NEWSLETTER

ONTARIO ASSOCIATION OF PHYSICS TEACHERS

(an affiliate of the American Association of Physics Teachers)

Volume XVIII, Number 3 **Spring 1996**

EDITORIAL:

LETTING RESEARCH INFORM PRACTICE

Don't knock it 'til you try it

When I started teaching I remember clearly listening in on the conversations of the more experienced teachers, hoping to hear any educational important scrap that I could use in that day's classes (I couldn't just ask outright for help, I had a piece of paper telling me I could teach, it would have been embarrassing if my colleagues found out that I was struggling to survive in the classroom; they didn't appear to be having any problems—but that's another editorial). One of the first things I learned was that educational research was useless as far as the practicing teacher was concerned. Researchers lived in their ivory towers and, if they had had any teaching experience at all, it had been so long ago that they had no idea of what they classroom was like now.

It has taken me the better part of ten years to unlearn this 'fact'. Educational research is not performed in a sterile lab environment with the results extrapolated to the classroom. Most of the research literature I have read has a very practical nature. In many cases researchers work in the classroom with teachers, trying out and evaluating their models.

The idea that the only way to learn about teaching is to teach needs to be modified by adding two conditions. The first condition is that, when designing and implementing curriculum, teachers need to have more than a passing knowledge of the research into learning. For example, a lot of studies have been done on students' alternative conceptions in mechanics, electricity, heat and temperature and other areas. Many of these alternative conceptions are formed over many years by a student's observations of his or her environment, and are very resistant to change through instruction—even when the student is confronted with a demonstration that directly contradicts one of these conceptions. Many of these concepts are similar for students across different cultures (e.g., in mechanics, many of the features of the Aristotelian view of the universe are found in students around the world), and some are persistent enough to still be found in university physics professors.

The second condition for improving teaching practice is through the deliberate reflection on a particular unit or lesson when evaluating its educational value. This reflection needs to be more than a 'gut' feeling that things went well—perhaps by having a colleague come into your class, or by video-taping some of the key lessons during a unit. Evaluation of the students needs to be more than a summative paper and pencil test. It might include interviewing students about a concept, having students predict and explain the outcome of a demonstration, or using some of the other techniques researchers and teachers have created for this purpose.

PHYSICS NEWS UPDATE

The American Institute of Physics Bulletin of Physics News. Number 262. March 14, 1996
by Phillip F. Schewe and Ben Stein

THE SURFACE OF PLUTO HAS BEEN IMAGED for the first time. The Hubble Space Telescope has snapped a series of high-resolution pictures throughout Pluto's 6.4-day rotation period. The photo sequence reveals that Pluto possesses more visible large-scale features than any planet except for Earth. The features include a variety of dark and bright spots and a dark stripe across the frosty north pole. Pluto had not previously been imaged clearly before, even with the bigger Earth-based telescopes, because its angular size on the sky is only a tenth of an arcsecond across. All of this comes at a time when some astronomers want to take away Pluto's status as a planet. (NASA press release, 7 March 1996.)

IN THE LATE HEAVY BOMBARDMENT (LHB) EPOCH, a span of about 200 million years some 4 billion years ago, the Moon sustained many large impacts. Some astronomers believe that the projectiles responsible may have pestered Mercury, Venus, Earth, and Mars as well. Others assert that the LHB phenomenon was unique to the Earth-Moon system or that it did not happen at all, at least not so suddenly. Now, a group of scientists at the University of Manchester (UK) has dated a rock found here on Earth but which is believed to have been a meteorite originating at Mars. The 4-billion-year age of the object, determined by isotope dating, is much older than previously studied Martian meteorites. The antiquity of the rock, say the researchers, provides evidence for a widespread LHB effect. (R.D. Ash et al, Nature, 7 March 1996.)

You should have received a mailing about the June conference at York, and the OAPT Physics contest in May. If you did not get this mailing, please send me a note (the address is on page 2) and we will get the information to you.

UNIVERSE!

A Hands-On Astronomy Workshop for Teachers

Saturday April 20, 1996; 10 am - 5 pm

Ontario Science Centre*

770 Don Mills Road, North York, Ontario

The workshop includes exciting lecture and planetarium presentations, practical demonstrations, displays, hands-on activities, resources and discussions designed to help teachers understand astronomy concepts, and implement them in their classrooms. Target audience is grade 5-10 teachers, but all educators will benefit from the workshop. Presenters include Michele Gerbaldi (Université de Paris), John Percy (University of Toronto) and others to be confirmed.

En Francais: A parallel workshop in French will be held at the same time and place. Presenters include Michele Gerbaldi (Université de Paris), and others to be confirmed.

Sponsors

Ontario Science Centre
Marc Garneau Collegiate Institute
Metro Toronto Science Coordinators Association
Ontario Secondary School Teachers' Federation
Royal Astronomical Society of Canada
Royal Ontario Museum
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For more information or registration forms
Contact Kirsten Vanstone (voice: 416-696-3177; fax: 416-696-3197), Ontario Science Centre, 770 Don Mills Road, North York, Ontario M3C 1T3. Renseignements en francais, composer le 416-696-3136. Pre-registration fee of $25 includes lunch, am and pm snacks, and handouts. On-site registration fee: $30.

This event is part of International Astronomy Week 1996

* NOTE: If the OPSEU strike continues past March 25, the workshop will be moved to the University of Toronto. Registration will go to John Percy, Erindale College, University of Toronto, Mississauga, ON, L5L 1C6, FAX 905-828-5425, phone 905-828-5351.

PHYSICS DEMOS FROM THE WOODROW WILSON PHYSICS INSTITUTE

compiled by Pat Cannan

Physics Institute: Woodrow Wilson National Fellowship Foundation
Box 642
Princeton, NJ 08542

Baffle the Speaker:
Purchase an ear phone attachment for a cassette player. Cut off the ear piece and in its place solder a small (5cm) speaker (Radio Shack). Plug this speaker into the cassette player and listen to the musical sounds before and after the speaker is placed near the opening of each of the following objects: plastic pipe, bottomless styrofoam cup, a sheet of 60 cm square cardboard with a 5cm hole cut in the center.

Football Spin:
Try spinning the following objects on a bare floor or on a smooth table top: Small toy football, hollow egg-shaped plastic container (l'eggs), full-size football. Though the football begins its rotations about its short axis, it reorients itself to a lower energy state by
standing up and rotating about its longer axis. (See The Physics Teacher, Vol. 15. p 188, 1977).

The Levitating Screwdriver:
When various objects are individually placed in a narrow stream of fast moving air, they seem to float. Objects which have been used include: golf balls, small footballs, styrofoam balls, rubber balls, steel balls, hollow egg-shaped plastic containers, and smooth handled screwdrivers.

E-Mail Us!

We want to hear from you: your comments, criticisms, observations...
Send correspondence to:
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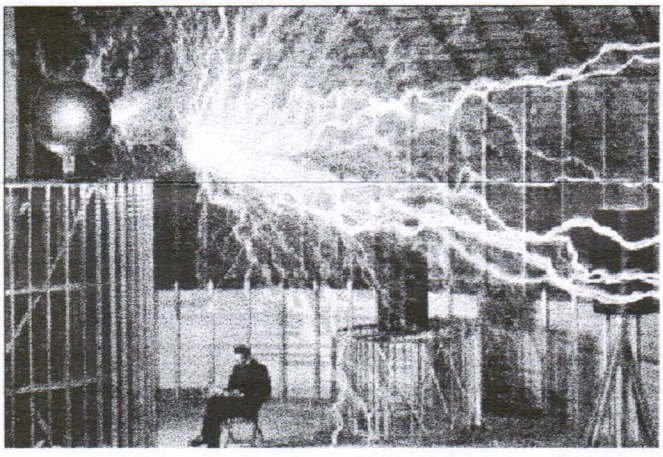
Recommended Reading

by Alan Hirsch

If you want to interest your students with intriguing stories of the ultimate "mad physicist," you do not have to look beyond the real-life stories of Nikola Tesla. Although physicists and physics educators are well aware of the Tesla coil, and Tesla has been honoured by having the unit of magnetic flux density named after him, most people are unaware of this man's important contributions to our world and of his eccentric, almost unbelievable, lifestyle.



You can find an excellent introduction to Nikola Tesla's life and contributions in Pierre Berton's *Niagara—A History of the Falls* (McClelland & Stewart, Toronto, 1992). The entire book is fascinating, but Chapter 7 is of special interest to physics educators because it delves into harnessing the falls to produce electricity. Berton brings to life the intellectual battle between Thomas Edison, who stubbornly argued for the generation of direct current, and Nikola Tesla, who could foresee the advantages of generating and transmitting electricity using alternating current. As we know, Tesla won the battle. But did he become a celebrated hero of invention, as did his opponent and former employer, Edison? No. And did Tesla become rich through his inventions, as did the industrial giant, the George Westinghouse Corporation, which manufactured his designs? Again, the answer is no. However, the stories behind these negative answers are exciting and unusual in a way that is stranger than science fiction.

Berton devotes pages 210 to 221 to Tesla, and there he mentions one important biographer, Margaret Cheney, who wrote the book *Tesla: Man Out of Time* (Prentice-Hall Inc., Englewood Cliffs, New Jersey, 1981). I recently bought this book for only $7.50, and I highly recommend it for physics teachers who want to go beyond the lay person's understanding of Tesla's life. This book was written after research revealed findings about Tesla's life that previous biographers had not known. The book includes numerous references, eight pages of rare photographs, and a comprehensive index.

In the bibliography near the end of Berton's *Niagra* are references to other resources about and by Tesla. (See the following entries: Goldman, Hunt, Ratzlaff, Tesla and Tribute to Nikola Tesla.) If any reader has access to any of these resources and is willing to review one or more of them, I am sure the readers of this newsletter would be interested in your comments.

Internet Interest

The Proceedings of the Third International Seminar on Misconceptions and Educational Strategies in Science and Mathematics.

http://meaningful.education.cornell.edu/

This seminar, held in 1993 (the first was in 1983, and the second in 1987), brought some 500 people to Ithaca. They presented 283 papers on a variety of topics relevant to dealing with alternative conceptions (see the Editorial on p. 1). All of the papers from this conference are online. Ascii text files can be downloaded, or the completely formatted paper. To view the formatted papers you need to download the viewing software: BINHEX (which converts the downloaded file into a .DP file) and VIEWER (which views the .DP files). The files are organized by author and subject.

ASTRONOMY SITES

AstroWeb: http://stsci.edu/net-resources.html
Advanced Space Studies: telnet://cass.jsc.nasa.gov (login: cass, password: online)
Einet Galaxy's Astronomy Collection: http://www.einet.net/galaxy/Science/Astronomy.html
Guide to Stars and Galaxies: http://www.eia.brad.ac.uk/btl/
The Nine Planets: http://www.atklab.yorku.ca/tnp/nineplanets/nineplanets.html

Why wait until it's too late?

The date on your address label is the expiry date for your membership. You may use the coupon below (or a facsimile) to renew it, or to indicate a change of address (or both) by checking the appropriate box. And, hey, what the heck, why not renew it for two (or more!) years; it will save you the hassle of renewing over and over again.

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Send to: Ernie McFarland, Department of Physics, University of Guelph, Guelph, Ontario N1G 2W1; Email: elm@physics.uoguelph.ca

How About That?

by

Murray D. Kucherawy

A.B. Lucas S. S., 656 Tennent Ave.
London, ON N5X 1L8

Effective classroom demonstrations often require tinkering with temperamental equipment. With the permission of the editor, I would like to share a "thought demonstration" that requires no equipment, but which still makes a surprising point.

A physics teacher's wife took her gold wedding ring to a jeweller for repair. It was her 25th wedding anniversary and the jeweller who originally had sold the ring noted that the wear amounted to 0.25 g. The physics teacher decided to calculate the rate of wear in the interesting units of atoms/second. Estimating the molar mass of 14k gold to be 120 g/mole, we get:

$$0.25 \text{ g}/25 \text{ yr} = (0.25 \text{ g}/(120 \text{ g/mole})) \times 6.02 \times 10^{23} \text{ atoms/mole}$$

$$\div (25 \text{ yr} \times 365 \text{ days/yr} \times 24 \text{ hr/day} \times 3600 \text{ s/hr})$$

$$= 1.6 \times 10^{12} \text{ atoms/s}$$

Before beginning the solution, do ask your students what they consider to be "reasonable" answers. You'll be surprised.

End the session by asking why you are not knee-deep in gold atoms as you walk around the class.

(based on an article by J. Shull, Alfred University.)

NOTE: If, during the solution, your students can tell you coherently what a "mole" is, treat your local chemistry teacher to a coffee. He/she will have earned it!

Editor's Note: Fermi questions are an excellent way to get students to practise estimating (which is a good excuse for putting a large picture of Fermi here).

Now, a second thought experiment your students will enjoy.
A monkey hangs onto a long, massless rope which passes over a large-diameter, massless, frictionless pulley and is connected to a mirror equal to the monkey's mass directly opposite the monkey. On seeing his image, the monkey is frightened and wishes to escape. Can he?

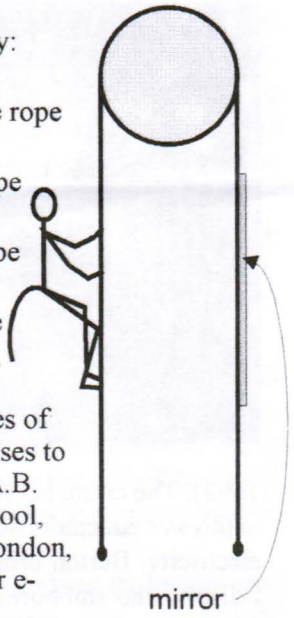
The monkey might try:

(i) climbing down the rope

(ii) climbing up the rope

(iii) letting go of the rope

(iv) something else (should be interesting).



Please send in samples of your students' responses to (iv). Contact me at A.B. Lucas Secondary School, 656 Tennent Ave., London, Ontario, N5X 1L8, or e-mail to murrkuch@village.ca.(*Editor's note: this may not be possible at the moment; see the notice on below about Village e-mail*) The best answers will appear in a later edition of this *Newsletter*.

ELECTRONIC VILLAGE DOWN

As many of you may know, the *Electronic Village*, through which many Ontario teachers had an e-mail address, was shut down. I have heard that they are trying to get it running again, but you cannot send e-mail to Village addresses at the moment.

You can reach me at: plaxon@edu.uwo.ca

Paul Laxon, Editor

Column Editor: Ernie McFarland, Physics Dept., University of Guelph, Guelph, Ontario, N1G 2W1
Email: elm@physics.uoguelph.ca

Submissions describing demonstrations will be gladly received by the column editor.