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Resources - Thinking Small: Nano Small

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thinking small: nano small

by David Stricker

Daily, we enjoy the increasing efficiency, utility, elegance, and the convenience of mobile phones and computers. It is hard to imagine how we could function without them. Clearly, their speed and ease of use endear them to us and might explain why we reach for them almost unconsciously for work or play. Indeed, as a result of their ergonomically efficient design and ever-shrinking size and weight, our use of these products has become routine if not habitual.

For nearly twenty years, nanotechnologies—the deliberate manipulation of matter at size scales of less than 100 nanometers—are gaining in commercial use (Waldron, Douglas, and Batt, 2006). Scientists have discovered that materials at this small dimension, or at the nanoscale, can have significantly different properties than the same materials at larger scale. It is these materials that are being used to engineer devices so small they are measured on a molecular scale. These nano materials are not only responsible for the capabilities of the electronic devices we enjoy, but have become commonplace in products ranging from cosmetics to automotive batteries. So, from wet wipes to stuffed animals to videogame systems, the use of nanotechnology in common products permeates our lives today.

Engineers, technologists, and scientists from the disciplines of physics, chemistry, biology, material science, and information technology are embracing this ability to "think small" and design small by harnessing nanotechnology's potential for improving devices, structures, and materials. Since this technology exists at the molecular level and is still considered to be emerging, it is understandable that very few of us are aware of the current impact it has on our lives. Furthermore, many in our society may not be considering nanotechnology's effects—both positive and negative—on sustainable energy, materials, electronics, chemicals, aeronautics, and molecular medicine. This column will feature resources that could be used in your classroom to help you and your students explore the emerging issues in nanotechnology.

thinking small – nanotechnology resources

Nanooze! is a magazine resource that can be mailed free of charge to classroom teachers just by emailing a request for copies to info@nanooze.org. *Nanooze!* is supported by the National Science Foundation through the National Nanoscale Infrastructure Network and the Cornell Nanoscale Science and Technology Facility. Its primary audiences, as can be deduced from its kid-friendly style and graphics, are elementary and early middle school children. It features informative and age-appropriate articles that cover not only the basics of nanotechnology, but their application in the areas of medicine, the human body,

biology, energy, materials, daily life, microscopy, electronics, and space. Examining just a few of the available titles below reveals not only the diversity of information covered, but the appealing nature in which it is explored:

- **Swing Your Racket...**
  ...like Vitas Gerulaitis, the world famous tennis pro. All you need is a little help from carbon nanotubes!
- **Liquid Armor**
  Can nanotechnology help to protect soldiers in combat? Maybe someday.
- **Smart Medicine**
  Using nanotechnology, we can create tiny vehicles that can deliver medicine to the exact area where it is needed.
- **Nanobots—The Reality**
  So, you see on the Internet little robot things that swim around your blood and kill germs . . . where can I get some?
- **Going up!**
  Some scientists are currently thinking about a space elevator. Would you ride one up into space?

The fact that this technology is not limited to just physics, biology, or chemistry but integrates all of them, makes studying nanotechnology a particularly powerful subject—it is where engineering and science meet! Using *Standards for Technological Literacy* (ITEA, 2000/2002/2007) as a guide, lessons in nanotechnology can help students come to grips with defining principles such as the difference between the natural and human-made world (Standard 1), as well as issues concerning ethics and technology (Standard 4). For example, as highlighted

in the above article, "Nanobots—The Reality," nanotechnology can be a very powerful resource in combating illness. As a result, would it be unethical to not research this capability? In essence, nanotechnology can be a subject of its own, but it is also a powerful way for students to think and learn about other subjects as well.

If you would rather have access to the *Nanooze!* resources electronically, the same information can be attained via the website: www.nanooze.org. As an added value, the website offers students an opportunity to blog and meet and contact the very scientists and technologists who contribute to the content of the publication, which is a diverse group in terms of age, education level, and ethnicity. In addition, all material on the site is available in English, Spanish, Portuguese, and Swahili—you can even meet the interpreters!

Finally, the blog associated with the *Nanooze!* site offers a wide variety of topics concerned with science and nanotechnology. Contributions are organized under the headings of latest news, physics, biology, chemistry, medicine, materials, daily life, and history and can be archived monthly as far back

as 2005. Another section, labeled "Links for Kids," has information under headings such as Earth & Sky Nanotechnology, Exploring the Nanoworld, Nanotech Kids, Science News for Kids, and Small Science, Big Deal. These resources, coupled with ten additional links geared for adult audiences, not only allow students to reference up-to-date information relative to science and technology as they relate to nanotechnology, but also allow teachers a quick reference to news updates relative to the subject matter and ways to present it that are engaging to students.

The National Nanotechnology Infrastructure Network (NNIN) Education Portal (www.nnin.org/nnin_edu.html) is the parent site for the aforementioned *Nanooze!* online resource. For K-12 teachers specifically, there is a link to the NNIN Education Site—Nanotechnology Educational Resources and Activities for K-12 Teachers (www.nnin.org/nnin_k12teachers.html)—that offers information on where nanotechnology fits in the science and technology curriculum, research experiences and teacher workshops that are available, and a comprehensive list of classroom support materials that consist of easily printable student and teacher guides for specific lessons and units.

references

International Technology Education Association. (2000/2002/2007). *Standards for technological literacy: Content for the study of technology.* Reston, VA: Author.

Waldron, A. M., Douglas, S., & Batt, C. A. (2006). The current state of public understanding of nanotechnology. *Journal of Nanoparticle Research, 8,* 569–575.

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