

Web of Nano Knowledge

Subject Area(s): Science & Technology

Associated Unit

Associated Lesson: Invisibility and the Real World

Activity Title: Web of Nano Knowledge

Header: Insert Image 1 here, centered

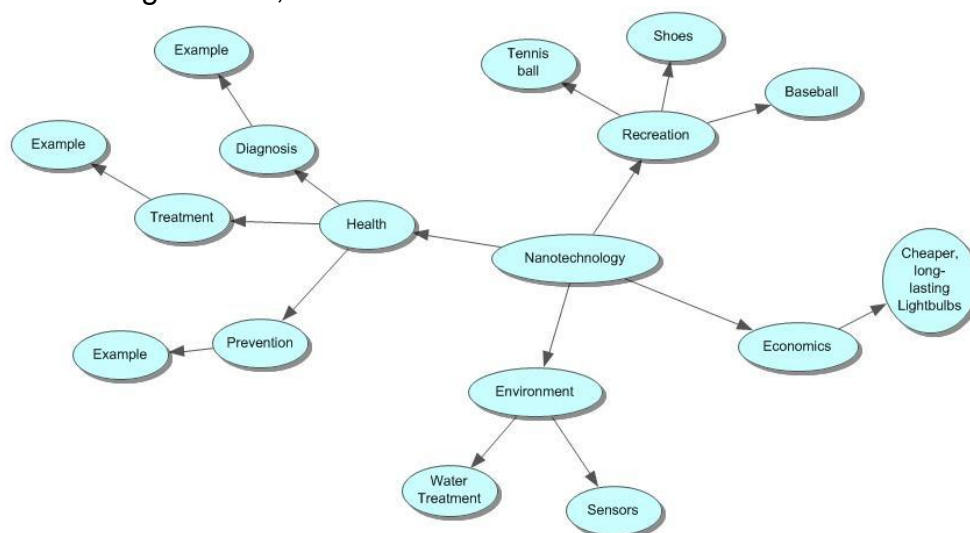


Image 1

ADA Description: An example of a web created by Inpsiration as a skeleton of what the students will create in this activity. It can be given to the students as a base example.

Caption: none

Image file: web_of_nano_knowledge.jpg

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Grade Level 8 (6 - 8)

Activity Dependency: None

Time Required: 60 minutes

Group Size: 1

Note on Group Size: The group size is determined under the premise that there is computer available for each student as with a technology class. The group size could range from 1-4 depending on the availability of computers in the classroom.

Expendable Cost per Group US\$0

Summary

Students will be introduced to the concept of nanotechnology and the area that nanotechnology is involved. Through a pre-activity discussion and demonstration, students will get a preliminary understanding of nanotechnology. Then, students will use Inspiration 9 to create a web of information surround this main idea of nanotechnology. Through individual research, students will specifically identify different nanotechnology advances and create an understanding of how nanotechnology has an impact in many different areas and ways.

Engineering Connection

While most students will associate engineering with large projects (buildings, bridges, computers, etc.), it is important that students understand that engineering happens a small scales as well. This activity has valuable engineering application because it exposes students to the concept nanotechnology in a multitude of areas and. Each of these areas range from medicine to materials, different type of engineers use advancements made through nanotechnology to better products, equipment, and ultimately results.

Engineering Category = #1

Choose the category that best describes this activity's amount/depth of engineering content:

1. Relating science and/or math concept(s) to engineering
2. Engineering analysis or partial design
3. Engineering design process

Keywords

Nanotechnology, nanoscale, technology

Educational Standards

NOTE: The Standards covered could be less or morning depending on the individual work of each group.

International Technology and Engineering Educators Association (ITEEA) Standards

Standard 1, Grade Level 6-8, F. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.

Standard 1, Grade Level 6-8, G. The development of technology is a human activity and is the result of individual and collective needs and the ability to be creative.

Standard 3, Grade Level 6-8, E. A product, system, or environment developed for one setting may be applied to another setting.

Standard 4, Grade Level 6-8, D. The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use.

Standard 5, Grade Level 9-12 G. Humans can devise technologies to conserve water, soil, and energy through such techniques as reusing, reducing, and recycling.

Standard 5, Grade Level 9-12 H. When new technologies are developed to reduce the use of resources, considerations of trade-offs are important.

Standard 5, Grade Level 9-12 I. With the aid of technology, various aspects of the environment can be monitored to provide information for decision-making.

Standard 5, Grade Level 9-12 J. The alignment of technological processes with natural processes maximizes performance and reduces negative impacts on the environment.

Standard 5, Grade Level 9-12 K. Humans devise technologies to reduce the negative consequences of other technologies.

Standard 5, Grade Level 9-12 L. Decisions regarding the implementation of technologies involve the weighing of trade-offs between predicted positive and negative effects on the environment.

Standard 12, Grade Level 6-8 H. Use information provided in manuals, protocols, or by experienced people to see and understand how things work.

Standard 12, Grade Level 6-8 I. Use tools, materials, and machines safely to diagnose, adjust, and repair systems.

Standard 12, Grade Level 6-8 J. Use computers and calculators in various applications.

Standard 12, Grade Level 6-8 K. Operate and maintain systems in order to achieve a given purpose.

Standard 14, Grade Level 6-8 G. Advances and innovations in medical technologies are used to improve healthcare.

Standard 14, Grade Level 6-8 H. Sanitation processes used in the disposal of medical products help to protect people from harmful organisms and disease, and shape the ethics of medical safety.

Standard 14, Grade Level 6-8 I. The vaccines developed for use in immunization require specialized technologies to support environments in which a sufficient amount of vaccines is produced.

Standard 14, Grade Level 6-8 J. Genetic engineering involves modifying the structure of DNA to produce novel genetic make-ups.

Texas Essential Knowledge and Skills (TEKS)

Technology Applications

126.12 (c) (1) (A) demonstrate knowledge and appropriate use of operating systems, software applications, and communication and networking components.

126.12 (c) (1) (E) use technology terminology appropriate to the task.

126.12 (c) (1) (F) perform basic software application functions including, but not limited to, opening an application program and creating, modifying, printing, and saving documents

126.12 (c) (1) (D) identify the impact of technology applications on society through research, interviews, and personal observation; and

126.12 (c) (1) (E) demonstrate knowledge of the relevancy of technology to future careers, life-long learning, and daily living for individuals of all ages.

126.12 (c) (7) (A) plan, create, and edit documents created with a word processor using readable fonts, alignment, page setup, tabs, and ruler settings;

126.16 (c) (2) (B) communicate effectively with multiple audiences using a variety of media and formats; and

126.16 (c) (6) (A) define and use current technology terminology appropriately

126.16 (c) (6) (H) evaluate how changes in technology throughout history have impacted various areas of study;

126.16 (c) (6) (I) evaluate the relevance of technology as it applies to college and career readiness, life-long learning, and daily living;

126.16 (c) (6) (L) (iv) create and edit files with productivity tools, including: a digital publication using relevant publication standards and graphic design principles;

126.16 (c) (6) (N) integrate two or more technology tools to create a new digital product.

Pre-Requisite Knowledge

Inspiration 9 (General Knowledge)

Learning Objectives

After this activity, students should be able to:

- Define nanotechnology in their own words
- Identify four areas where nanotechnology is having an impact
- Within each area, identify two specific advancements related to nanotechnology
- Be able to reflect on the scope of the impact of nanotechnology

Materials List

Each group needs:

- Computer with internet access and Microsoft Suite (Assessment)
- Inspiration 9 (or equivalent version)

To share with the entire class:

- A small tea cup
- A regular coffee cup
- Water
- Bowl

Introduction / Motivation

What is nanotechnology? On a board, list some answers students suggest and have the students give examples of nanotechnology. Save this list so that it can be reevaluated later.

Nanotechnology is basically the combination of two words or worlds, “nano” and “technology.” So what does nano mean? (Have a few students give their opinion). Nano means one-billionth. Holding a basketball explain to students that one-billionth the diameter of the earth is equivalent to this basketball. Similarly, when we are talking about nanoscale compared to us, we are looking at molecules (approximately 10 hydrogen atoms). But if something is so small, does it really matter compared to something much bigger? To present this concept, bring the students attention to the table that had been set up. Present the question to the group: Using the same amount of force, which cup is it easiest to pour water out of? Call on one student to come up and pour water out of each cup. Using the student’s opinion, discuss with the students that when you make the scale much smaller, different forces are at play. In this case, when pouring out water from the regular coffee mug gravity is the overpowering force that causes water to flow out of the cup; however, when pouring water from the miniature cup, gravity plays less of a role because the weight of the water has drastically decreased. Instead, surface tension requires that the cup be tipped over even more to pour the water out (more force). As we move down to nanoscale, different forces are at play and can be affected.

Technology is defined as the application of science. Ask students what technology is to them and have a few students give their opinion. Ultimately, technology is the use of science to benefit society so when the students use this understanding to think of their own definition of nanotechnology.

Nanotechnology affects a multitude of areas ranging from health care to recreational uses. We all have our own passions whether it is medicine, computers, soccer, football, or dance. Ask a few of the students to tell the class what they are passionate about. Point out to the students that while science and technology may not be their passion, science and technology is a part of their passion through nanotechnology.

Vocabulary / Definitions

Word	Definition
Nano	One billionth derived from the greek word meaning dwarf [1]
Technology	The application of science
Nanotechnology	The study and use of structures at a nanoscale

Procedure

Before the Activity

- Install Inspiration 9 (or equivalent version) on all computers that will be used by the students for this activity.
- On a table in the front of the class (or in a visible location), set up a bowl full of water, the miniature tea cup, and regular coffee cup.
- Print and cut strips of paper with the website for students to visit for their research.

With the Students

1. Discuss the idea of nanotechnology with the students. What does nanotechnology mean? (Background)
2. Breaking the word down, discuss the concept of “nano” and “technology”. Use the information in the Background section to focus the discussion on “nano” being very small and “technology” being the application of science in a helpful way. In this light, how can something so small such large applications. The goal of this activity is to understanding this idea.
3. Ask each group to open Inspiration 9 on their computer.
4. What is our main idea/topic for this activity? Tell each group to main topic as nanotechnology and within that cell, define nanotechnology (See Activity Embedded Assessment).
5. Model for the students going to the website:
<http://www.nanoforum.org/educationtree/index.htm>. On this website, students will be able to follow links to difference areas where nanotechnology is evolved.
6. Now set the expectations of the activity: (1) The web must have four branches (general areas) coming from the main idea and two branches coming from area about specific examples of nanotechnology (2) each example must be defined or explained as to how it improves/affects the area that it is in. (3) time limit: 40 minutes (10 minutes per branch) However, depending on the speed of the students additional time may be required or given as homework.

Attachments

Website strips (pdf)

Website strips (docx)

Safety Issues

- Internet safety: Make sure all computers have appropriate parental settings for searches so that students do not find themselves getting into information that is not appropriate.

Troubleshooting Tips

Investigating Questions

None

Assessment

Pre-Activity Assessment

What is Nanotechnology? : On the board, right what student think nanotechnology is and a list a examples they think are related to nanotechnology. Encourage students to postulate exactly how nanotechnology is involved in each example mentioned.

Activity Embedded Assessment

Defining the Main Idea: When students are asked to write the main idea and definition in Inspiration 9, walk around and observe the student's responses. Use this as an opportunity to identify students that may still to understand the concept and work with them throughout the activity to better their understanding.

Post-Activity Assessment

Nano, Nano, Everywhere: For homework or following the activity, students should use the information to write a short paragraph about nanotechnology including information from their web of nano knowledge. This will assess whether students achieved the objectives listed in the Lesson Objectives section.

Activity Extensions

The result of this activity (web of knowledge) could be used as an outline for a research paper or presentation that each group would submit or present to the class. The results of the activity could also be used to create a comprehensive list of nanotechnology examples which can be compared with the Pre-activity Assessment.

Activity Scaling

- For lower grades, allow students to work in groups of four with each person being in charge for one area. This would give students more time to research examples on the website with each student being required to teach the other students in their group about their “area of expertise.”
- For upper grades, require students identify an area that is not mentioned on the website provided. The students can research using difference resources and can be the basis for a research paper. Students could also be allowed to include images associated with each nanotechnology example.

Additional Multimedia Support

References

1. Cook, K.A. *Nano 1010*. 2005 [cited 2011 Dec 14, 2011]; Available from: http://www.discovernano.northwestern.edu/whatis/index_html/index_html.

Other

Redirect URL

Contributors

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Supporting Program

National Science Foundation AWARD # 0840889, GK-12 Program at the University of Houston: Innovations in Nanotechnology and Nanosciences using a Knowledge, Applications, Research, and Technology (KART) Approach