

Visualization of the Atom

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Visualization of the Atom

Timing: 1–2 class periods

Grade level: 6–12

Subject: Science

Lesson description

Representations can help turn abstract concepts into concrete understanding. In constructing a visual representation, students learn to think critically and creatively and to use valuable digital communication skills. Use this lesson, originally created by Jorge Barrossa and Collette Stemple, to enhance the learning experience through visual exploration of science concepts. Students will create visual representations of the atom to illustrate their understanding of the concepts they have learned. Each visual representation will be accompanied by a presentation and a written explanation of the representation and concept. Students can also use this same technique and digital imaging technology to concretize any abstract concept.

Students will:

- Analyze a specific aspect of the atom
- Create a visual representation of an aspect of the atom by using Photoshop Elements
- Illustrate understanding of the concept by communicating, verbally and in writing, a rationale for the visual representation

Lesson materials

- Adobe Photoshop Elements 6
- Adobe Acrobat 8 Professional

Background preparation resources

- Technical skills and information
- Content skill and information
- Standards

Lesson steps

Introduce the project

1. Introduce the visualization project to students. Discuss representations and how they can concretely illustrate concepts not easily seen by the human eye.

Planning the representation

2. Have students consider the relationships between the elements that make up an atom and the meaning behind these relationships. Have students select a concept they plan to represent, such as:
 - Relationship of electrons to each other
 - Relationship of protons to each other
 - Relationship of protons and electrons
 - Electron clouds
 - Atomic nucleus
3. Have students begin planning the visual representation of the concept. Have students sketch or write out how they plan to create their representation. Some questions to consider might include:
 - Is the concept something people have seen, or is it a representation people developed to understand the concept? What does the concept look like?
 - What images or shapes can be associated with the concept?
 - What types of phenomena are associated with the concept?
 - How does a particular phenomenon impact the concept?

For example, a student might choose to show the relationship of electrons to each other and create a representation of circular objects that look as if they are repelling each other.

Creating the concept

4. Students can create their representations with the use of a few simple tools in Photoshop Elements. By knowing how to create simple shapes, select and transform those shapes, and add filters, students can create sophisticated representations. After students have selected and planned their concepts, demonstrate creating shapes, selecting objects, and using filters in Photoshop Elements to help them implement the concepts.

Photoshop Elements guide: How to create shapes

Photoshop Elements guide: How to rotate, level, crop, and size images

Photoshop Elements guide: How to make selections

Photoshop Elements guide: How to apply filters

5. After students have created their visual representations, instruct them to write 2–3 paragraphs explaining the rationale for each of the shapes and filters used in their representations and how the visualizations they created help explain or better represent the concepts.

Presenting the concept

6. Have students create PDF documents in Acrobat 8 Professional that include their images and rationale. Have students present their documents to the class, explaining their visualization and the choices they made in creating it.

Acrobat 8 Professional guide: How to create a PDF

Extension activities

You can extend the content in this lesson in the following ways:

- Have students create visual representations of other types of science concepts, such as:
 - The properties of conductors and insulators in terms of the freedom of movement of electronics
 - The process of electrostatic induction
 - Use of the gold leaf electroscope
 - The electric potential energy difference between two points in an electric field
 - Coulomb's law
 - Ohm's law
 - The concept of internal resistance
- Have students create visual representations in other subjects, such as math.

You can extend the technical aspects in this lesson in the following ways:

- Have students contribute their visual representations to a class website, using Contribute to create a library of visualizations aggregated in one website to communicate student understanding.
- Have students use the commenting tools in Acrobat 8 Professional to provide feedback to other students on the explanation of their visualizations. After receiving peer feedback, have students improve their work accordingly. You might have students include, in their presentations, what feedback was provided and how it helped them improve their work.
- Have students create multiple visualizations about different aspects of the atom and then create a slideshow of these visualizations using Photoshop Elements.

Assessment

- Lesson plan rubric

Background preparation resources

Technical skills and information:

- If this is the first time you and your students are editing digital images, you may want to go over the Digital Workflow Information.
www.adobe.com/education/digkids/intro/goingdigital/workflow.html
- For an overview of the interface and for more information on the technical aspects of Photoshop Elements 6, see the Help > Photoshop Elements Help.
- Preparation tips for using this lesson plan:
 - If necessary, work with your school's technology coordinator to help you prepare for the lesson.
 - Install any necessary software on all workstations used for the projects.
 - Prior to teaching this lesson become comfortable with the basics of the software program(s) used in this lesson; use the help section, tutorials, and review the step-by-step technical guides.
 - Find out if your computer setups satisfy all the software system requirements.
 - Prior to teaching this lesson, bookmark all the websites used in the lesson on each computer in your classroom or upload the links to an online bookmarking utility program. Preview all the websites used in the lesson to make certain they are appropriate for your students.

Content skill and information:

- Before undertaking this lesson, your students should be familiar with the following scientific concepts and terms:
 - Atom
 - Protons
 - Electrons
 - Neutrons
 - Atomic nucleus
 - Positive and negative charges
 - Electron clouds
- Review the work of the MIT TEAL (Technology Enabled Active Learning) Project that supports and encourages exploring concepts visually to gain greater understanding.
 - MIT iCampus – Introduction to TEAL
<http://icampus.mit.edu/icampus/index.shtml>
 - MIT Physics 8.02 - TEAL Exhibit
<http://web.mit.edu/8.02t/www/>

Standards

This lesson is aligned to the ISTE NETS*S Technology Standards. Depending on the subject and content area the student selects you may research your own state content standards to see how this lesson aligns to your state requirements.

ISTE NETS*S: Curriculum and Content Area Standards – NETS for Students

1. Creativity and Innovation

Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students:

- a. apply existing knowledge to generate new ideas, products, or processes.
- b. create original works as a means of personal or group expression.
- c. use models and simulations to explore complex systems and issues.

3. Research and Information Fluency

Students apply digital tools to gather, evaluate, and use information. Students:

- a. plan strategies to guide inquiry.

4. Critical Thinking, Problem-Solving & Decision-Making

Students use critical thinking skills to plan and conduct research, manage projects, solve problems and make informed decisions using appropriate digital tools and resources. Students:

- a. identify and define authentic problems and significant questions for investigation.
- b. plan and manage activities to develop a solution or complete a project.

5. Digital Citizenship

Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:

- b. exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.

6. Technology Operations and Concepts

Students demonstrate a sound understanding of technology concepts, systems and operations. Students:

- b. select and use applications effectively and productively.

Assessment

	Does not meet expectations	Meets expectations	Exceeds expectations
Visualization	Absent or incomplete image	Creates a visual image of a concept related to the atom.	Creates a clear and precise visual image of a concept related to the atom.
Rationale	Absent, incomplete, or unfocused rationale	Provides 2–3 written paragraphs detailing each of the shapes and filters used in the visual image and how the visualization better represents a particular concept related to the atom.	Provides 2–3 clear and precise written paragraphs detailing each of the shapes and filters used in the visual image and how the visualization better represents a particular concept related to the atom.
Presentation	Absent, incomplete, or unfocused presentation	Presents a presentation with PDF handouts of the visual image and the choices made in creating it.	Presents a thorough and well-spoken presentation with PDF handouts of the visual image. Makes a clear connection to the visual image and the choices made in creating it. Includes some commentary on the trial-and-error process used in determining the best techniques to create the image.