


## PR2.A – TEACHING SOURCES

<b>Title</b>	Newton's Third Law
<b>Duration</b>	1 session
<b>Age Group</b>	14 – 16 YO
<b>Dimension of the advised group of students</b>	<i>One group of 10-20 people</i>
<b>Area</b>	<input type="checkbox"/> Area 1: Reading, writing and literature <input type="checkbox"/> Area 2: Math <input type="checkbox"/> Area 3: Second language learning <input checked="" type="checkbox"/> Area 4: Sciences <input type="checkbox"/> Area 5: Soft skills
<b>Specific objectives</b>	<ul style="list-style-type: none"> <li>- <i>To learn about Newton's laws</i></li> <li>- <i>To conduct an experiment</i></li> </ul>
<b>Needed Materials</b>	<ul style="list-style-type: none"> <li>- Plastic cup</li> <li>- 2 plastic bendable straws</li> <li>- String</li> <li>- Craft knife</li> <li>- Water and sink</li> <li>- Modeling clay</li> </ul> <p>If the training is organized <b>online</b> one communication platform will be necessary.</p>
<b>Software</b>	<ul style="list-style-type: none"> <li>- <i>One online communication platform, such us: Zoom, Google Meet, Webex, etc.</i></li> <li>- <i>In person, no software is needed.</i></li> </ul>
<b>Description</b>	<p><i>Sir Isaac Newton, a scientist and philosopher of the late 1600's, spent many years trying to come up with codified rules that describe how all stuff in the universe behaves. In the experiment below, we will explore Newton's third law, which states that "for every action there is an equal and opposite reaction"—but what does this mean, exactly?</i></p> <p><i>Imagine dropping a tennis ball to the ground. What happens in response to the action of the ball striking the ground? It bounces back up towards you. This is due to the reactionary force of the floor acting against the ball, which pushes it upwards into the air.</i></p> <p><i>To explore this idea more fully, you can easily construct your very own device called an aeolipile (sometimes referred to as Hero's Engine or a Hero engine). Created by an engineer named Hero of Alexandria about 2000 years ago, this invention was able to show one way in which an action can lead to an equal and opposite reaction: an example of Newton's third law.</i></p>

	<p>Participants will conduct their own experiments and be the protagonists of the workshop. If doing an online training, materials are easy enough to find at home or could be provided by the organizers.</p>
<p><b>Procedure on how to put in practice</b></p>	<p><b>Duration:</b> 45 minutes  <b>No of participants:</b> 10-20  <b>Methods used:</b> experimentation  <b>Competences developed:</b> research methodology, scientific awareness</p> <p><b>Step-by-step description:</b></p> <ol style="list-style-type: none"> <li>1. Ask the group to discuss what they know about the laws of physics. Can they name any? Introduce Newton and the laws he devised.</li> <li>2. The experiment is as follows:             <ol style="list-style-type: none"> <li>a. Take plastic cup poke two small holes near the top rim on opposite sides from one another.</li> <li>b. Thread string through the holes and tie a knot so that the cup can be suspended from the string.</li> <li>c. Make two slightly larger holes near the bottom of the cup as seen in the picture below (make sure these holes are just large enough for the straws to fit through)</li> <li>d. Cut each straw about 1.5 inches below its bendable portion.</li> <li>e. Slide the straws into the holes. Make sure that they both point in a clockwise direction.</li> <li>f. Use your modeling clay to seal the space between the cup and the straw so that no water leaks out when you fill the cup.</li> <li>g. Hold the finished Hero engine away from your body. Pour water into the cup and observe.</li> </ol> </li> </ol>  <p><b>Debriefing question:</b> Where else does this principle apply?</p>
<p><b>Link</b></p>	<p><a href="https://www.education.com/science-fair/article/newton-law-motion-action-reaction/">https://www.education.com/science-fair/article/newton-law-motion-action-reaction/</a></p>
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