Tennessee Tech University  
Lesson Plan Template

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| Name: Brandy Gates, Bethany Baird, Brianna Butler, and Jenna Bullock  Date: October 7, 2013 Lesson Title: Heat - Conductors and Insulators Grade/Level: 3rd Grade |
| Curriculum Standards |
| *State/Common Core Curriculum Standards*  **GLE 0307.10.2** Design and conduct an experiment to investigate the ability of different materials to conduct heat.  **Check for Understanding: 0307.10.2** Investigate various materials to explore heat conduction.  **SPI 0307.10.2** Classifying materials according to their ability to conduct heat. |
| Focus Questions/Big Idea/Goal (List all 3) |
| **Question:** What is heat and how does it relate to conduction?  **Big Idea:** Students should understand thatheat is a type of energy that has the ability to do work, and that heat can be transferred through conduction by direct contact from one object to another. While conductors transfer heat, insulators prevent heat from transferring. Gaining this understanding will help students understand how different materials conduct heat.  **Goals:** Students will understand what heat is andhow it is transferred through conduction, along with what materials conduct and insulate from heat. |
| Lesson Objective(s) |
| 1. Students will be able to conduct experiments in class to experience how heat is transferred through conduction.  2. Students will know the difference between conductors and insulators.  3. Students will be able to experiment with insulators and conductors by using a virtual manipulative. |
| Vocabulary/ Academic Language |
| **Heat:** a form of energy that is transferred by a difference in temperature.  **Conduction:** transfer of energy through matter from particle to particle.  **Conductors:** take in heat quickly or allow heat to pass through them easily.  **Insulator:** Insulators do not allow heat to pass through them easily.  **Energy:** The ability to work and/or cause change.  Students will be instructed to use the academic vocabulary in their science journals, as well as through group discussion throughout the activities. |
| Material/Resources |
| * pencils with erasers * metal hanger * cotton balls * notebook paper * teacher made justified list * post-it notes * Four Cartoon Character Concept strips per group * Heat Transfer Game <http://www.sciencekids.co.nz/gamesactivities/keepingwarm.html> |
| Assessment/Evaluation |

**Formative*:***

We will use formative assessment throughout the lesson. Students will demonstrate understanding of the topic by completing multiple FACTs. We will use “sticky bars” as a pre-assessment to see what our students already know and what misconceptions they may have. We will use “Concept Cartoons” during evaluation to discuss the misconceptions students may have about heat, conductors, and insulators.We will use “Four Corners” during the explain process of the lesson. “Four Corners” will give the teacher a visual of what the students’ ideas are, it will also give the students a chance to argue their point of view and have the opportunity to formulate new ideas about the topic.

**Summative:**

We will check for mastery of the lesson objectives by conducting the “Justified List” FACT. The students will complete the justified list and the teacher will then collect the list to determine if each student has mastered the objective of knowing the difference between insulators and conductors.

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| Instruction  (Include a suggested time for each major activity)  TIme for total lesson: 60-65 minutes | List Questions for higher order thinking *These cannot be answered by yes or no.*  (Identify Bloom’s Level of Thinking) |
| **Set:(10min)** Engage.To engage students interest in the lesson, we will use a starter known as “sticky bars” to discover what the students already know about the topic. We will present the students with the question “What is heat?” and give them a post-it note to anonymously record their answer. After recording their answer, they will then pass them to the teacher and he or she will arrange them on the board in the form of a bar graph. After arranging their answers in the bar graph, they will discuss the various answers and talk about the correct answer. This starter shows the students how their answers vary and doesn’t embarrass anyone by having the “wrong” answer. It also shows the teacher where the students stand on the topic. | Remembering: Define the term Heat. |
| Instructional Procedures/Learning Tasks**:**  **Activity (10 mins):** **Explore Part I.** The students will explore the subject of heat by producing heat. First the students will bend a piece of a wire hanger back and forth ten times. Then quickly touch the wire at the point of where it was bent. Ask students what they feel and what they think will happen if they bend it more times. Have the students try bending it a few more times. The next activity involves rubbing different materials together to see if heat is produced. First have them rub their hands together hard and fast. Ask them what they feel. Next have the students try rubbing an eraser on paper hard and fast, then touching the eraser to the tip of their nose. Ask them again what they feel. Repeat these steps with different materials such as; eraser on skin, metal on paper, and two cotton balls.  **Explore Part II (15 mins):** After the students had the opportunity to explore the outcome of different materials, the teacher will introduce the students to the idea of insulators and conductors through an online virtual manipulative game found at <http://www.sciencekids.co.nz/gamesactivities/keepingwarm.html>. This game, which will be displayed on the smartboard to play as a class, will allow students a chance to experiment with different materials to find which ones are insulators and which are conductors. Students will take turns coming up to the smartboard to interact with the simulation activity, which should produce discussion and analytical thinking from the students. The students will also create and maintain a table in their science journals, which has been suggested from the online game, to input their data and/or results.  **Explain** (**15 Mins):** Based on the students’ exploration of producing heat through the different materials and using the data the students collected from the online game, the teacher will lead discussion and questioning as to “what the students feel once heat is produced”, “Why do you think certain materials produce heat, while other materials do not”, and ‘What’s the difference between conductors and insulators” ? After the students have recorded their data from the online activity game, as well as the exploration of producing heat outcomes into their science journals, the teacher will review their information as a class.  The teacher will review the first two activities by posing the question “What is heat”. The students will refer back to the first activity *Sticky Ba*rs; “ was there a definition provided that was close to the actual meaning? Were you able to define heat after participating in the exploration activities? If given the opportunity, would you go back and change your answer and why? ” To help students review these types of questions, the teacher will display a model of her journal with the vocabulary words and definitions on the smartboard. This will help some students who might be struggling with the layout of the journal, defining the vocabulary words, and/or distracted during the online activity game. Once the teacher is comfortable with the discussion assessment of the students, the teacher will lead them into their last activity.  This will lead to the “Four Corners” FACT. The teacher will ask the question “Which of the following is the best conductor of heat? A.)Metal,B.)Cotton,C.)Plastic,D.)Wood”. Once the students have picked an answer they will move to a corner of the room that represents that answer. Once in the designated corner, the students will discuss it with one another and come up with an argument to present to the class. After all the arguments have been made, the students will have a chance to change their answer and switch to a different corner. The goal is to have all the students in one corner that represents the scientific view.  **Evaluate (10 Mins):** The students will then break up into groups of four. Each group will have an envelope containing the same four strips of cartoon characters with comments and ideas that were presented in the discussion, with the possibility of one or two strips containing misconceptions and/or incorrect information. The students will have a few minutes to discuss within their group which cartoon characters they agreed with and why, with supporting evidence. This provides the students the opportunity to activate their own thinking, argue their findings and/or answers, and share their ideas with others. They will then present their argument to the rest of the class.The goal is to have all the students represent their conceptual understanding of the scientific view. The cartoon characters concept is attached to the end of this lesson plan. | Understanding: Explain why you think when certain objects are rubbed together they produce heat.  Analyzing: Experiment with different materials to find out which items conduct/ produce heat. What do you think will happen if you bend the wire more times?  Evaluating: Produce an argument to support your answer to the Four-Corners fact.  Creating: What new ideas can you formulate from tachis experiment? |
| **Closure(5-10 Mins): Evaluate.** At the end of the lesson the students will complete a justified list worksheet. The students will have to know the difference between a conductor and an insulator. At the bottom of this worksheet there will be a space provided for the students to write a short paragraph explaining what makes a good conductor and insulator with a real-life example of why it is important to know the difference. After the students complete the worksheet it will be taken up to serve as an evaluation telling if the students mastered the lesson. The justified list is attached at the end of this lesson. | Applying: Demonstrate what you have learned by completing the justified list. |

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| **Adaptations to Meet Individual Needs:**   * **Visual-Spatial:** Visual learners will like be attracted to the cartoon characters concepts because they are able to to represent this conceptual understanding of the scientific view. * **Bodily-kinesthetic:** Activity one would be appealing to these types of learners because they get to do things such as bend a piece of wire and feel it heat up in the crease. * **Visual:** The sticky bars presentation where the students can view the answers in the form of a bar graph is pleasing to these types of learners.The online game is also a great visual. * **Interpersonal:** The four corners activity, where the students have to get in group, will be helpful for these learners. * **Intrapersonal:** These learners will be attracted to the independent closure justified list worksheet and the journal entries. * **Logical Mathematical:** The students will be able to view their post-it note answers in the form of a bar graph on the whiteboard.   **Management/Safety Issues:** Bending the wire hanger causes it to heat up in the crease. The teacher will need to make sure the students do not bend it so much that it will burn them when they touch it. |
| **Rationale/Theoretical Reasoning:** The Rationale behind the lesson of heat is to teach the students basics about heat and what it actually is. This lesson also disproves some of the common misconceptions that children have about heat.  **Common Misconceptions**:   1. The students misconstrue heat as being a substance and not energy. Heat is energy because it is creating a movement of molecules which is causing a transferring process. 2. The students may think that substances such as flour, sugar and air cannot heat up, when in fact all substances heat up. It is just a matter of how quickly some substances gain heat more easily than others. 3. Students think objects such as mittens, blankets and sweaters are sources of heat because they keep things warm. Objects keep things warm because they are trapping in the heat.   [**http://beyondpenguins.ehe.osu.edu/issue/keeping-warm/common-misconceptions-about-heat-and-insulation**](http://beyondpenguins.ehe.osu.edu/issue/keeping-warm/common-misconceptions-about-heat-and-insulation)   * Students are provided an opportunity to socially construct knowledge while working with their peers. They also have the opportunity to work in their zone of proximal development. (Vygotsky, 1978)   **Marzano’s Essential Instructional Strategies**   * **Identifying Similarities and Differences:** By analyzing the question, “What is Heat,” in the form of the a bar graph, students are able to compare their answers anonymously with their peers. * **Summarizing and Note-taking:** The students will maintain a page in their learning log for a table to go along with the online game. * **Nonlinguistic Representations:** By bending the wire to create heat, the students are accomplishing nonlinguistic representation. * **Cooperative Learning:** In the Cartoon Concepts, the students are placed into groups of four and will discuss which cartoon they agree with to their peers.   “Mitten Problem”  Under the Curricular and Instructional Considerations section of the probe, it mentions ideas of the various ways heat is produced. We achieved this goal by letting the students participate in activity one. They get to explore different ways to produce heat such as bending a piece of wire and rubbing their hands together. |
| **References:**   * **Activity 1:** rin, Arthur A., Joel E. Bass, and Terry L. Contant. Teaching Science as Inquiry: With MyEducationLab. Upper Saddle River, NJ: Pearson Education, 2008. Print. * **Facts:** Keeley, Page. Science Formative Assessment: 75 Practical Strategies for Linking Assessment, Instruction, and Learning. Thousand Oaks, CA: Corwin, 2008. Print. * **Definitions:** [**http://dictionary.reference.com/**](http://dictionary.reference.com/) * **Misconceptions:** [**http://beyondpenguins.ehe.osu.edu/issue/keeping-warm/common-misconceptions-about-heat-and-insulation**](http://beyondpenguins.ehe.osu.edu/issue/keeping-warm/common-misconceptions-about-heat-and-insulation) |
| Reflections/Future Modifications:*To what extent did the class learn what you intended them to learn? What will be your next steps instructionally? What did you learn about your students as learners? What have you learned about yourself as a teacher?*  Brianna: The class mastered learning what heat is. They also mastered the differences between conductors and insulators. Since the class mastered what was taught today the next step is to move on to another lesson. Kinetic heat would be a great lesson to move on to. The students had some misconceptions about conductors and insulators, but through 4corners and the cartoons they were corrected. As a teacher you must be ready to answer and explain in different ways. All students will not understand the first time directions are given, you must be prepared to answer in multiple ways.  Brandy: The students were able to master the conceptual understanding and scientific vocabulary and methods through the use of hands-on activities, as well as the virtual online game. The students were able to record their data and vocabulary for present and future understanding in their journals. Through the formative and summative assessments, such as the Sticky Bar graph, the Four Corners and the Cartoon Character Concept, the teacher was able to establish which students were grasping the concepts and which students needed more assistants. As a teacher, it is important to remember that no matter how seemingly insignificant the details may appear, each child will learn differently and so what seems insignificant to one, may be the trigger to understanding for another. Since the students mastered the Heat subject exceptionally well, the next step is to move on to a new topic in the physical science category. If the students had not mastered the topic, then the teacher would need to bring in more experiments that relate to heat, conductors and insulators. Another modification would be to split the group of students which have mastered the subject help those who need the extra assistants.  Bethany: The students were able to master the concept of conductors and insulators. By the end of the lesson, they were able to identify what materials would be conductors and which would be insulators. They also know what heat was and were able to experience materials that produce heat. The next steps for instruction would be to discuss how heat is transferred. The students would learn more about conduction. They would learn new vocabulary such as radiation, and convection. I learned that the students were able to grasp the concept well and didn’t have to have much guidance. This may have been a different case had our students not been college students. I learned that I am able to handle the situation well. I felt like I was also able to communicate the concept well. I learned how to use the FACTs correctly and felt that the four corners FACT really helped eliminate misconceptions. Overall, I felt our group did well and that our students were able to master the task.  Jenna: The teacher is able to show that the students mastered the subject of heat in the lesson plan today through the use of activities, assessments and online manipulatives. Using the sticky bars as an opening to the lesson shows what the students already know about heat and informs them of the correct definition. The Four Corners and Cartoon Characters helped clear up misconceptions the students had about heat. In the activity, the students learned certain conductors and insulators of heat. As our exit slip, we used a justified list to determine if the students had actually mastered the concept of heat. After determining this, the teacher would be able to move onto a different topic. |

Conductors vs. Insulators

All of the materials below are conductors or insulators. Conductors take in heat quickly or allow heat to pass through them easily. Insulators do not allow heat to pass through them easily. Put an X next to the materials that are conductors.

\_\_\_Metal

\_\_\_Wood

\_\_\_Copper

\_\_\_Plastic

\_\_\_Cotton

\_\_\_Iron

\_\_\_Aluminum

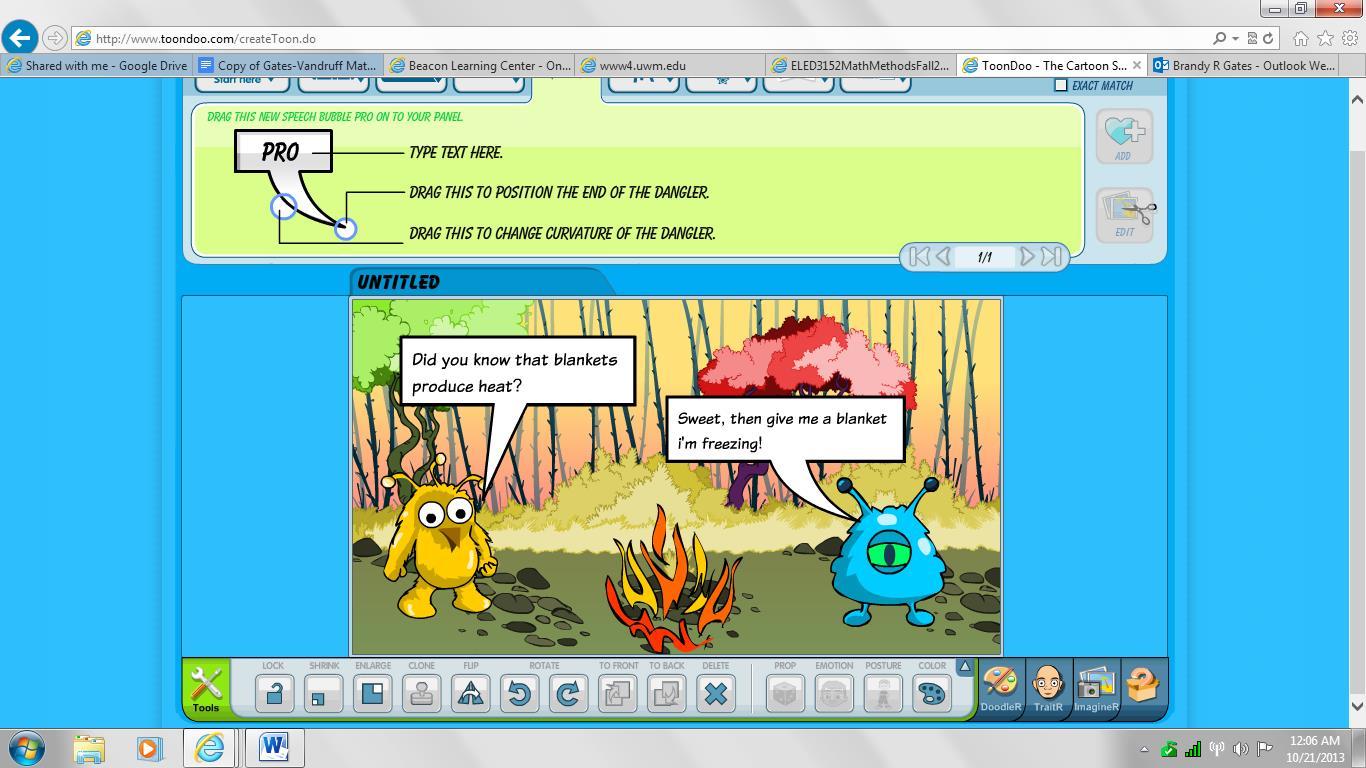
\_\_\_Glass

\_\_\_Silver

\_\_\_Wool

\*\*In a short paragraph describe what makes a good conductor and insulator. Also give a real-life example of why it is important to know the difference between the two.

Cartoon Character Concepts



Teacher Notes: This is a misconception. Blankets do not produce heat they keep things warm by trapping heat.



Teacher Notes: This is a correct scientific statement. The hot cocoa heats by conduction. Need to make sure you explain to the students the harmful hazards of touching something hot that can burn.



Teacher Notes: Conductors are materials that allow heat to pass through. Such conductors are metal. Insulators do not let heat pass through easily. Such insulators are plastic.



Teacher Notes: This is a misconception. Hot particles rise (such as fluid), but later fall as they become less dense than the surroundings. They have not lost all their heat energy so they are still hot when they fall.