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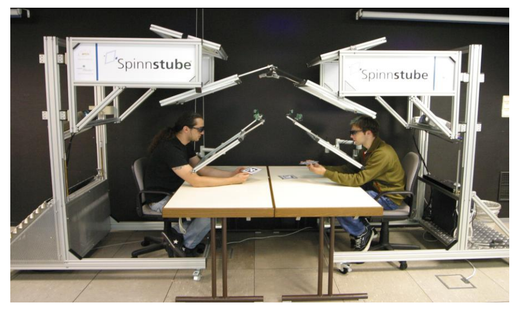
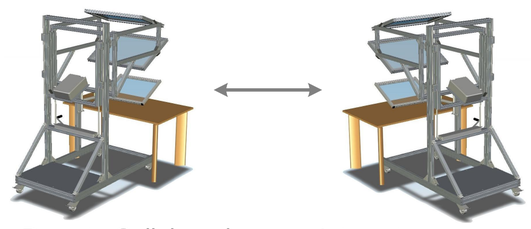
Augmented Reality in School Environments

The ARiSE project leverages the affordances of tabletop augmented reality to develop new practices in the classroom, helping learners to explore scientific and cultural content in more engaging and effective ways. The project consortium has developed the rugged and affordable augmented reality display Spinnstube™ based on off-the-shelf hardware and open-source software. As a networked augmented reality display Spinnstube supports co-located as well as remote collaboration between learners in a shared workspace.



Co-Located Collaboration



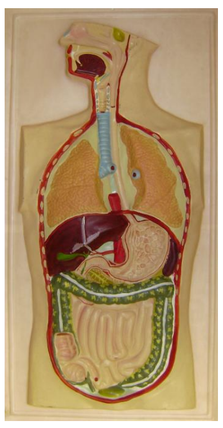
Remote Collaboration over Internet

In order to evaluate Spinnstube as a learning platform, three educational applications were developed and evaluated between 2006 and 2008, each reflecting the evolving technological capabilities of the system and addressing different pedagogical approaches.

2006 — 2007 — 2008

Process Visualisation

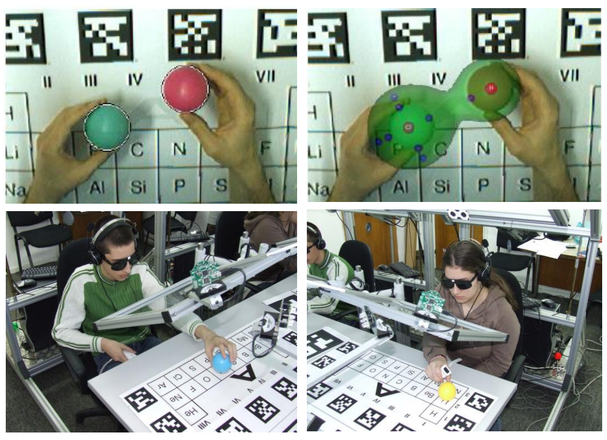
The Human Digestive System



Learn through instruction and knowledge consolidation. A model of an open human torso is augmented with animated images and audio explaining the digestive process. Students complete a number of assignments such as pointing out where specific food products are reduced in the digestive system.

Construction with Guidance

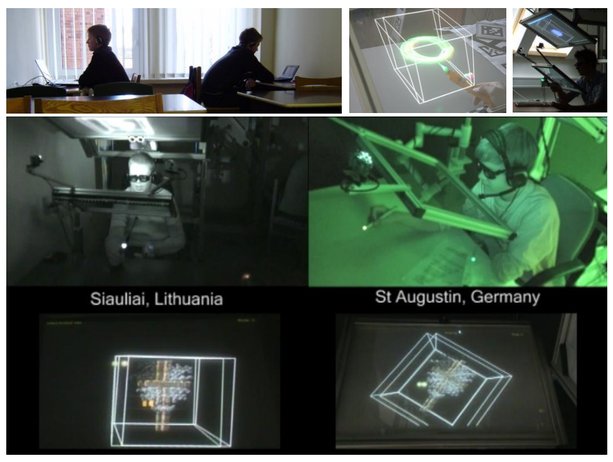
Atomic Structure and Chemical Bonds



Learn through active experimentation and knowledge construction. Foam rubber balls as a graspable user interface are augmented to look like atoms, with nucleus and electron shells. Learners construct chemical bonds by placing balls (atoms) next to each other. An audio cue guides students through their experiments.

Tele-presence and remote discussion

Cultural Exchange



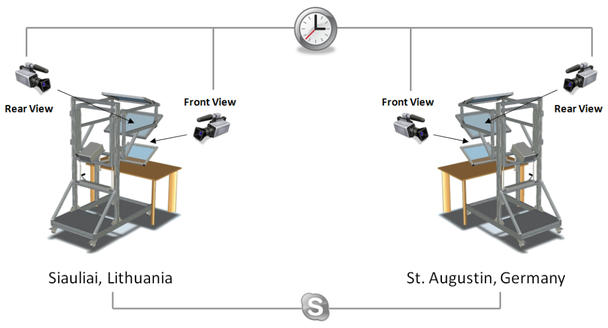
Learn through communication and the negotiation of meaning. Students choose suitable topics from their local culture and prepare meaningful digital artefacts before the summer school. At summer school the artefacts are used to anchor and illustrate remote discussions between students about their local culture and customs.

The Summer School Team 2006

Usability questionnaire

Pedagogical evaluation

The applications have been evaluated with 13 to 15 year old students in summer school projects in Malta (2006), Romania (2007), Lithuania (2008) and Germany (2008). In addition to the paedagogical and usability evaluation for all three applications, the third summer school also involved a social interaction evaluation with synchronised video observation in both locations to better understand how the system supports remote collaboration between students.



Evaluation results indicate a high acceptance rate amongst students. The main advantages are seen in the 3D visualisation, haptic user interface, and support for remote collaboration, which overall led to increased motivation, better concentration, and faster and more accurate understanding of the learning content. Balancing these positive results were technical and usability issues that had a negative impact on the learning process.