Immersive Learning Project Showcase & Competition, iLRN 2020,
6th International Conf. Immersive Learning Research Network, online and in virtual reality, June 21 to 25, 2020.

H2020 project Helios – A Context-aware Distributed Social Networking Framework

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Abstract: Online virtual spaces revolutionize the educational landscape by providing distant courses and non-formal education activities that otherwise would be difficult if not infeasible to be offered. We offer a solution towards optimizing the learning process in three types of virtual spaces, namely one related to the subject of Chemistry, one to the subject of Wind Energy, and a culture related one. Knowledge from the domain of 3D graphics engines, i.e. Unity, where the capture and analysis of detailed behavioral data is exploited. Game Analytics is used to profile users, predict their behavior, provide insights into the design of experience and adapt them to users. Our data-driven approach solves the problems of designing, revising and evolving virtual spaces by the development of an easy to use authoring environment with web technologies for educators and cultural experts that integrates the above methodological paradigms. The work, initially supported by EU project ENVISAGE and currently supported by EU project HELIOS, attempts to find a solution for authoring multiplaying experiences that have the character of collaboration between actual and virtual presence, i.e. by connecting augmented and virtual reality, an interconnection which can be crucial for distant learning due to COVID-19.

Audience sector: K-12 Education, K-12 STEM

Topics: Barriers to Adoption - Inadequate XR Teacher Training Programs, Barriers to Adoption - Lack of Infrastructure and Tech Support, Catalyzing Tech & Developments - Artificial Intelligence and Machine Learning in XR, Catalyzing Tech & Developments - Flexible and Open XR Resources

Innovation

- Offering to educators and cultural experts an authoring tool that does not require programming knowledge to author a 3D educational experience, democratize thus the access and lowering the development costs for such experiences.
- Offering to educators behavioural analytics visualizations for each individual student of their class as well as aggregated views across class within the authoring tool, allowing them to produce improved versions of the labs.
- Using AI and predictive analytics in order to predict the behaviour of the students before playing the newest version of the educational experience allowing thus for an efficient authoring process.
- Offering multi-authoring capabilities in the authoring process and multi-playing capabilities in the resulted educational immersive experiences.
- Offering communication between virtual experiences' users with actual visitors in real spaces.

Explain how the project is based upon sound pedagogical and instructional design principles that are grounded in evidence-based learning science. *

Our solution has fully analysed the educational requirements of the different target groups. The requirements elicitation process is based on a) an extended literature review on the use of the virtual spaces, b) their potential to support students learning, c) a series of innovative assessment methods to identify students' competence proficiency, and d) the current barriers that prevent the up-take of such tools in the current school settings. ENVISAGE has developed a series of shallow and deep analytics as described in ENVISAGE project deliverables D2.1, D2.2 and D2.3 in the project website [https://www.envisage-h2020.eu/deliverables/] with increased value in the ENVISAGE solution. The ENVISAGE virtual labs

are integrated to full educational activities and lessons providing useful data (through the combination of shallow and deep analytics) for the assessment of the problem-solving competence of the students involved in the task. Parameters like the time on task (shallow analytics) are combined with deeper analytics (students' proficiency level based on the complexity of the task) to provide insights to students learning process. The extended literature review findings were discussed also with a group of 20 stakeholders in the framework of a workshop that was organised for this purpose, followed by interviews and reviews of best practices with a series of online labs that partner Ellinogermaniki School (http://ea.gr) is already employing in the framework of the offered services (lessons, labs or Professional Development activities). We are proposing a characterization scheme for the virtual labs according to their complexity and the opportunities they are offering for supporting low, medium or higher -level tasks. The overall concept is based on iterating the process of improving virtual labs through a pipeline that i) starts from the current version of a lab, ii) collects shallow analytics extracted from user behavioural data, iii) digs deeper into the obtained analytics using machine learning methods, iv) integrates the obtained information under the authoring tool, v) employs the authoring tool to build an improved version of the virtual lab and finally vi) iterates the above process. A working demo can be found in the tool website (https://envisagelabs.iti.gr/).

Current developments performed during HELIOS project (http://helios-social.eu) aims into leveraging ENVISAGE results by transforming virtual labs into social VR/AR spaces. The features that will be embedded is the multi-playing one so that several persons can co-exist in the same place and communicate efficiently. The use case selected is a visiting to a cultural space, namely a museum. Unity 3D graphics engine and Photon networking engine (https://photonengine.com) have been exploited in order to allow virtual visitors to communicate with video, audio, and text during playing the experience, targeting mostly for Android mobile devices in the first approach. Lately, HELIOS is performing research to interconnect a the multi-playing Android 3D experience with an actual museum space in order to allow virtual visitors to communicate with actual visitors of the physical space. Towards this goal, the 3D scanned space of the museum will be inserted into the 3D experience in order to achieve a digital twin, and several audiovisual systems will be installed near the museum artifacts in the actual museum space in order to allow a two-way communication. The latest developments can be found in the authoring tool prototype (https://heliosvr.mklab.iti.gr) and the project website (http://helios-social.eu).

C. Information About the Proposed Showcase Exhibit

What media format(s) and type(s) of artifact do you intend to use in your showcase exhibit? *

2D videos, 2D images / screenshots, Standalone application or experience accessible from a web browser

How will you use these media and artifacts to effectively convey the features and highlights of your project, including the way(s) in which it has employed a research-informed and evidence-based approach? *

The resources that will be provided include primarily a Chemistry and a Wind-Energy virtual labs available in project website through a web-browser [http://www.envisage-h2020.eu/virtual-labs/], the authoring tool to create such virtual labs offered in the ENVISAGE authoring tool [https://envisagelabs.iti.gr/]. The participants can play with the virtual labs, but they can also try the authoring tool to generate the labs of their preference. Help for authoring is provided under the form of scenarios written in pdf format. The scenarios have been co-designed with educators from Ellinogermaniki Agogi School of Greece (http://ea.gr), and the labs are played every year in the subjects of Chemistry and STEM in the aforementioned school. Research in the field of Analytics and AI has been exploited in order to measure analytics during the experience, visualize the progress of students to educators, and allow educators to make changes in the labs predicting the behaviour of the students with AI before playing the newest version of the labs (Predictive Analytics). As regards the results of project HELIOS, an Android package (apk file) will be provided in order to allow multiple users to play the 3D experience for visiting a virtual museum. The latest developments on the authoring tool for supporting the authoring of a virtual museum experience will be demonstrated from the website of the authoring tool for HELIOS, namely [http://heliosvr.mklab.iti.gr].

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