

# Extended Educational Environments for Past, Present and Future Students of Design & Computation

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## 1 Context

Our research project emerged in the context of a joint master study program “Design & Computation” (D&C), affiliated to Art and Technical Universities. The collaborative nature of the program allows for the development of new teaching and research formats that leverage the strengths of both human and artificial intelligence (AI). Students and researchers have access to extensive resources and expertise from a wide range of disciplines, facilitating investigation and study tasks through an immersive and interactive multi-sensory experience using Extended Reality (XR) technologies in educational settings.

We use the study program as a case study to fine-tune custom, open source Large Language Models (LLMs) based on data collected from students, including descriptions of their personal histories, projects, skills, habits, and external data sources relevant to the program’s topics. By curating and aggregating such information, we aim to create personalized and context-aware learning spaces that enhance student engagement, improve learning outcomes and strengthen interpersonal relationships between past, present and future actors affiliated to the study program. XR technologies are integral in fostering diverse information acquisition and visual perception, engaging learners more deeply by adding sounds, videos, and graphics to the learning and social situation.

## 2 Challenge

The primary challenge addressed by this proposal is bridging the gap in communication and knowledge transfer across various disciplines, cultural contexts, and psychological temperaments to establish an inclusive, trustful learning environment. Furthermore, significant fluctuations and the loss of knowledge over time necessitate the development of archives, systems or more complex learning environment that effectively preserve and seamlessly transfer knowledge across

different domains and academic generations. This brings us to Extended Educational Environment.

### 3 Extended Educational Environment

We define an Extended Educational Environment (EEE or E3) as an *immersive and interactive XR*<sup>1</sup> [1, 2] *learning environment enriched with AI-driven artifacts and avatars*. These avatars and artifacts, developed using tools like Unreal Engine and MetaHuman, each possess distinct "personalities" or "characters" reflecting their underlying machine learning models. They serve as an interface between the data corpora and human users. XR integration offers students a wider array of information through immersive, multisensory experiences, enhancing audiovisual engagement and deepening their immersion in learning activities for better retention and understanding of complex concepts.[3, 4]

In our prototype, each distinct avatar inhabiting the EEE of D&C study program has a unique Low Rank Adaptation (LoRa, [5] large-language model (LLM) neural network adapter associated to it. These adapters are trained from corpora provided and self-curated by different D&C stake-holders. In order to reduce the amount of false information and "hallucinations" to minimum, LLM2Vec [6] and Retrieval Augmented methodologies (RAGs) [7] are used there, where necessary.

Additionally, diverse avatars are enriched with specific text-to-speech (TTS,[8]), face expression or stylized audio-driven [9] face generator models.

### 4 Human-Machine Peer Learning

Didactic method with which we teach diverse visitors of our EEE is based on concept of "Human-Machine Peer Learning" (HMPL) [10, 11]. In HMPL, humans and AIs learn from and with each other, resulting for a win-win situation for both parties alike.

In our prototype, new colleagues enter into diverse types of dialogues with already existing avatars and artefacts. During such dialogues, knowledge of human as well as artificial cognitive agents is gradually increased by nothing else than encounter, information and exchange.

### 5 Roadmap

In the current phase, we generate LORA-adapters and LLM2Vec datasets from corpora provided and auto-curated by core teacher and assistant affiliates. In the subsequent phase, the dataset will be extended with corpora provided and auto-curated by ten current and alumni student volunteers. In the final "deployment" phase, the teacher-archivist Avatar emerging from the project will begin collecting data independently, *inhabiting* its XR space where students, alumni, and researchers can engage and seek advice and guidance.

<sup>1</sup> Extended Reality (XR) is a generic concept including Augmented Reality (AR), Mixed Reality (MR), and Virtual Reality (VR).

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