

Modeling Atoms

Introduction:

Science students at the high school level have a limited knowledge concerning the atomic structure. Students often have very basic knowledge or have developed misconceptions concerning the abstract concept of atomic structure. To address inadequacies in student understanding of atomic structure, I have developed the following lesson for students. In this lesson, students will gather evidence, review and understand their findings, and compare their solutions with those of others. Students will use technology to access information, process ideas and communicate results. Students will engage in contributing productively as members of a group. This lesson will let me assess student prior understanding and use this prior understanding of atomic structure to facilitate the student learning to a higher level of understanding.

In the past, I would guide the students through the different atomic models developed over time and then explain the modern atomic model. I would have the students learn aspects and components of the atomic model from their reading in the text book and discussion in class. This lesson engages the students in the role of determining atomic structure through inquiry. The use of technology enhances student engagement and also aids in the communication of acquired information. Students are more involved in the learning process and internalize the information for a better understanding of atomic structure.

Learning Standards:

Illinois Learning Standards

- Learning Standard 11 - Know and apply the concepts, principles and processes of scientific inquiry.
- Learning Standard 11B - Know and apply the concepts, principles and processes of technological design.

Nation Board for Professional Teaching Standards

- Instructional Resources- Accomplished science teachers select and adapt instructional resources including technology, laboratory and community resources, and create their own to support active student explorations of science.
- Engagement – Accomplished science teachers stimulate interest in science and technology and elicit all their students' sustained participation in learning activities.
- Science Inquiry – Accomplished science teachers develop in students the mental operations, habits of mind and attitudes that characterize the process of scientific inquiry.
- Conceptual Understandings- Accomplished science teachers use a variety of instructional strategies to expand students' understandings of the major ideas of science.

Objectives:

- Students will have an understanding of the use of models.
- Students will acknowledge the inadequacies and/or limitations of models.
- Students will understand the key ideas of atomic structure.
- Students will have a conceptual understanding of atomic structure.
- Students will use a working model of the atom to inquire about the history and development of the modern atomic model. (Future lessons listed below.)

Lesson:

Learning Activity 1 – I bring into class a variety of models for the students to critique. Some of the models are very good representations of the real object that they represent and others have inadequacies. As a class, we discuss aspects of a good model and the use of models in general.

Learning Activity 2 – Students list on Discussion Board in Blackboard what they already know about the atom. I use the projector to let the entire class view the student entries from Blackboard. (The students may also view entries individually from their laptops.) As a class, we skim through the entries while I assess and address prior student knowledge and misconceptions.

Learning Activity 3 – Students are assigned into groups of 3 or 4 depending on class size. Each group will submit a list of criteria for a good atomic model. The students are to list 2 criteria for a good model in general and list 3 criteria specifically for a good model of an atom. Each student will search the Internet for what they consider a good model of the atom. The students within each group will share their model with group members. Each group will be required to agree on a best model and submit their model along with the list of criteria they generated previously to Drop Box in Blackboard. As students submit their model to Drop Box, I will cut and paste the models from individual groups into one document. I will then send this document to Blackboard to open and project the document in class.

Learning Activity 4 – Students are able to view all the models submitted. I facilitate a class discussion on comparing and contrasting the models while students refer to their list of criteria for models. The class then votes on the best atomic model among the models selected and submitted previously. The model that the class selects will be posted in Blackboard as the class atomic model.

Future lessons: This model will be used throughout the unit on atomic structure as a reference. As a class, students will be encouraged to continue to critic the “class atomic model”.

Day 2 and 3 (next lessons): Class discussion reviewing subatomic particles, charges and locations of subatomic particles. Working from a historical timeline (1803 -1932), students will work in groups and assigned a particular atomic model to research and present. Each group will present to the class the scientist that developed the model, accepted atomic model at that time, and experimentation and evidence to support the model.

Day 4: Class discussion on how atomic theory has been tested and refined over time. Students submit a typed summary for the development of atomic theory or create a graphic timeline for development of the atom. Student submissions are via drop box in blackboard.

Laptop implications:

- Students will use technology to access information, process ideas and communicate results.
- Students will learn and contribute productively as individuals and as members of groups.
- Teacher will facilitate student centered learning.

Role of teacher:

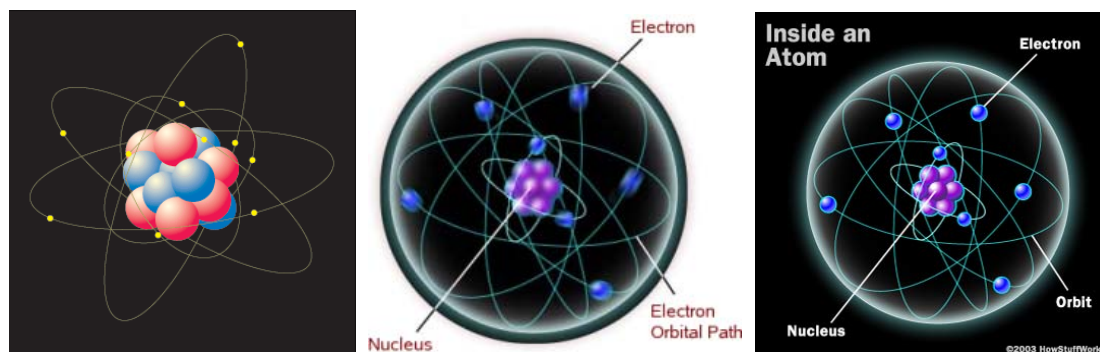
The role of the teacher is that of facilitator. After the initial introduction of models, the teacher facilitates the students' research on the computers for a good atomic model. The teacher's role would include keeping students on task and guiding students in their quest for the "best atomic model". In addition, the role of the teacher is to monitor and guide student discussion to address misunderstandings that impede student learning. Lastly, the role of the teacher is to guide students in the use of technology to capture key ideas of the atom and help students develop a conceptual understanding of atomic structure.

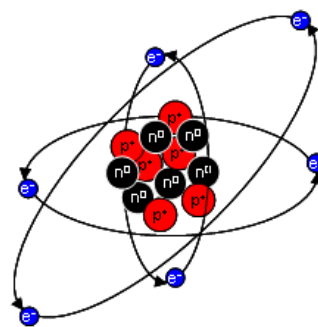
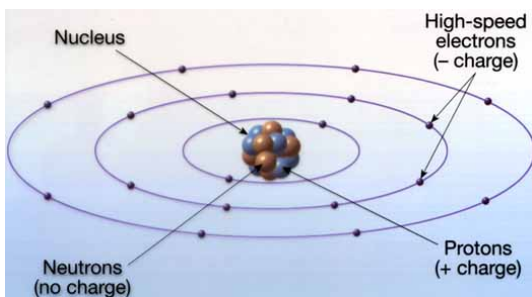
Student reaction:

Students responded positively to this activity. Students were engaged in the use of technology to do inquiry into models and atomic structure. Students' learning was impacted by the sharing of ideas within their groups. Students' learning was impacted by the class discussion of misconceptions which were evidenced in their posted discussion of what they already knew about atomic structure. Students were able to internalize and understand an abstract concept by using technology to research and organize information in a collaborative environment. The elevation of student learning was evidenced in the students' enthusiasm for determining a "best atomic model" as a class model.

Student work:

"Best atomic model" contributions from individual groups:



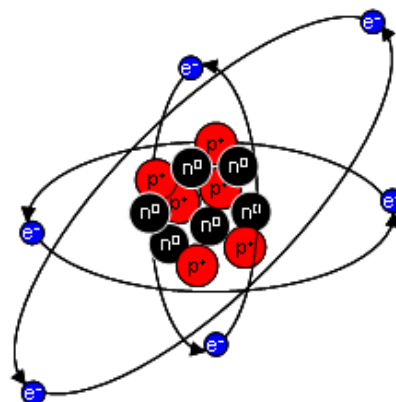


Students as a class reflected upon the models submitted and determined the best model according to previously gathered criteria.

Examples of student formulated criteria:

Scale	accuracy of information	simple to understand
Labeling	movement of particles	amount of information
Coloring		

Class selection of “best atomic model”:



Students’ reflection on selection:

Atomic particles were designated by different colors.

Atomic particles were labeled.

All subatomic particles were included.

Electrons were shown to be moving which is depicted by arrows.

Good representation of atom and easy to understand.

A negative attribute of this model was that it was not to scale. However it was noted that none of the models were to scale and this would be impossible to do in a real world workable representation of the atom.