

**TEACHING WITH ASTROBIOLOGY. ENHANCING SCIENCE AND TECHNOLOGY AWARENESS IN HUMANITIES AND SOCIAL SCIENCE STUDENTS.** Michael Waltemathe<sup>1</sup> and Elke Hemminger<sup>2</sup>, <sup>1</sup>Ruhr-University Bochum (michael.waltemathe@rub.de), <sup>2</sup>University of Education Schwaebisch Gmuend (elke.hemminger@ph-gmuend.de).

**Introduction:** In a preliminary empirical study of social-science and humanities students enrolled in teacher-training programs at two German universities, the authors have found a disparaging view of technology and science among said students. Outdated knowledge of science and technology coincides with peremptory moral and ethical judgements about the implications of scientific research and innovative technology, but also with a strong interest in new technologies and scientific developments. Despite this interest, the students lack key competencies that enable them to make an analytical connection between humanities and social sciences and technology and science, without resorting to moral and ethical judgement. That is in part due to the depiction of science and technology in humanities and social-science courses, on the other hand due to a lack in current science and technology education as part of a humanities and social -sciences program.

**Adding Astrobiology:** This is where the authors believe that Astrobiology as an interdisciplinary academic field will show its merits.

Astrobiology is the study of the origins, evolution, distribution, and future of life in the universe as an interdisciplinary field. It also includes key questions the humanities and social sciences have been asking for centuries. Methodologically and structurally, however, in our understanding Astrobiology is more than just an interdisciplinary endeavour. Astrobiology uses existing knowledge about life to extrapolate from there into unknown realms. All we assume to learn about extraterrestrial life is based on our basic knowledge about the life we know and goes from there. Astrobiology in that regard teaches a lot about our knowledge about our world and our status as being life itself. Structurally, Astrobiology teaches us how to approach the unknown in an exemplary fashion in a scientific way while at the same time including traditional philosophical, religious and social questions that come with learning about the future of life. This can be used to teach students about an unknown in their worldview, bridging the gap between science and the humanities. In that way the structure of the field of Astrobiology enables learning and teaching beyond the possibilities of other interdisciplinary fields.

**Changing Worldviews:** Approaching these key questions in an open and scientific way from

Astrobiology gives new approaches to the answers the humanities have given; it will show some of them to be worthwhile and others to be wrong. It will - in short - change established world-views. This approaches one of the key problems the authors have identified with their students' technology and science awareness.

**Teaching with Astrobiology:** Our approach to teaching Astrobiology is not so much teaching Astrobiology itself, but using key concepts of Astrobiology research and analysing their underlying assumptions and scientific reasoning and connections to non-STEM fields. Many of the key concepts of Astrobiology are very well suited to show the students how to bridge a perceived conceptual gap between the STEM subjects and their respective fields without having to resort to ethical or even moral evaluation and judgement. This is where a constructivist pedagogical approach in combination with the concept of the thought experiment comes into play.

**Thought Experiments:** The common denominator between STEM and humanities and social sciences while approaching new ground is the thought experiment. This method has a long history not only in philosophy and religion, but also in the natural sciences and has been used for example to further the theory of relativity and also in teaching science. In the form of ethical dilemmas, the thought experiment has traditionally been used to enable students to learn to make analytically sound decisions without instinctively resorting to moral and ethical judgement.

This paper will show the basic structure of the thought experiment, expanding it to include constructivist pedagogics and playful learning.

The deep connection between Astrobiological methodology and current debates in the humanities and social sciences will be demonstrated by a number of practical examples, thus showing how the students approach to science and technology will change from being an ethical or even moral evaluation to learning from both sides of the coin and facing the common possibilities of social and scientific growth.