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Space Age Classroom Science Experiments

By Tim Van Milligan

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Are you looking for some topics to present that can add excitement to your science classroom? Rocketry and space exploration, like no other subject, have a way to captivate students that makes it easy for them to learn science. They are having so much fun, that they don't even realize they are learning basic science concepts.

To leverage the benefits of this area of study, you can use your school's computer to explore a lot of different science topics. In the January 2005 issue of the education magazine, "Tech Directions" (<http://www.techdirections.com>), there is an article by Spencer C. Wilson of J.R. Fugett Middle School in West Chester. In it, he describes how he uses a rocket design software, called RockSim (<http://www.rocksim.com>) to show students the process of engineering design.

In this article, I'd like to give you some other ideas on how to use the model rocket design software to demonstrate other basic science concepts. Here are some benefits to using RockSim software:

1. Allows the student to simulate hundreds of rocket flights very quickly --- this saves lots of money! Just think of the time saved too. You don't have to spend hundreds of dollar buying motors and hours--and--hours of time building different configurations, launching, recovering, and repacking rockets to test one control feature.

2. Safety. When you go out to fly rockets, knowing how they'll behave is an important aspect of safety. Precautions can be made. By running the simulations, the students learn what concepts contribute to keeping the actual launch safe.

3. The scientific value is awesome. Each launch simulation generates a mountain of useful data. Analyzing this data is a fantastic way to teach the scientific method.

4. Students love software because it is fun! It has features like a video game, so the students may not realize how much

they are learning at the same time.

5. The RockSim software is the same tool that is used by real rocketry professionals – like NASA, military contractors, and universities. So you can feel confident in the results you get back from the program.

6. The software allows students to explore their creativity. They can design vastly different looking models, while learning engineering skills, assembly steps, and physics.

Here are just some of the many topics you can explore with RockSim:

1. Aerodynamics and drag reduction.
2. Forces of flight: Lift, Drag, Thrust, and Gravity.
3. Projectile motion.
4. Rocket propulsion as used for space travel.
5. Atmospheric studies: how does temperature and pressure affect performance?
6. Planetary differences: how does the same rocket perform on different planets in our solar system.
7. Dynamics and harmonic motion with damping.
8. Engineering – how parts fit together.
9. Newton's Laws of motion.

10. Artistic expression - because every student can design a different looking rocket, and change colors of the components to further increase the rocket's uniqueness.
11. Explaining distance, velocity, and acceleration.
12. Material properties, like density and volume.
13. The importance of weight and balance (CG position) when designing rockets.
14. Explaining that $Work = Force \times Distance$.
15. Explaining the concepts of Kinetic and Potential Energy.
16. Showing free-fall, and terminal velocity.
17. The importance of units and unit conversion.
18. The importance of following directions.
19. Exporting data and using spreadsheet programs to perform data reduction and manipulation
20. To show why multi-stage and cluster motor rockets are used in real rockets.
21. Concept of stored chemical energy (in the rocket propellant) and how it is converted to mechanical energy.
22. Concept of efficiency – getting the most performance from the least exertion of energy. Can be explained by the different types of propellant formulations.
23. Showing the concept of momentum and how it affects the optimum mass of the rocket.
24. Finding the optimal launch angle for breezy conditions.
25. Optimal launch angle for distance (ballistic curves), and how it varies with the thrust curve of the motor.
26. Show how the distribution of mass affects the dynamic stability of the rocket.

27. Demonstrating the concept of "Numeric Precision" --- the more iterations performed, the better the accuracy.

28. Show how different shaped components affects the static stability of the rocket.

29. Compare the thrust curves of different motors. This can show how different geometries (hole size, location, dimensions) affect the thrust produced by the rocket.

30. Concept of "Impulse:" which is a thrust force multiplied by the time duration that thrust is created. The higher the impulse, the more power the motor has.

As you can see, the RockSim software is a versatile tool. You'll save hundreds of dollars because it can be used in a variety of ways.

Tim Van Milligan (B.S. Aeronautical Engineering) writes articles about model rocketry for the e-zine newsletter called: "Peak-of-Flight." He is also the author of the book: "Model Rocket Design and Construction," which can be found on his web site: <http://www.ApogeeRockets.com>.

Voom Factor

By Richard Flowers

Home Science Experiments and the
Voom Factor
By Richard Flowers, AA, BS, MS, CT

"He has something called a voom.
Voom is so hard to get,
You never saw anything
Like it, I bet."
Dr. Seuss

When Dr. Seuss wrote these quotes in his fantastic children's books he probably did not know how germane and relevant his quotes would be to the daily life of children and adults. The more that you learn the more places you'll go is a noteworthy quote when it comes to teaching science to kids.

We have read Dr. Seuss's *Cat in the Hat Comes Back* where we learned about the secret ingredient called Voom. What is Voom? Dr. Seuss had it right. Voom is what makes learning fascinating, effective, enjoyable and relevant to kids. As a first grade teacher, I use the secret ingredient of voom to teach science. How do you teach science using voom?

Here's my science voom recipe:

1. 1 beaker full of excitement
2. 1 pound of drama
3. 1 gallon of supplies
4. 21 ounces of concepts
5. 1 human experimenter know as Professor Tweety Bird

Who is Professor Tweety Bird?

Professor Tweety Bird is a character that I play in my classroom to perform science experiments and teach scientific concepts. Professor Tweety Bird is a world famous Professor Emeritus in science,

sociology, medicine, philosophy, mathematics, English, etc., etc., etc., from Oxford University in England. He is an eccentric, fun loving professor that speaks with a thick, classical English accent. He loves to introduce science to kids using exciting hands on experiments that make the kids say, "wow" in excitement. The best way to teach science is with hands on experiments where the children can actually see the process occur in front of them.

"Think left and think right and think low and think high. Oh, the thinks you can think up if only you try!"

Dr. Seuss

Let me share with you a few experiments that I have done in my own classroom that you can do at home to teach some basic science concepts. Don't forget to use voom!

1. The vibrating fork: Take a string and tie it around a fork. Now let it hang from both of your ears and tap it with another fork. You will hear a sound in your ears that will surprise you. The sound is actually traveling thorough the string and into your ears. It sounds like a bell! This is a form of mechanical energy being manifested as sound, which is vibration.
2. The straw through the potato: Take a raw potato in one hand and a drinking straw through the other hand. Place your index finger on the end of the straw and pierce the straw through the potato with a quick action. The straw will pierce the entire potato and you can even pull the sliver of potato

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out of the straw. It will be in a perfect cylinder shape. This works by mechanical energy and air pressure. The air pressure is increased since you are covering one end of the straw with your finger. This in turn reinforces the strength of the straw allowing it to go through the potato.

3. Ping pong ball on a hair dryer: Take a hair drier, turn it on to high and hold it so the air flows upward. Take a ping-pong ball and you will see it float on a cushion of air. This experiment demonstrates how air flow can float the ball in the air.

4. Penny polish: Take some of your most corroded pennies and soak them in a solution of vinegar and salt. You will find the corrosion on the pennies will vanish and the pennies will look like new. This is due to a chemical reaction that is occurring with the mixing of vinegar and salt. Also the grittiness of the salt that can help wear down some of the corrosion. This is similar to the pumice that is put into some soap to clean grease off your hands.

Please go to my website at www.MultipleIntelligences.citymax.com and you can see pictures of these experiments. This will also help you set one up since you can see it visually.

These are just a few experiments that you can do at home to teach science with your kids. You don't have to be Professor Tweety Bird from Oxford University either! You can invent your own character or just me yourself. But don't forget the voom. Voom is what makes it work! Whenever we do these experiments, the professor talks about what processes the experiment is demonstrating and how these apply to other machines or processes that occur around us in our daily lives. He does it with a lot of voom!

The Professor teaches the kids this acronym to learn the seven forms of energy that often show up in any experiment. Remember the word McHALES.

M–Mechanical

C–Chemical

H–Heat

A–Atomic

L–Light

E–Electric

S–Solar

One of these seven forms of energy often shows up in the experiments above. Science is all around us in everything we do. Take this time to share with your child the wonderful science experiments that you can do at home with things you have around your house. This is what Dr. Seuss talks about with his secret ingredient voom. Put voom in your learning with your children with science and everything else you do with your children. It can become a learning event that you and your child will never forget.

"You tell me, and I forget. You teach me, and I remember. You involve me, and I learn."

Benjamin Franklin

"The more that you read, the more things you will know. The more that you learn the more places you'll go."

Dr. Seuss

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