• Paper / Proposal Title:
3D Material Literacy - View on Educational Model Approaches between Design and Biology

• Author Name:
Joosten Mueller

• University Affiliation:
PhD Candidate
University of the Arts Bremen / University Groningen – Minerva Art Academy [Artistic Research PhD / binational PhD-cooperation]
Research Fellow
University of the Arts Bremen

• Abstract (300 words):
Many biological models and scientific schematic visualizations are highly complex and appear partially difficult to understand even for scientists. Geometric models used in natural sciences to explain intricate topics (like the morphology of viruses) push students to their limits. During the development of educational models in cooperation with natural scientists, I often recognized a limited competence-based view on models by students. It seems that there is a lack of fundamental understanding of what models are and how they can be used between knowledge transfer and knowledge-creation through model-based research. The failure in understanding scientific models can be seen in a missing 3D material literacy. In this context, it seems not only important to create precise and valuable models, but also to develop experimental concepts to help students understand the fundamentals of model research. The designer should enable students to view critically on common models and visualization concepts used in their field of study. This article will show first attempts of implemented model-based classroom experiments with undergraduate biology students at the University Bremen.
(Germany) developed in cooperation with the department of Virology and the department of Biology Didactics. The aim is to demonstrate how impulses from design, architecture and history of science can students approach through a transdisciplinary object-based learning. How can students be given the opportunity to develop solutions for scientific phenomena with the help of models, extending own model creation skills in a playful way? How can analogies between viruses and geodesic domes lead to a better understanding of virus structures? What impact on historic results in the virus research can be traced back to interdisciplinary collaborations, for instance between the scientists Donald Caspar and Aaron Klug with the architect Richard Buckminster Fuller in the 1960’s?

• Author(s) Biography (200 words each):
Joosten Mueller studied Integrated Design at the University of the Arts Bremen. During his master's studies he worked theoretically and practically on models as central element of knowledge-creation and -transfer. His master's thesis was developed in cooperation with the Laboratory of Virus Research at the University Bremen. It investigated the creation-process and history of didactic models and graphics in virological teaching literature. The work was published in 2019 by the Cluster of Excellence ‘Image Knowledge Gestaltung’ at the Humboldt University of Berlin. In cooperation with the Institute of Virology and Biology Didactics at the University Bremen, an experimental lecture and workshop concept was developed. It was successfully implemented with biology students (undergraduate) on the topic of object-based problem-solving and model building as research tool (object-based learning/ material thinking/ competence-based view on models) in 2018.

Joosten Mueller is a PhD candidate in a binational cooperation of the University of Groningen (Prof. Dr. Ann-Sophie Lehmann [Art History & Material Culture]) and the University of the Arts Bremen (Prof. Dr. Andrea Sick [Culture & Media History]. His scientific-artistic doctoral studies focus on the history of cell models and the question of their current relevance in research and teaching. Since 2020 he holds a Research Fellowship at the University of Bremen.