

# HUMAN-BASED SCIENCE: WHERE HUMANS CAN DO IT ON THEIR OWN

## A 3RS LEARNING SCENARIO

### Author(s)

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### Summary

This learning scenario challenges the idea that animal testing is unavoidable due to the lack of alternative options to carry out research and conduct tests. Thus, the aim is to illustrate such innovative methods and the way they are being applied. Students will make use of creative thinking techniques to identify the positive aspects, the challenges and even think of potential innovative future applications. Students will be provided with adequate information and will have to elaborate their findings and prepare an output which will be used during a hypothetical funding-request interview. The output can take the form of a presentation, a model, a chart, a video or any other form the students would realistically be able to produce.

### Key elements

<i>Key Element</i>	<i>Suggestions</i>
<b>Subject</b>	Biology, Life Sciences, Integrated Science
<b>Topic</b>	An introduction to methods and applications of Human-based Science.
<b>Age of students</b>	14-17
<b>Preparation time</b>	<ul style="list-style-type: none"> <li>Teachers will need approximately 2 hours of preparation prior to the implementation of the Learning Scenario, in order to read all the materials and research/understand the Human based Research Method.</li> <li>Print the '6 Thinking Hats' worksheet that students will use during their research (please see Annex 3).</li> </ul>
<b>Teaching time</b>	The authors have allocated a total of 135 minutes for the implementation of the lesson, and further divided it in a double lesson for student group work and 1 lesson dedicated to the presentations (classes with a big number of students may require 2 lessons to present).
<b>Online teaching material</b>	<ul style="list-style-type: none"> <li><a href="https://www.health.harvard.edu/heart-health/repairing-the-heart-with-stem-cells">https://www.health.harvard.edu/heart-health/repairing-the-heart-with-stem-cells</a></li> <li><a href="https://mrc.ukri.org/news/browse/potential-new-treatment-for-heart-attack/">https://mrc.ukri.org/news/browse/potential-new-treatment-for-heart-attack/</a></li> <li><a href="https://medicalxpress.com/news/2019-08-stem-cell-combination-hearts.html">https://medicalxpress.com/news/2019-08-stem-cell-combination-hearts.html</a></li> <li><a href="https://www.sciencedaily.com/releases/2019/08/190829122141.htm">https://www.sciencedaily.com/releases/2019/08/190829122141.htm</a></li> </ul>

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Key Element	Suggestions
	<ul style="list-style-type: none"> <li>● <a href="https://ncats.nih.gov/tissuechip/chip/liver">https://ncats.nih.gov/tissuechip/chip/liver</a></li> <li>● <a href="https://www.drugtargetreview.com/news/10805/silico-prediction-drug-side-effects/">https://www.drugtargetreview.com/news/10805/silico-prediction-drug-side-effects/</a></li> <li>● <a href="https://www.pharmaceutical-journal.com/news-and-analysis/software-solutions-could-couple-symptoms-with-drug-side-effects/10005086.article?firstPass=false">https://www.pharmaceutical-journal.com/news-and-analysis/software-solutions-could-couple-symptoms-with-drug-side-effects/10005086.article?firstPass=false</a></li> <li>● <a href="https://medicalgiving.stanford.edu/news/virtual-reality-system-helps-surgeons-reassures-patients.html">https://medicalgiving.stanford.edu/news/virtual-reality-system-helps-surgeons-reassures-patients.html</a></li> <li>● <a href="https://zspace.com/blog/Doctors-Use-VR">https://zspace.com/blog/Doctors-Use-VR</a></li> <li>● <a href="https://fortune.com/2019/01/09/virtual-reality-surgery-operating-room/">https://fortune.com/2019/01/09/virtual-reality-surgery-operating-room/</a></li> <li>● <a href="https://www.standard.co.uk/futurelondon/health/virtual-reality-in-surgery-a3998166.html">https://www.standard.co.uk/futurelondon/health/virtual-reality-in-surgery-a3998166.html</a></li> <li>● <a href="http://news.bbc.co.uk/2/hi/health/7774016.stm">http://news.bbc.co.uk/2/hi/health/7774016.stm</a></li> <li>● <a href="https://phys.org/news/2019-08-toxicity-screening-cosmetics-sunscreens-pharmaceuticals.html">https://phys.org/news/2019-08-toxicity-screening-cosmetics-sunscreens-pharmaceuticals.html</a></li> <li>● <a href="https://www.cosmeticsdesign-europe.com/Article/2019/01/08/L-Oreal-unveils-microfluidic-sensor-to-measure-skin-pH-levels-world-first">https://www.cosmeticsdesign-europe.com/Article/2019/01/08/L-Oreal-unveils-microfluidic-sensor-to-measure-skin-pH-levels-world-first</a></li> <li>● <a href="https://www.cosmeticsdesign-asia.com/Article/2018/12/12/Skin-on-a-Chip-Singaporean-scientists-develop-device-which-can-replace-animal-testing#">https://www.cosmeticsdesign-asia.com/Article/2018/12/12/Skin-on-a-Chip-Singaporean-scientists-develop-device-which-can-replace-animal-testing#</a></li> </ul>
<b>Offline teaching material</b>	If students do not have access to laptops or tablets to read the material provided, teachers should provide the links as printed text to give to students.
<b>Resources used</b>	<ul style="list-style-type: none"> <li>● laptop and projector/interactive white board</li> <li>● websites</li> </ul>

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### Aim of the lesson

To introduce the different Human-based Science Methods (as examples of implementing **Replacement**) as well as their application.

### Trends

- Student centered learning
- Flipped classroom
- Use of research in the STEM classroom
- Peer learning

### 21<sup>st</sup> century skills

- Communication
- Collaboration
- Creativity
- Creative thinking
- Information literacy

### Lesson Plan

Name of activity	Procedure	Time
<b>Introduction</b>	<ul style="list-style-type: none"> <li>• Introductory question: <i>“What is your opinion about animal testing? Are you in favor; are you against? Why?”</i> <a href="https://www.youtube.com/watch?v=2hxUMpYFo_Y">https://www.youtube.com/watch?v=2hxUMpYFo_Y</a> Discuss any concepts with students if needed</li> </ul>	10’
<b>Investigating Human based Science Methods</b>	<ul style="list-style-type: none"> <li>• Students will be divided into groups of 3 or 4.</li> <li>• Each group is given a sub-topic related to Human-based science methods</li> <li>• Each group is given sub-topic specific articles to read as well as an introductory article: <a href="https://kids.frontiersin.org/article/10.3389/frym.2018.00044">https://kids.frontiersin.org/article/10.3389/frym.2018.00044</a></li> <li>• The group will need to explore the HRS from all aspects of the 6 thinking hats (distribute worksheet to guide students)</li> <li>• Each group needs to compile a presentation product such as a chart, Power Point, etc.</li> <li>• Each group needs to make a case in favor of the sub-topic chosen in order to obtain funding to similar research. The students will use the ‘6 Thinking Hats’ worksheet that the teacher will distribute.</li> <li>• Teachers may choose to formally assess this work. The rubric attached may help with grading (please see Annex 2).</li> </ul>	80’

Name of activity	Procedure	Time
	For the resources to be used during the research for each sub-topic please see Annex 1.	
<b>Presentation and role play</b>	<ul style="list-style-type: none"> <li>Students make their pitch for funding to the rest of the class. Each group will present their HRS method as if they were asking for funding.</li> <li>A role play activity takes place where one group presents, and another one/two would be the assessor/s.</li> </ul>	30'
<b>Conclusion and optional assignment of homework</b>	<p><u>Discussion</u></p> <p>Following all the presentations, ask students to provide their opinion of the human based science methods mentioned. Discuss briefly how these methods could impact the future of human health and human life in general and how their view of animal testing has changed as a result of this activity.</p> <p>As an optional activity, the teacher may assign students to list their thoughts in a Padlet as a collaborative activity</p>	15'

### Assessment

The assessment will be carried out by using the grading rubric found in Annex 2.

### Student feedback

The students were asked to complete surveys prior and after the implementation of the Learning Scenario, in order to give feedback to their instructors about the content and the activities. The responses were balanced when it comes to the level of difficulties they faced during the implementation, but the topic was met with excitement.

### Teacher's remarks

- While students were very motivated to participate in the lesson and the activities were highly engaging, the idea of the final assessment was intimidating for some students. Teachers are advised to take the opportunity and teach their students about this important topic, but also address the questions about the assessment (given that it is mentioned in the lesson plan table and a worksheet will be used for this purpose).
- This is a challenging topic and finding all the necessary materials to cover it in the students' mother tongue might be difficult.
- The subject of ethics might not be included in the curricula of all countries; therefore some students might not be aware of how to approach the topic. In this case, teachers are advised to do some preliminary research and introduce their students prior to the lesson.
- Teachers need to consider that apart from ethics, certain isolated ideas/notions might not be approved by the Ministries or other authorities.

## About 3Rs project

This Learning Scenario has been created in the framework of the 3Rs project. The 3Rs project is building learning activities for secondary schools to introduce the principles of the 3Rs - the Replacement, Reduction and Refinement of animal use in science. Students will develop their critical thinking and science literacy skills by exploring topics such as ethics in science, how the European Union is protecting the welfare of laboratory animals, and what high-tech non-animal tools are available as alternatives. The learning activities are available for teachers in a Massive Open Online Course (MOOC), organised by the European Schoolnet Academy.

The 3Rs project has been funded by the European Commission's Joint Research Centre under a European Parliament Pilot Project. This document has been prepared by European Schoolnet (a network of 34 European Ministries of Education which aims to bring innovation in teaching and learning), in collaboration with ECORYS (international company providing research, consultancy and management services) and SYRCLE (Systematic Review Centre for Laboratory Animal Experimentation).

## ANNEXES

### ANNEX 1

Human based science method	Linking Topic	Resources
stem cell use	the heart	<ul style="list-style-type: none"> <li>• <a href="https://www.health.harvard.edu/heart-health/repairing-the-heart-with-stem-cells">https://www.health.harvard.edu/heart-health/repairing-the-heart-with-stem-cells</a></li> <li>• <a href="https://mrc.ukri.org/news/browse/potential-new-treatment-for-heart-attack/">https://mrc.ukri.org/news/browse/potential-new-treatment-for-heart-attack/</a></li> <li>• <a href="https://medicalxpress.com/news/2019-08-stem-cell-combination-hearts.html">https://medicalxpress.com/news/2019-08-stem-cell-combination-hearts.html</a></li> </ul>
organ-on-a-chip	the liver	<ul style="list-style-type: none"> <li>• <a href="https://www.sciencedaily.com/releases/2019/08/190829122141.htm">https://www.sciencedaily.com/releases/2019/08/190829122141.htm</a></li> <li>• <a href="https://ncats.nih.gov/tissuechip/chip/liver">https://ncats.nih.gov/tissuechip/chip/liver</a></li> </ul>
computer simulations	medication and side-effects	<ul style="list-style-type: none"> <li>• <a href="https://www.drugtargetreview.com/news/10805/silico-prediction-drug-side-effects/">https://www.drugtargetreview.com/news/10805/silico-prediction-drug-side-effects/</a></li> <li>• <a href="https://www.pharmaceutical-journal.com/news-and-analysis/software-solutions-could-couple-symptoms-with-drug-side-effects/10005086.article?firstPass=false">https://www.pharmaceutical-journal.com/news-and-analysis/software-solutions-could-couple-symptoms-with-drug-side-effects/10005086.article?firstPass=false</a></li> </ul>
virtual reality	surgeries	<ul style="list-style-type: none"> <li>• <a href="https://medicalgiving.stanford.edu/news/virtual-reality-system-helps-surgeons-reassures-patients.html">https://medicalgiving.stanford.edu/news/virtual-reality-system-helps-surgeons-reassures-patients.html</a></li> <li>• <a href="https://zspace.com/blog/Doctors-Use-VR">https://zspace.com/blog/Doctors-Use-VR</a></li> <li>• <a href="https://fortune.com/2019/01/09/virtual-reality-surgery-operating-room/">https://fortune.com/2019/01/09/virtual-reality-surgery-operating-room/</a></li> <li>• <a href="https://www.standard.co.uk/futurelondon/health/virtual-reality-in-surgery-a3998166.html">https://www.standard.co.uk/futurelondon/health/virtual-reality-in-surgery-a3998166.html</a></li> <li>• <a href="http://news.bbc.co.uk/2/hi/health/7774016.stm">http://news.bbc.co.uk/2/hi/health/7774016.stm</a></li> </ul>
microfluidic devices	personal care items - testing	<ul style="list-style-type: none"> <li>• <a href="https://phys.org/news/2019-08-toxicity-screening-cosmetics-sunscreens-pharmaceuticals.html">https://phys.org/news/2019-08-toxicity-screening-cosmetics-sunscreens-pharmaceuticals.html</a></li> <li>• <a href="https://www.cosmeticsdesign-europe.com/Article/2019/01/08/L-Oreal-unveils-microfluidic-sensor-to-measure-skin-pH-levels-world-first">https://www.cosmeticsdesign-europe.com/Article/2019/01/08/L-Oreal-unveils-microfluidic-sensor-to-measure-skin-pH-levels-world-first</a></li> <li>• <a href="https://www.cosmeticsdesign-asia.com/Article/2018/12/12/Skin-on-a-Chip-Singaporean-scientists-develop-device-which-can-replace-animal-testing">https://www.cosmeticsdesign-asia.com/Article/2018/12/12/Skin-on-a-Chip-Singaporean-scientists-develop-device-which-can-replace-animal-testing</a></li> </ul>

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## Annex 2

Rubric to be used for the assignment

CATEGORY	4	3	2	1
<b>Group Work</b>	Students worked well as a team. All students contributed equally during the research, product creation and presentation components of the assignment.	Students worked fairly well as a team. Most students contributed equally during the research, product creation and presentation components of the assignment.	Only some students worked well. Some students contributed equally during the research, product creation and presentation components of the assignment.	Students did not work well in their group resulting in a poor overall effort.
<b>Campaign/Product</b>	Students create an original, accurate and interesting product that adequately addresses the issue.	Students create an accurate product that adequately addresses the issue.	Students create an accurate product but it does not adequately address the issue.	The product is not accurate.
<b>Information and Values</b>	Students have presented unbiased information but are able to demonstrate their values and personal opinion.	Students have presented unbiased information but have not included their values and personal opinions.	Students have presented biased information to support their values and personal opinions.	Students have provided their values and personal opinions without presenting any supporting information.
<b>Creativity</b>	Students have presented work that is original and creative. Students have used their own words when presenting information and/or original visual presentation.	Students have used their own words when presenting information and/or original visual presentation but is not considered as creative.	Students frequently copied & pasted text and/or used only copied images nor arranged in an original manner.	Students did not display any attempt to be creative as only included copied and pasted text and/or a few copied images which were not arranged in an original manner.
<b>Score</b>				
<b>Total + Remarks</b>				





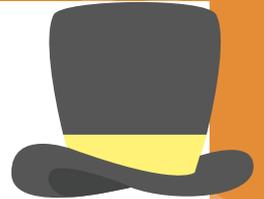
**HUMAN RELEVANT  
SCIENCE METHOD**

**GROUP  
MEMBERS**

**The facts are...**



**The positive aspects are...**



**The negative aspects are...**

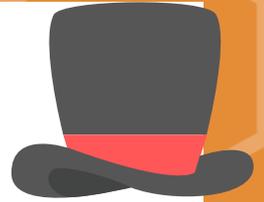




**HUMAN RELEVANT  
SCIENCE METHOD**

**GROUP  
MEMBERS**

**This Human Relevant Science method might make people feel...**



**In the future this Human Relevant Science method could be used...**



**These are the main issues we need to include in our presentation...**

