundred billion galaxies in the visible universe. An important discovery made by Edwin Hubble is that galaxies that are more distant appear redder than nearer ones. Wavelengths emit light shift towards longer wavelengths in fainter galaxies. The mechanism that causes this shift is called the Doppler

Effect. According to Charles Sheffield, the Doppler Effect means light from a receding object will be shifted to longer (redder) wavelengths; light from an approaching object will be shifted to shorter (bluer) wavelengths. Sound works in the same way, which is why a speeding police car's siren seems to drop in pitch as it passes. The Doppler Effect leads us to believe that the universe is expanding at a close and constant rate. This has led scientists to assume that the universe started together at a single point. This theory is called the Big Bang. It is because of this theory we estimate our universe to be between 10 and 20 billion years old.

Students must understand the vastness of the universe. At one point in A Wrinkle in Time, Meg, Charles and Calvin asked Mrs. Whatsit where they were. Mrs. Whatsit explained they were on Uriel, the third planet of the star Malak in the spiral nebula Messier 101. Children many times do not comprehend the size of the universe. As a result, ask the students to describe a universe and how it started. Create a time line beginning with the Big Bang. An example of this time line is as follows:

1. The Big Bang
2. One Second after the Big Bang
3. Five Minutes
4. 3000 years
5. 100 million years
6. 1 billion years
7. 13 to 15 billion years (today)

(MA #6)

Expanding Universe

Materials
balloons
markers
air

1. To understand the expanding universe, pick up a deflated balloon and a marker.
2. Draw galaxies on the balloon.
3. Blow it up.

Ask the children what they discovered. Have the children write their observations in their journal. As a follow up assignment, tell the children when they go home tonight to stand outside and think about the following: Astronomer Hyron Spinrad says in the time it takes you to read this paragraph, typical distance galaxy clusters have moved apart by 1.6 million km (1 million mi.). That is how fast the universe is expanding. **(ST #6)**

Doppler Effect

Materials

zip lock plastic bag
water
penny
small stone
paper with small print

1. Get a clear plastic bag.
2. Fill the bag until it is about full.

3. Close the bag tightly.
4. Hold the water lens to the penny, small stone or the paper.

Again, have the children write their observations in their journal. Illustrations are a necessity. Children cannot always see differences the first time. If asked to draw the object they are force to look at the object several times. The bulging sides of the bag make the lens. The more curved the water bag the more it will magnify. Explain to the children this is a technique used to look into space. **(ST #1, 6; COM. #4)**

Activity 4

Gravity Physics

Gravity is one of the four fundamental forces of nature. It is a universal force affecting the largest and the smallest objects. Gravity manages the motion of the universe. This is why the moon travels around the earth and the earth travels around the sun. Gravity also governs the expansion of the universe by slowing the outward growth because of the inward attraction of galaxies to other galaxies.

Students always ask, " If we are in space, then what keeps us from floating?" Gravity is another concept children have a hard time visualizing. To better explain this concept do the following hands on activity.

Gravity Physics #1

Materials

ball
one piece of paper

1. Take a piece of paper and a ball.
2. Hold the ball and the paper in the air at the same height.
3. Drop the ball and the paper at the same time

What object hit the floor first? What do you think would happen if you crumbled the paper up?

4. Crumple the paper into a wad, as small as you can make it.
5. Hold the wad and the ball at the same height
6. Drop the ball and the wad.

What were your observations? Why do you think this occurred? **(ST #6; MA #2)**

Activity 5

Motion, Speed and Friction

Motion is the changing of position. Position is the place or location where an object is in relation to a reference point. You can describe motion in terms of how fast you are moving, the direction you are moving and changes in your speed and direction.

There are times when motion can be confusing. If you are in an elevator that moves slowly, do you have the feeling of motion? Sometimes you can be confused as to which object is moving. An example is when you are stopped in a car at a red light and are unsure if the car next to you is creeping forward or if you are rolling backwards. Most people judge motion in relation to a stationary reference point. An observer of the two cars on the street corner could easily tell which car was moving. The observer has a stationary reference point, the ground, from which to judge motion.

Speed is a measure of how far an object moves in a given period. When a motor vehicle speeds up and slows down, it changes the distance it covers in a period. Speed also describes how fast an object is moving. Velocity describes both the object's speed and its direction. An example of velocity would be two cars traveling at the same speed but one car travels east and the other car travels west. The speed is the same but the velocities are different. If both cars traveled east at the same speed, then their velocities are the same.

There are times when both speed and direction change. A baseball moves from the pitcher toward the plate with little change in velocity until the batter hits it. The property of an object that resists any change in velocity is inertia. Inertia depends on the amount of mass in an object. The more mass an object has the greater the inertia.

Friction is the force that opposes motion. The amount of friction depends on the types of surfaces involved and the amount of force pressing them together. The friction of the boat bottom rubbing against the water slows a boat moving through water. As airplanes move through the air, the air rubbing against the plane causes friction. Friction between your feet and the ground allows you to walk across a surface without falling. Due to the rubbing motion of friction, heat is produced. This happens to all objects that produce the force of friction. The greater the force of friction the more heat produced.

Sir Isaac Newton studied relationships between motion and forces. He developed three laws.

Newton's first law of motion states that an object at rest stays at rest and an object in motion keeps moving at a constant velocity unless acted on by other force.
Example: Objects tends to do keep doing what they are already doing unless something makes them change.

Newton's second law of motion states that the acceleration of an object depends on the mass of the object and the force acting on it. Force = mass x acceleration
Example: You want to rearrange the furniture. You move the couch in the center of the room. The greater force you apply to the couch, the faster it accelerates. If someone helps you push, the couch will reach the same velocity in a shorter time.

Newton's third law of motion states, that when one object exerts a force on a second object, the second object exerts an equal and opposite force on the first.
Example: As the space shuttle is basting off, the earth's gravitational force pulls down on the rocket. At the same time, the space shuttle's gravitational force pulls up equally on earth.

In the story, Calvin wanted to know how they were able to cover such a large distance in such a short amount of time. He says, "Even traveling at the speed of light it would take us years and years to get there." The next activities will give reasons why it is difficult for human to travel out into space. The student should understand that these are some of the problems that scientist face. Because of the vastness of space, the writer developed another way of travel the Tesseract. She developed this type of travel because she knew of the impossibility to travel faster than the speed of light (which zips along at about 300,000 km or 186,000mi.). In using this term, she was able to establish math concepts.

The author explained that the tesseract was time travel through the fifth dimension.

The following experiment should be done in teams of three to four. All children will keep a record of each experiment. Any observation and questions answered will be kept in their journal.

Friction #1 Which create more friction with smooth surface, rubber bands or sandpaper?

Materials

hard book cover
cup of water
box of playing cards
paper cup
pipe cleaner
15 medium weight washers
scissors
pushpin
string, 1m
masking tape
3 wide rubber bands
piece of coarse sandpaper

1. Open the book. Place your right index finger at the center bottom of the right hand page as shown. Try to turn the page. Can you turn the page easily? Try to turn five more pages in the same way.

2. Dip your finger in water. Repeat Step 1. Is it easier or harder to turn the pages?

3. Wrap a rubber band loosely around the tip of your index finger. Repeat Step 1. Remove the rubber band.

4. Wrap a piece of sandpaper around the tip of your index finger. Repeat step 1.

Questions

Which method easily turned the page? Which was most difficult? **(COM. #6; ST #6, 1)**

Friction #2 How does different surfaces effect the way an object moves on top of it?

Materials

wind up walking toy
sandpaper, 2 10-cm x 10-cm strips and a 5-cm square
aluminum foil, 2.5m, 2 10-cm x 10-cm strips, and a 5-cm square 100 straws
dishwashing liquid
sponge
wax paper, 2.5m
tape air pumped, skimmer, and cardboard racecourse

1. Tape one strip of aluminum foil and one strip of sandpaper end to end on a table or other clear, level area. Make sure the strips are flat. Mark a line with tape 10 cm from the foil strip. Label the line "Start".

2. Repeat Step 1 with other two strips. Use the sponge to spread a thin layer of dishwashing liquid on this second set of strip and on the table u to the start line.

3. Make a record like the one shown.

4. Feel the bottoms of the toy's feet. How do they feel? Feel the wet and dry surfaces of the table, the foil and the sandpaper. On the record sheet, describe what you feel.

5. Wind up the toy and put it down at the start line in front of the dry strips. Let it walk. Record the way it moves.

Record Sheet		
Surface	Description of Surface	How Toy Moved Over Surface
Dry table		
Dry foil		
Dry sandpaper		
Wet table		
Wet foil		
Wet sandpaper		

Questions

Does the toy move the same way on each surface?

Does the toy move the same way across the wet surface?

Can you make a pair of shoes that will help it walk across the surface? **(ST #6, 5, 4; MA #6)**

Friction #3 On which surface should you race your skimmer?

1. Get the top of a small jewelry box. This will be called a skimmer.
2. Place aluminum foil between the rails of the cardboard. Make a record sheet like the one shown. Use the air pump to test how far the skimmer travels on foil. Do three trials. Find the average distance traveled in cm. Record the results.
3. Test the straws and the waxed paper one at a time. Do three trials for each surface. Record the results on you record sheet.
4. Study your record sheet.

RECORD SHEET				
Surface	Distance			Average Distance
	Trials			
	1	2	3	
Aluminum foil				
Straws				
Waxed paper				

Questions

Which surface gives just the right amount of friction?

How do you know?

(MA #2, 6, 7;ST #4, 6)

Speed #1 Does weight affect a toy car's speed?
Materials

5 or 6 books
board, about 50 cm long
3 small toy cars, different weights
meter stick
masking tape
marble
ball bearing, same size as marble
clay
watch with a second hand

1. Make a record sheet like the one shown. Make a ramp about 20 cm high by placing one end of the board on the books. Put a piece of tape at the bottom of the ramp and a piece 75cm away. Label the tapes "Start" and "Finish."

2. Measure and weigh the cars. If you do not have a scale, tie each car to a rubber band and let it hang freely. Measure the distance the rubber band stretches. On your record sheet, described the weight of each car. Predict which car will win a race down the ramp and tell why you think so.

3. Release the cars at the top of the ramp at the same time. Which car wins?

a. Run five races. Record the winner for each trial. Which car won the most races?

RECORD SHEET	
WINNER	
Race 1	
Race 2	
Race 3	
Race 4	
Race5	

(ST #6; CO #6)

Speed #2 Does the weight of a sphere affect its ability to change direction without changing speed?

1. Make a record sheet like the one shown. Roll the clay into two pencil-thin strips the same length as the ramp from Speed 1. Lay the strips straight down the ramp. Put them just far enough apart for one of the spheres to roll freely between them.

2. Release the marble at the top of the ramp. Time and record how long it takes to reach the end of the strips. What is the speed of the marble in cm/sec? (distance in cm/time in second) Do three trials. Record the average speed.
a. Repeat Step 2 with the bearing.
b. Carefully form the clay strips into the curved track as shown. Is this track the same length as the straight track? How do you know? Repeat Steps 2 and # using the curved track.

Record Sheet	Trial	Distance (in cm)	Time (in sec)	Speed (cm per sec)	Average Speed
Marble straight path	1				
	2				
	3				
Marble curved path	1				

	2				
	3				
Bearing straight path	1				
	2				
	3				
Bearing curved path	1				
	2				
	3				

Questions

What was the marble's speed on the straight track? The bearing's speed?
What was the marble's speed on the curved track? What did you find out?
Does a sphere's weight affect its speed?
(CO #6; MA #2, 6, 7; ST #1, 2, 6)
Does a sphere’s weight affect its ability to change direction without changing speed? How do you know?
Planets

Encarta defines planets as being any of the nine major celestial bodies that orbit the sun and shine by reflecting its light or any similar celestial body orbiting a star other than the sun. Smaller bodies that also orbit the sun and are not satellites of a planet are called asteroids or planetoid. Astronomers group planets of the Solar

System in different ways. The planets are grouped into the inner and outer planets based on their structure. The inner planets are small solid spheres. The outer planets, with the exception of Pluto, are giant balls of gases.

Mercury

Mercury is the first planet from the sun. It is about 58 million km (36 million mi.) away from the sun. Like the ancient Roman messenger god it was named after, Mercury races through space, circling the Sun once every 88 days. This planet is very slow when it come to rotating. It rotates once every 59 earth days. Temperatures on Mercury can range from 800° Fahrenheit (427° C) by day to -280°Fahrenheit (-173° C) at night. To the surprise of scientist, there is ice on Mercury's North Pole. The surface of the planet is covered with deep craters with few plains and cliffs. The core of the planet is nearly solid metal made up of iron and nickel. Mercury has no known moons.

Venus

Venus is the second planet from the sun and the closest planet to the earth. This planet is sometimes called Earth's twin because the two planets are so close in density and size. Like Earth, Venus has an atmosphere. Venus is 108.2 million km (67million mi.) away from the sun. It is the only planet that rotates in the opposite direction, this is known as a retrograde. It takes 243 Earth days to complete one rotation on Venus. Temperatures on Venus never drop below 900° Fahrenheit (482° C). There is no water on the surface. The core is made of molten iron. Pancake volcanoes that erupt thick lava, are found on the surface. Venus has no moons.

Earth

Earth is the most active of the rocky planet. The surface is constantly changing due to earth's hot, solid, iron inner core. This planet is 150 million km (93 million mi.) away from the sun. It takes 23.56 hours to rotate. Earth is the only planet with much liquid water, which covers two-thirds of its surface. It also has a protective atmosphere. But Earth's most amazing feature is LIFE.

Mars

Mars is the fourth planet from the Sun and the only other planet in our solar system that could have supported life as we know it. Mars is nick-named the Red Planet. It gets its color from the iron in its soil. Mars is mainly composed of carbon dioxide. The polar ice caps are made of solid carbon dioxide and clouds. The average temperature is -67° F (-55° C). Mountains, canyons, valleys, and plains can be found on this planet. There is evidence of river systems and erosion due to large floods. Mars is 228 million km (142 million mi.) away from the sun. One rotation on Mars takes 24.37hrs. The largest volcano in the solar system can be found on Mars.

Jupiter

Jupiter is 779 million km (484 million mi.) away from the sun. It is the biggest planet in the solar system. It has no solid surface. The planet has a small rocky core surrounded immense layers of gas. The outer atmosphere stretches about 70,000 km (42,000 mi.) from the planets center. Jupiter's most visible feature is the huge Great Red Spot. This massive storm spins around its center every six days. This storm has been raging for more than three hundred years. Jupiter has a total of 16 + moons.

Saturn

Saturn is the second largest planet. At 1.43 billion km (888million mi.) from the Sun, it is the farthest planet that can be seen with the naked eye. The spectacular rings of Saturn hold billions of icy rocks in thousands of bands. This gas giant gives off more energy than it gets from the Sun. The planet has a hot rocky core

surrounded by liquid and solid hydrogen and helium. The outer layer is made of gas. This planet completes on rotation in 10.7 hours which causes the planet to bulge around its equator. Because of the rapid rotation, the planet has very strong winds (blowing at 1,500 km/h) in its atmosphere.

Saturn has 18 moons.

Uranus

Uranus is 2.86 billion km (1.78 billion mi.) away from the Sun. It takes about 84 Earth years to revolve around the Sun. The strangest thing about Uranus is that it is tilted on its side. Due to this strange tilt, seasons are odd. One pole of the planet points directly to the sun during that pole's mid summer. Forty-two Earth years later (half a year for Uranus) the other pole points at the Sun. This makes the poles warmer than the equator. Uranus has a total of 17 moons.

Neptune

The coldest of the gas giants is Neptune. It is also the windiest of the planets. Even though it is far from the sun, solar winds whip around the planet at 2,000km (1,243 miles) per hour. Like Jupiter and Saturn, Neptune gives off more heat than it gets from the sun. The heat rises into the atmosphere in current, creating strong winds. Powerful storms are found on the planet's surface. The strongest of the storms is called the Great Dark Spot. Neptune has five faint rings.

Pluto

Of all the planets Pluto has the most eccentric orbit. It curves in to within 4.3 billion km (2.7million mi.) of the Sun and then swings out nearly 7.7 billion km (4.8 billion mi.) away. For 20 years out of each 248, Pluto's orbit lies inside Neptune's. Pluto has one moon Charon. This moon is half the size of Pluto and orbit very close to the planet. Astronomers sometimes think of these two companions as a double planet.

Meg, Charles Wallace and Calvin journeyed through various parts of the universe. They learned about many planets on their adventure and even met several interesting beings. Introduce the planets by discussing the many planets that the characters of A Wrinkle in Time visited. Encourage the children to list the differences and similarities they found between that planet and our own. Explain to the children, they to are going to take a journey to a special planet and their final project will be for them to write a cartoon about that planet using factual information.

Planets #1

Find an open field and measure out 31 m (102ft.). Select 10 volunteers. Everyone should choose to be either the Sun or one of the nine planets. Have the person who is the Sun stand at one end of the field. Let 31cm (1ft) equal about 58 million km (36 million mi.). Space the planets according to the measurements below. The planets should be in order. The student should experience and imagine the distances between the planet. After the activity, again stress the vastness of space providing examples and visuals.

Planet/Star	Distance in Meters	Distance in Feet
1. Sun	0cm	0ft
2. Mercury	31cm	1ft

3. Venus	62cm	2ft
4. Earth	92cm	3ft
5. Mars	1m	4ft
6. Jupiter	4m	13ft
7. Saturn	8m	25ft
8. Uranus	15m	50ft
9. Neptune	24m	78ft
10. Pluto	31m	102ft

(CO #8; MA #2; ST #1)
Planets #2

The student will begin their journey through the solar system. Divide the children into groups of two or three. Supply the groups with the planet they will be researching and explain that they are to become expert on the chosen planet. Provide children with many different types of resources (encyclopedias, atlas, books about the planets, internet sites, etc.). Due to the age of the focused child, questions should be prepared to guide the child through the research. Throughout the research, the student will keep notes in their journal.

Example Guide Questions

1. How did the planet get its name?

2. What is the symbol of the planet?

3. What is its distance from the sun?

4. What is its gravitational pull?

5. What type of atmosphere does the planet have?

<>

(CO #1, 2, 3, 4, 6)

Planet Symbols and Gods	
Mercury wings ??????????????????Messenger of the	Jupiter lighting bolt King of Roman gods

Roman gods	
Venus hand mirror Roman goddess of love and beauty	Saturn curved sickle Roman god of reaping, father of Jupiter
Earth Greek for sphere Greek goddess Earth Mother	Uranus sign for the metal platinum Roman father of Saturn
Mars shield and spear Roman god of war	Neptune trident: fishing spear Roman god of the ocean
Pluto PL: Pluto and Percival Lowell (Pluto was discover at Lowell Observatory in 1930.) Greek god of the dark under world.	

Planet #3

The children should take the information received in Planet #2 and begin to create a cartoon. The cartoon should include the following information. Realistic information about the researched planet, how they traveled to the planet, survival mechanisms and life forms on that particular planet. Each topic should include authentic scientific information. Some example of the can be found in A Wrinkle in Time when Mrs. Who accidentally took them to a planet that was one dimensional. The children felt as if they were being squeezed to death. Another example can be found in Our Universe. They provided examples of what aliens may look like if they live on different planets. Make available questions to guide the children. This is to ensure the success of the child.

Example Guide Questions

1. In what area will the story take place?

2. What is the most striking feature? (animals, aliens, climate)

3. How will you travel?

4. What survival tactics will be used?

5. What are the characteristic of the aliens? **(CO #2, 3, 4)**

Planet #4

Each group will read and discuss their cartoon in front of the class. As the group are reporting the audience will fill out the chart provide. This chart will allow them to retain certain facts about each planet. Following the reports the children can cut apart each section and create a little book. **(CO #7, 8)**

Categories	Mercury	Venus	Earth	Mars	Jupiter	Saturn
Diameter in miles: (kilometers) Diameters relative to Earth's	3,050 (4,880)	7,563 (12,100)	7,973 (12,756)	4,246 (6,794)	89,365 (142,984)	75,335 (120,536)
	.38	.95	1.0	.53	11.2	9.4
Average distance from sun in millions of miles: (kilometers) Relative to Earth's distance from the sun:	36 (57.9)	67 (108.2)	93 (149.6)	142 (227.9)	486 (778.3)	893 (1,429)
	0.4AU*	0.7 AU*	1.0 AU*	1.5 AU*	5.2 AU*	9.6 AU*
Length of year (trip around the sun):	88 days	224.7 days	365.3 days	687 days	11.86 years	29.46 years
Length of day (turn around once on axis):	59 days	243 days Retro**	23 h. 56 m.	24 h. 37m.	9 h. 55 m.	10 h.40 m.
Gravity at surface:	.38 g	.91 g	1.0 g	.38 g	2.53 g	1.07 g

Number of moons:	0	0	1	2	16	23
Number of rings:	0	0	0	0	3	1,000 +

*AU=Astronomical Unit, average distance between Earth and sun is 93 million miles (149.6 million kilometers). distance in astronomical units.

**Retro=retrograde or backwards motion from the rest of the planets. Earth turns (rotates) on its axis from west t rotate east to west.

Mercury	**Venus**	**Uranus**
Diameter=_____	Diameter=_____	Diameter=_____
Distance from the sun=_____	Distance from the sun=_____	Distance from the sun=_____
Fascinating Facts: _____	Fascinating Facts: _____	Fascinating Facts: _____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Earth	**Mars**	**Pluto**
Diameter=_____	Diameter=_____	Diameter=_____
Distance from the sun=_____	Distance from the sun=_____	Distance from the sun=_____
Fascinating Facts: _____	Fascinating Facts: _____	Fascinating Facts: _____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Jupiter	**Saturn**	**Neptune**
Diameter=_____	Diameter=_____	Diameter=_____
Distance from the sun=_____	Distance from the sun=_____	Distance from the sun=_____
Fascinating Facts: _____	Fascinating Facts: _____	Fascinating Facts: _____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Student Resources/Suggested Readings

Branley, Franklyn M. **Floating in Space.** HarperCollins, 1998. Examines life aboard a space shuttle, describing how astronauts deal with weightlessness, how they eat and exercise, some work they do, and more.

Cole, Joanna. **The Magic School Bus: Lost in the Solar System**. Scholastic, Inc., 1990. Ms. Frizzle and her students go on a trip through the solar system aboard the Magic Bus.

Time-Life's The Universe. Time life Inc., 1998. Examines the origin, structure and workings of the universe, including galaxies, stars, dark matter, light-years, black holes, and other aspects, and describes space exploration from ancient astronomy to modern probes.

Nye, Bill. **Bill Nye the Science Guy's; Big Blast of Science**. Addison-Wesley Publishing Company, 1993. Contains a variety of hands-on activities to teach related space science topics.

Haynes, Betsy. **Bone Chillers; Welcome to Alien Inn**. Harper Collins Publishers, 1996. A family finds their self trapped in a hotel that checks people in but not out.

L'Engle, Madeleine. **A Wrinkle in Time**. Bantam Doubleday dell books for Young Readers, 1962. Children travel through space and time to find their long lost father.

L'Engle, Madeleine. **A Swiftly Tilting Planet**. Bantam Doubleday dell books for Young Readers, 1978. Charles Wallace and a unicorn take a perilous journey through time and space in a desperate attempt to stop the destruction of the world.

L'Engle, Madeleine. **A Wind in the Door**. Bantam Doubleday dell books for Young Readers, 1973. Charles Wallace befriends a dragon which takes he, his sister and her friend out into space to battle the forces of evil.

L'Engle, Madeleine. **Many Waters**. Bantam Doubleday dell books for Young Readers, 1986. The Murry twins find themselves in trouble when they accidentally travel through time to a desert land that will flood.

Bibliography

Teacher Resources

Gallant, Roy A. **Our Universe**. National Geographic, 1994. A picture atlas that includes: chapters for each of the planets and excellent information about deep space objects, shuttles and future space exploration.

Sheffield, Charles. **Borderlands of Science**. Baen Publishing, 1999. This book describes how to think like a scientist and write science fiction.

World in Motion. Mazer Co., 1990. This teachers guide includes several hands-on activities that teach concepts of motion, friction and speed.

Feather, Ralph M. **Science Connections**. Merrill Publishing, 1990. A teacher's guide which includes concepts of friction, motion and speed.

Pofahl, Jane. **High Interest Learning**. Instructional Fair, 1999. A teacher's guide which includes concepts of space, planets, space travel, stars and other topics relating to space.

Bernstein, Leonard. **Physical Science**. Globe Book Company, 1986. This teachers guide includes several hands-on activities that teach concepts of motion, friction and speed.

Young, Ruth M. **Space**. Teacher Created Materials, Inc., 1999. A teacher created thematic unit that has cooperative learning, hands on activities that deal with space.

Cavanaugh, Terence W. **Learning Science with Science Fiction Films**. Kendell/ Hunt Publishing Company, 1996. This guide walks you through ways that you can use science fiction books and teach physics.

Websites

The Universe in the Classroom http://www.aspsky.org/html/tnl/tnl.html This site provides background information and lesson ideas for teachers.

Astronomy Café http://www2.ari.net/home/odenwald/café.html A question and answer site for teachers as well as students.

Boeing International Space Station http://www.boeing.com/defense-space/space/spacestation/description.html Links to specific information and pictures of International Space Station.

Center for Mars Exploration http://cmex-www.arc.nasa.gov/ Provides a maintained web site for Mars.

Kennedy Space http://www.ksc.nasa.gov/ksc.html Provides information regarding Mercury Gemini and the space shuttle.

Big Bang Theory http://spacelink.nasa.gov/NASA.projects/space.science/universe/ Explains and simulates the big bang theory.

Planets http://seds.lpl.arizona.edu/nineplanets/nineplanets/ Offers comprehensive information about the planets.

Future Space Travel http://nmp.jpl.nasa.gov/ Gives more details about the New Millennium Program.