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Augmented and Virtual Reality Experiences in Plant and Agriculture Science Education

Authors : Sandra Arango-Caro, Kristine Callis-Duehl

Abstract : The Education Research and Outreach Lab at the Donald Danforth Plant Science Center established the Plant and Agriculture Augmented and Virtual Reality Learning Laboratory (PAVRLL) to promote science education through professional development, school programs, internships, and outreach events. Professional development is offered to high school and college science and agriculture educators on the use and applications of zSpace and Oculus platforms. Educators learn to use, edit, or create lesson plans in the zSpace platform that are aligned with the Next Generation Science Standards. They also learn to use virtual reality experiences created by the PAVRLL available in Oculus (e.g. The Soybean Saga). Using a cost-free loan rotation system, educators can bring the AVR units to the classroom and offer AVR activities to their students. Each activity has user guides and activity protocols for both teachers and students. The PAVRLL also offers activities for 3D plant modeling. High school students work in teams of art-, science-, and technology-oriented students to design and create 3D models of plant species that are under research at the Danforth Center and present their projects at scientific events. Those 3D models are open access through the zSpace platform and are used by PAVRLL for professional development and the creation of VR activities. Both teachers and students acquire knowledge of plant and agriculture content and real-world problems, gain skills in AVR technology, 3D modeling, and science communication, and become more aware and interested in plant science. Students that participate in the PAVRLL activities complete pre- and post-surveys and reflection questions that evaluate interests in STEM and STEM careers, students' perceptions of three design features of biology lab courses (collaboration, discovery/relevance, and iteration/productive failure), plant awareness, and engagement and learning in AVR environments. The PAVRLL was established in the fall of 2019, and since then, it has trained 15 educators, three of which will implement the AVR programs in the fall of 2021. Seven students have worked in the 3D plant modeling activity through a virtual internship. Due to the COVID-19 pandemic, the number of teachers trained, and classroom implementations have been very limited. It is expected that in the fall of 2021, students will come back to the schools in person, and by the spring of 2022, the PAVRLL activities will be fully implemented. This will allow the collection of enough data on student assessments that will provide insights on benefits and best practices for the use of AVR technologies in the classrooms. The PAVRLL uses cutting-edge educational technologies to promote science education and assess their benefits and will continue its expansion. Currently, the PAVRLL is applying for grants to create its own virtual labs where students can experience authentic research experiences using real Danforth research data based on programs the Education Lab already used in classrooms.

Keywords : assessment, augmented reality, education, plant science, virtual reality
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