Paper ID: 85894
oral

IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
In Orbit: Postgraduate Space Education (4)

Author: Dr. Valentina Sumini
Politecnico di Milano, Italy

Ms. Marta Rossi
Politecnico di Torino, Italy

THE EVOLUTION OF COMPUTATIONAL DESIGN AND XR-ENHANCED SPACE ARCHITECTURE EDUCATION

Abstract

Over the past four years, the "Architecture for Human Space Exploration" course at Politecnico di Milano has undergone a significant evolution, marking a shift towards a more computationally designed approach, integrating extended reality (XR) systems to deepen the understanding of human factors and habitability requirements in space environments. This paper synthesizes the pedagogical journey and methodological advancements in teaching and learning space architecture, reflecting on the iterative improvements and the integration of cutting-edge technologies in the curriculum. Initially, the course focused on traditional design methodologies, emphasizing conceptual understanding and manual design skills pertinent to space architecture. As the complexities of designing for extraterrestrial environments became more apparent, there was a clear need to incorporate computational design techniques. This shift not only allowed for the exploration of more complex geometries and space configurations but also enabled the simulation of space environments to better understand the challenges of extraterrestrial habitability The introduction of computational design tools into the curriculum was a turning point, enabling students to experiment with parametric design and digital fabrication techniques. These tools facilitated a more nuanced exploration of the spatial, structural, and environmental aspects of space habitats, allowing for a deeper analysis of how human factors influence design decisions. However, the most transformative development in the didactic activity was the incorporation of XR systems, such as virtual reality (VR) and augmented reality (AR), into the design process.This integration marked a departure from conventional design methodologies towards an immersive design experience. By leveraging XR technologies, students were able to virtually inhabit their designs, gaining immediate feedback on the scale, proportions, and usability of spaces. This hands-on experience was invaluable in understanding the psychological and physiological needs of astronauts, ensuring that designs were not only functional but also conducive to well-being in extreme environments. The use of XR systems in space architecture education represents a forward-thinking approach to design education, one that recognizes the importance of human-centric design in the unforgiving context of space. Through this immersive design process, students have been able to explore innovative solutions to complex problems, considering not just the technical requirements of space habitats but also the human experience of living and working in such environments. This paper presents a comprehensive overview of the evolution of the "Architecture for Human Space Exploration" course, highlighting the pedagogical strategies employed, the integration of computational and immersive technologies, and the impact of these methodologies on students' design outcomes.