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AGRIENT - USING A 3D VIRTUAL WORLD TO ENHANCE AGRICULTURE ENTREPRENEURSHIP EDUCATION

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Abstract

The paper presents an educational platform and provides a systematic approach to train and support young people to succeed in formulating, starting and running their own agribusinesses. The educational platform uses 3D virtual reality (VR) to teach entrepreneurship focused on the agriculture domain (AGRIENT). The 3D virtual world allows users to navigate and interact with different multimedia content, such as slideshows, notecards, quizzes, non-player characters, multimedia presentations, 2D/3D simulations as well as interacting with other learners and instructors. The virtual interaction through chats and document sharing is available leveraging the constructivism. The virtual world is composed of islands of knowledge representing topics related to entrepreneurship and technologies that can be used in the agriculture domain.

Key words**:** *virtual reality, 3D virtual world, virtual education, learning technologies, teaching environment*

INTRODUCTION

Youth entrepreneurship is a key priority in the EU policy agenda for creating employment opportunities, fighting youth unemployment, social exclusion and also stimulating innovation among young people. The "Entrepreneurship Action Plan 2020" of EC highlights the important role of entrepreneurship education as a key strategy to stimulate economic growth in all sectors in the European level. On the other hand, agriculture is a strategic sector and pillar for the development in European countries. It's important for economic growth and society. Studies have shown that it is four times more effective than other sectors in reducing poverty. It is acknowledged that young people agriculture entrepreneurship skills and spirit are necessary more than ever before. Agriculture entrepreneurship can create jobs, foster wealth for society as a whole and contributes to community development, and produces social capital. In addition, with high levels of youth unemployment in Europe, entrepreneurship is increasingly seen as a vital way for young people to be active in the labour market, get income and realize their potential.

Technology evolution changes the way we think about education. Advances in the Internet and mobile devices make people adopt self-learning approaches through e-learning [6]. Nowadays, the use of virtual reality (VR) in education is becoming increasingly common as a new way of leveraging the interaction among the students and educators. VR is used for education on many different fields of expertise like renewable energy [1], civil engineering [3], mathematics [5], surgical training in medicine [12] and others. The motivation for using such technology either immersive or not has already been studied [13].

VR is considered to be an interesting tool for applying new strategies, and practices. This is because of the different advantages that are affordable with the use of this kind of technology. For instance, the use of VR in education can enhance the exploration of some phenomena which cannot be visualized in real life. Moreover, VR enables students to do experiments which can be dangerous or causes serious health problems [8]. In some

learning fields such as engineering, biology, physics, there is a need to use very expensive equipment, facilities, chemicals, etc. for effective and efficient in teaching. However, using VR in teaching will enable both teachers and students to acquire new experience and skills. Teachers can acquire skills that are related to integrating and utilizing VR technology in the teaching process in activities inside and outside classes. Furthermore, teachers will be able to share and publish their experience in the literature related to the use of VR in education. On the other hand, students will be able to enhance their learning process by using the VR modules developed for their courses. Also, students can collaborate in performing tasks, assignments, homework inside the virtual world.

Education using virtual worlds and its traditional way share characteristics with each other. However, virtual world differs from these systems since it provides a 3D virtual environment that provides a spatial dimension, different 3D objects that users can interact with them, 3D avatars and the sense of immersion that puts the users in a learning world with other users. This way, these specific properties can enrich traditional systems.

The remaining of this paper is structured as follows. Section 2 presents the theory and approach used in AGRIENT project. Section 3 describes two knowledge islands, one related to the theory of entrepreneurship and the other related to drones. Section 4 concludes this paper and presents future works.

MATERIALS AND METHODS

The solution here presented is based in the technological pedagogical content knowledge (TPACK) framework, an emergent form of knowledge that goes beyond three "core" components: technology, pedagogy, and content [10]. A graphic representation of this framework is shown in Fig. 1.

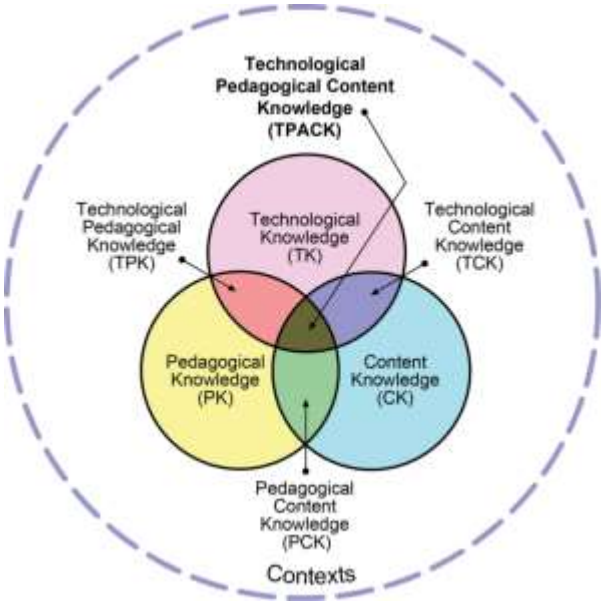

Fig. 1. TPACK framework.
Source: reproduced by permission of the publisher, © 2012 by tpack.org.

The 3D virtual world was designed using OpenSimulator which is an open source 3D application server that can be used to create a virtual environment, accessible through a variety of clients [11]. Authors can create a huge variety of 3D objects, define regions, terrains, 3D graphics, avatars, and textures. It supports real time physics simulation, with multiple engine options. It also offers an interface to define interactivities among avatars and the interaction between avatars and 3D objects. Moreover, OpenSimulator allows authors to program complex behaviour using scripts.

The development of the training path of each virtual world scenario requires the collaboration of numerous experts with professional roles, such as content experts, pedagogical experts, software developers and teachers. Fig. 2 illustrates the scenario development cycle with the interaction of these parts. Each knowledge island is formed by a combination of scenarios. The scenarios are the places which the users can interact with the 3D objects, other users, all the multimedia content and non-player characters (NPC). NPC's are avatars programmed to interact with users in order to help on executing tasks or accessing the content.

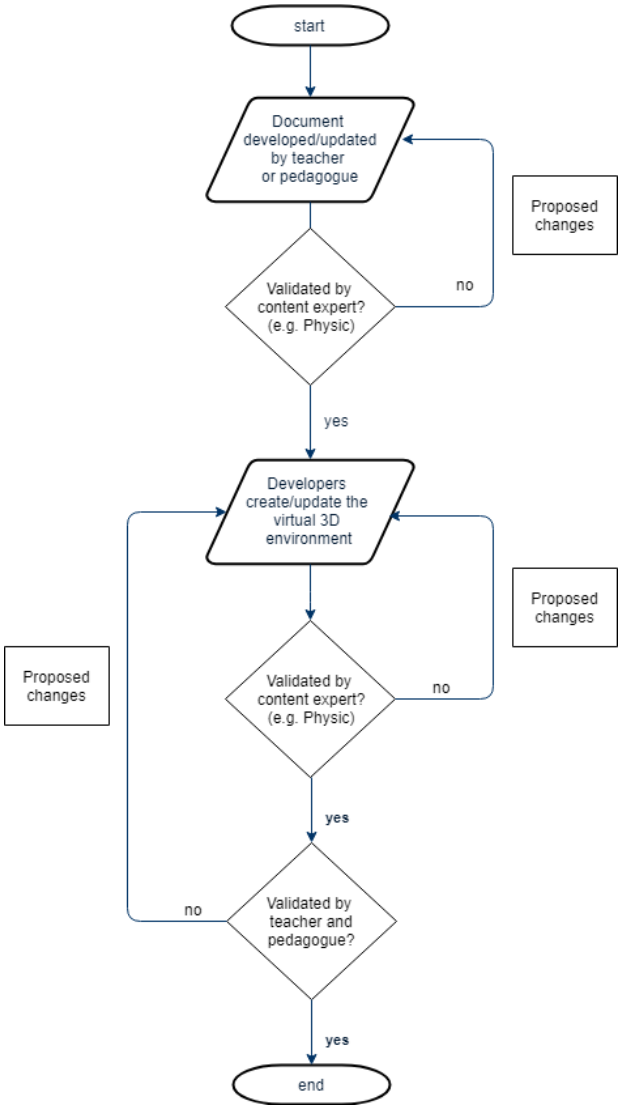

Fig. 2. The flow of interactions to develop a scenario in the 3D world
Source: project AGRIENT, © 2019 by agrient.eu, Accessed on Nov.10, 2019 [2].

In order for the users, teachers and students, be able to enter the virtual world, they should use 3D viewer software such as Firestorm [4]. Once inside the virtual world, the user can choose how to begin its learning experience from different options.

In a previous work [9] detailed a virtual world called VR4STEM (Virtual Reality for Science, Technology, Engineering and Mathematics). This world was formed by many knowledge islands and aimed to assist young people to gain entrepreneurship skills. The lessons learned in the VR4STEM project with respect to results and experience served as basis to the development of the AGRIENT project. Our project aims at producing an innovative educational platform and providing a systematic approach to train and support young people to succeed in formulating, starting and running their own start-ups or agribusinesses. In order to succeed in this goal, several courses and training procedures were designed to teach entrepreneurship, focused on the agriculture domain. Also, introductory parts of the courses cover entrepreneurship in general.

The main idea is to apply state of the art information and communication technologies (ICT) to education, particularly for work training with simulations, taking advantage of the immersion capabilities of virtual worlds [7].

The 3D virtual reality educational environment developed can be accessed from anywhere. This way, it will promote distance learning based on self-learning ideas, in order to support young people with fewer opportunities like the ones facing financial difficulties or living in isolated areas. All the mentioned characteristics are aimed to respond also to the need of attracting young people in agriculture education.

RESULTS AND DISCUSSIONS

The 3D world is being developed in the AGRIENT project, which has in view to produce an innovative educational platform and to provide a systematic approach for training and supporting young people to successfully implement entrepreneurship ideas by using advanced ICT technologies (like Virtual Reality). For instance, one idea is to construct a knowledge island for drones with several presentations, videos and links to gather more information about each topic. It is important to point out that the 3D world has an embedded web browser which maintains the user always in the same learning environment. In this way, Youtube videos, Wiki pages and other learning resources are accessed directly from the 3D world. There is no mandatory learning path in the 3D environment, so each user can access the topics in the order they like.

In the AGRIENT project, the authors have in view to prepare an island of drones with specific applications for Agriculture. This is a

technology already in use in some practical aspects of agriculture and with many potential applications that can be developed in the near future. In this island, the content is separated into three topics of interest. The first is an introduction to drones, the second explains its components and the last one shows a series of applications of drones in many areas including agriculture.

Fig. 3 shows the user avatar reading panels of information in the introduction to drones scenario. In the same scenario, another kind of interaction is allowed.

Fig. 3. Avatar of a user in front of a panel related to the drone knowledge island
Source: project AGRIENT, © 2019 by agrient.eu, Accessed on Nov.10, 2019 [2].

The user can access quizzes to test the knowledge acquired at any time. It is only necessary going to the interactive 3D box with the question mark (Fig. 4). After accessing a quiz, the user is prompted with a series of multiple choice questions that he has to answer correctly to receive some pieces of information, an object or a reward. An example is shown in Fig. 5, where a question about which device is used to rotate the drone. Four options are presented for the user to select. Another question sample about the definition of drones is presented in Fig. 6. A score is associated with the number of questions answered correctly and the time that the user spent on answering them.

The darker environment of Fig. 3 in relation to Fig. 4 aims to improve the immersion sense for the user, by introducing different sunlight levels related to each specific time of day.

Fig. 4. The 3D box object that represents the quiz
Source: project AGRIENT, © 2019 by agrient.eu, Accessed on Nov.10, 2019 [2].

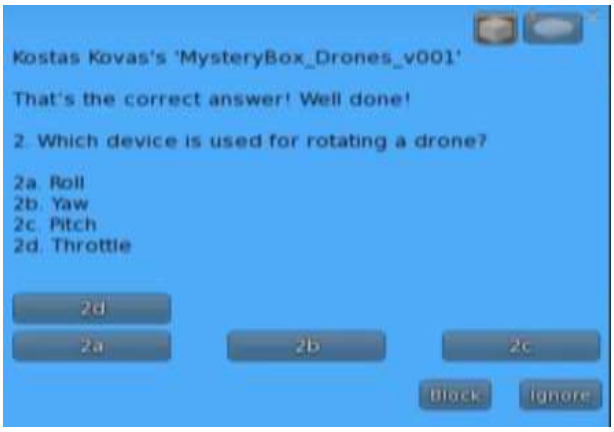

Fig. 5. Sample of a quiz about the drone operation
Source: project AGRIENT, © 2019 by agrient.eu, Accessed on Nov.10, 2019 [2].

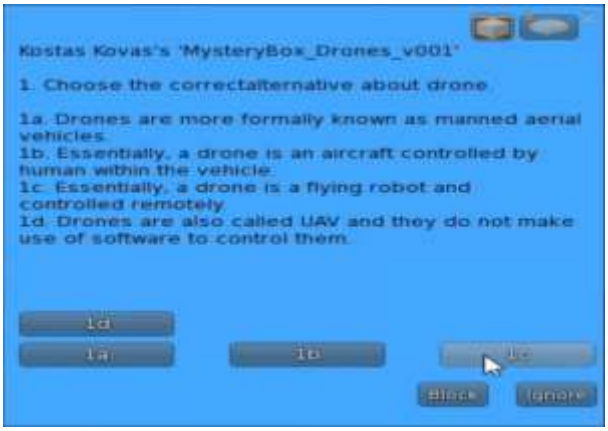

Fig. 6. Sample of a quiz about the drone description
Source: project AGRIENT, © 2019 by agrient.eu, Accessed on Nov.10, 2019 [2].

Fig. 7 shows a video about components that could be included in drones in order to, for e.g. detect obstacles. The video is part of the second scenario of the drones knowledge island.

Fig. 7. Sample of a video regarding the functions of drones and its components
Source: project AGRIENT, © 2019 by agrient.eu, Accessed on Nov.10, 2019 [2].

Fig. 8 shows the scenario of drone applications in another kind of interaction. It is a gamified approach related to the application of drones in agriculture domain. This is done using a 3D simulation where four fruit and vegetable crops are presented. The user must activate the drone to identify problems in these crops. After this, the user must choose the best treatment for each crop problem, based on the four options presented to the four crops. Then, the drone flies above the crop that makes part of the association and sprays the selected product. The score works as the quiz, the user will have higher scores making the correct associations in lesser time.

Fig. 8. Sample of a 3D simulation game based activity in the drone application scenario
Source: project AGRIENT, © 2019 by agrient.eu, Accessed on Nov.10, 2019 [2].

The approach of using new technologies like 3D Virtual Reality, can both offer new, more efficient ways of teaching, suitable for the agro-entrepreneurship domain. In this way, AGRIENT approach can attract many young people to take the designed course and gain valuable knowledge that will allow them to put their own ideas into practice and have successful careers as entrepreneurs in agriculture domain.

CONCLUSIONS

In this paper, we presented the main idea of the Erasmus+ project AGRIENT, Enhancing Youth Entrepreneurship Skills, Careers Guidance and Competences in Agriculture Thought a Game based Virtual Reality Platform, which already started preparations for a 3D virtual reality educational environment rich in a wide spectrum of advanced educational contents, that will provide efficient training procedures. The authors hope that most of all, it will be widely used at European level. This virtual environment aims at supporting the learning activities of young people to gain entrepreneurship skills.
Another major advantage from using VR is the positive impact on the motivation of young students, who are familiar to using this technology for entertainment.
The outcome of the project will support self-learning as well as formal learning.
The idea for future development is to continue adding more technology instruments in the form of islands of knowledge to the agriculture domain in the AGRIENT 3D world learning environment.

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Lifelong Learning Programme

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