INNOVATION OF LEARNING AND DEVELOPMENT FOR THE AGRITECH SECTOR USING GOOGLE TOUR CREATOR

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Abstract

This abstract describes an ongoing project that is a game changer for learning and development in the AgriTech sector. The AgriTech Centre of Excellence (ACE) offers a new and exciting approach to sectoral learning and development, through e-learning and virtual reality (VR). ACE is the first of its kind in Ireland & indeed Europe and is therefore, in its very nature, innovative. ACE aims to enhance the capabilities of Ireland’s AgriTech companies. A key aspect of this is the development of the learning experience, aiming to drive innovation around the learning and development for the AgriTech sector. At ACE we are utilizing a process based approach in identifying training and development needs of personnel in the AgriTech sector. Once identified, we implement bespoke and innovative training solutions to meet these needs. We are currently using VR scenarios to immerse learners in environments that they encounter every day in their work life. This is achieved by applying the capabilities of simple VR/AR learning tools as an integral part of a person’s training program. These training methods support experiential learning for people across a range of different specialties within the AgriTech sector (e.g. service technicians, engineers, sales).

The development of these training scenarios is realized using VR enabled low-cost digital devices. This creates a virtual, highly engaging collective learning environment for each learner in a class. VR training scenarios are constructed using a 360 Camera to capture various 360 images of a specific training environment or equipment. These images are compiled and imported into Google’s Tour Creator to build a series of immersive training scenes. Once compiled, the immersive VR training Tour is migrated to Google Expeditions. An advantage of using Expeditions software, is the ability for a trainer to guide learners through each scene, controlling the pace of the training session; ensuring that learners are bringing their attention towards the key learning items within each scene. The learner’s attention is drawn to specific points on equipment or in the environment. At these points of interest, information and additional imagery is added to support the learning process. The learner can also navigate through the scenes in their own time as often as required.

This innovative approach to learning and development for the AgriTech sector is enabled using software, available free of charge. The immersive VR training scenario is achieved by running the software application on low cost mobile devices; housed in a low-cost headset ‘viewer’, connected to a master tablet via a secure Wi-Fi gateway. The trainer then uses the master tablet to broadcast the content to the learners providing a visually stimulating and creative learning experience using VR. The advantages of using VR as a training tool to support learning and development for the AgriTech sector are:

1 Bespoke, active, immersive training experiences which engage the learner
2 Exploration and hands on approach supports learning and retention
3 Helps in understanding complex subjects/theories/concepts
4 Training embedded in the proper context; VR training scenes represent scenarios in which a learner will be working
5 Suited to all types of learners
6 Training can be carried out with no risk or impact to live manufacturing processes

Keywords: AgriTech, e-learning, Virtual Reality.

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1 INTRODUCTION

The ACE Project is an exciting approach to innovating learning and development for companies in the AgriTech industry. As a priority and a key starting point, the project is investigating and identifying the training needs of personnel in the AgriTech sector. This information is then used to direct the design, development, implementation and continuous improvement of learning plans for personnel in the sector. An integral part of the design and delivery of training plans for individuals and the industry as a whole is the learning technologies selected. A key technology that the ACE project incorporates into learning plan design and delivery is Virtual Reality (VR).

VR is not a new technology. It has been in existence since the 1970’s [1]. However, VR has gained renewed traction in recent years, becoming commonly employed as a Learning Technology aimed at enhancing the learning experience by providing immersive and realistic scenarios for learners to hone their skills and enrich their learning experience. This is a technology that has cross-sectoral applicability that can positively impact learning experiences and encourage participation in learning activities for organizations. With previous barriers to VR implementation as a mainstream learning technology being removed due to cost effective and easily accessible solutions. This has enabled the technology to be utilised to complement and enhance training as part of the overall training package or as a standalone learning tool. A simple starter VR technology solution we are using at ACE is cost effective and user friendly. It requires a limited skill set in developing training content, guiding and engaging in learning experiences. The VR technology solution employed consists of a mobile device, a viewer headset, a 360 Camera and free easily accessible and user friendly software package (Google Tour Creator [2]). The training item can then be readily uploaded as an expedition to Google Expeditions [3]. The tutor or training manager can easily develop interactive and engaging content using a 360 Camera and Google’s Tour Creator. The VR content is easily annotated with details, points of interest, graphical drawings and questions that make the training content easily aligned with already existing competency requirements in place in the organization. Through the use of the VR tool proposed, personnel in the organization will benefit from rich opportunities in experiential learning which will be inclusive of all learning styles, needs and abilities. This project and the virtual reality experience it provides will engage and motivate all learners and provide them with the opportunity to engage with learning content from the comfort of their own home or without physically leaving the organization.

The ACE project identified the following benefits in using VR technology as part of the overall learning experience for our industry partners. The benefits are further explored in Table 1. In Section 2 we will discuss the methodology in use and the main learning objectives of this ongoing project. This is followed in Section 3 by an overview of the results. Section 4 will discuss future work and identified challenges. The paper is concluded in Section 5

<table>
<thead>
<tr>
<th>What is the benefit?</th>
<th>How is this realised?</th>
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<tbody>
<tr>
<td>1 Expand your Organizations</td>
<td>By introducing VR into your organizations training plans, you can expand your training offerings to include additional areas of learning to supplement existing learning content.</td>
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<td>training offerings</td>
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<td>2 Foster innovation in learning</td>
<td>Offering project-based learning that incorporates VR technology as an initial offering or ‘taster’ creates an environment in your organization that fosters innovation.</td>
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<td>throughout your organization</td>
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<td>3 Introduce a different perspective</td>
<td>Complex training tasks are best taught from a variety of different perspectives in order to provide Learners with in-depth knowledge. With VR, you can introduce Learners to a multitude of different scenarios in more robust ways.</td>
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<td>4 Focused and aligned learning</td>
<td>It is reported that there is less ‘mind wandering’ and the learning is more engaged when progressing through learning content [4]. A tutor or guide can easily navigate learners through the VR scene, giving information/knowledge to further enhance the learning experience.</td>
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<td>across your organization</td>
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<td>5 Demonstrate that your organization</td>
<td>Revitalize your organizations approach to learning/training. The technology supports development of Bespoke, active, immersive training experiences which engage the learner. In doing this you promote your organization as a ‘work place of the future’ in terms of</td>
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<td>is technologically advanced and has a Learner centered approach’</td>
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<td>6</td>
<td>Learning flexibility</td>
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<td>7</td>
<td>Foster collaboration across your organization</td>
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<td>8</td>
<td>Improve Health and Safety across your organization</td>
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<td>9</td>
<td>Practice real work skills and scenarios</td>
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<td>10</td>
<td>Reduce cost of delivering training across your organization</td>
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2 METHODOLOGY

2.1 Materials for proof of concept

The proof of concept VR training module was constructed through the Department of Science Technology Engineering and Math's (STEM) at the Institute of Technology (IT) Tralee. The initial training scenario (John Deer Tractor model 6130M: ‘Cab-orientation’) was constructed using a Samsung Gear 360 camera and tripod. Once the 360 images were captured, they were designed into a training module using Google Tour Creator, with the resultant training module being uploaded onto Google Expeditions. A Samsung Galaxy S7 mobile device (with Google Expeditions application pre-loaded) was inserted into a Utopia 360 viewer. An additional Samsung Galaxy S7 Android Device is used to guide the tour.

![Image of hardware and software utilized](https://example.com/image1.png)

Figure 1: Hardware and software utilized

The next set of materials and equipment we intend to use to deliver training at scale for our AgriTech organizations are all in one VR kits offered by commercial vendor RedBoxV [7].

2.2 Participants

Initial proof of concept involved a small cohort of test participants, who had not previously used or participated in VR training nor who had prior knowledge or expertise with the subject matter or equipment selected for proof of concept training.

2.3 ACE Training Programme Design

2.3.1 Dales ‘Cone of Experience’ Theory

It is crucial that the instructional design approach we select for the ACE project is founded on evidence based research. To this end, we are utilising Edgar Dales ‘Cone of Experience theory’ [5].
Since 1969, Dales theory is widely used in instructional design of curricula and training programmes. Dales theory sets forward that there are 3 main types of learning experiences:

- **Enactive learning experiences** - this is where a person learns by ‘doing’ a task - this is the foundation of the cone and the most effective type of learning, with 70-90% of training material/content being retained by the learner.

- **Iconic learning experiences** - this is where a person learns by ‘observing’ a task, this is the middle part of the cone, with between 30-50% of content being retained by the learner.

- **Symbolic learning experiences** – this is where a person learns through ‘abstraction’ - reading or hearing about a task, this is the top of the cone and accounts for the retention of between 10-20% of training material by the learner.

The ACE learning experience will encompass all levels of the cone, with VR technology playing a key part (Fig. 2). This is aligned to Dales theory - that the medium by which training is delivered is vitally important for an efficient and robust understanding of training content [5]. Using simple solutions such as Google Tour Creator we can embed abstract information onto the VR training scene (s) to enhance the learning experience and ensure a more cumulative and comprehensive approach to retention of the training content. Use of the technology supports and actively encourages experiential learning during training and development of personnel within an organization.

![Figure 2: ACE Instructional design approach, adapted from Dale, 1969 [5]](image)

2.3.2 **Flipped classroom**

Based on Dales work it is evident that traditional delivery methods are merely a small part of the picture when it comes to designing a learning/training programme. It is therefore critical that the base of the cone of learning was at the forefront; playing a key part when designing, developing and delivering the ACE learning experience. An outward facing or learner centered approach is a key pillar of the ACE Learning Experience. Our aim is to empower our learners. Therefore, the instructional strategy that we use is the flipped classroom methodology, with VR being a key technology utilized.

2.3.3 **Process based approach’ in designing the ACE Learning Experience Process**

The Deming Cycle or Plan-Do-Check-Act is a methodology which drives continuous improvement in business processes [6]. PDCA is a technique used in Total Quality Management to logically plan out processes and implement continuous improvement actions. The ACE training process will follow this methodology. In addition, Value Stream Mapping will be utilized throughout the project in order to visualize current training processes in place, with a best in class training process VSM constructed using PDCA.
3 RESULTS

3.1 Proof of Concept

The proof of concept for the first VR training module utilized the materials and equipment outlined in Section 2.1. The Department of STEM at IT Tralee facilitated production of the VR training module by providing a piece of Agricultural Machinery - a John Deere Tractor, model 6130M. There were 6 Scenes constructed of the tractor, all with their own annotations of particular points to the learner-1) outside, 2) driver cab, focusing on main controls 3) Rear of tractor, focusing on hydraulics set up and power take-off (PTO) 4) Right side engine bay 5) left side engine bay 6) inside engine bay. Figure 3 illustrates one of the annotations from Scene 2) Driver Cab. The training module tour was then uploaded and kept in ‘private’ mode on Google Tour Creator. There is an alternative option to publically publish the tour.

![Screen shot from proof of concept training module- Scene 2 (Driver Cab)](image)

The recruited proof of concept participants were briefed in relation to the study and the feedback required to be targeted towards:

1. The ease of identification of each point of interest by the learner
2. The ease of navigating through the scenes
3. The value-add of having a tutor guide the learner through the scenes
4. The ease of understanding of the various technical aspects annotated in point of interest/ scene
5. Ease of recollection of information learnt

Study participants reported the following after progressing through the 6 scenes:

1. The points of interested were easily identifiable and it was easy to expand on the annotated parts of each scene
2. The scenes were easy to navigate through
3. A tutor was not determined to be value-add for the particular scenes constructed as part of the proof of concept. This may be due to the fact that the scenes were kept relatively basic. The more sophisticated and detailed the training module/ scenes, the more beneficial a guide or tutor would be
4. Study participants reported that the annotated points of interest gave sufficient information to understand the purpose of the equipment controls in each scene
Study participants were able to identify equipment controls and the purpose of each control readily when annotations and information points were removed.

4 FUTURE WORK AND CHALLENGES

The work outlined in this paper represents the start of an ambitious 3-year project to revolutionise learning and development for companies in the AgriTech sector. There are a number of challenges we are aware of at this stage in the project and mitigation measures will be put in place to ensure successful delivery of project FPO’s. Challenges identified to date include:

- Selection of a learning management system (LMS) solution which has cross organization compatibility, combining the technological and integration capabilities required to enhance our VR training experience and offer a truly immersive VR solution, whilst ensuring that the future needs of ACE are catered for.
- Change management- ensuring that training content is kept up to date and dynamic across partner organizations.
- Ensuring that PDCA methodology is maintained with opportunities for improvement being realised and embedded into the ACE training process.

5 CONCLUSION

This paper has described an on-going innovative project focusing on AgriTech Sectoral Learning and Development using VR as a key learning technology. This paper also presented an overview and observations of the project, the benefits, the initial challenges and the lessons learned to date. The evaluation of VR technology in the delivery of induction and ongoing training to personnel in the AgriTech Industry and generating knowledge of its benefits and challenges as a key learning technology for the entire AgriTech sector will be identified and incorporated into future training programmes and continuous improvement activities. This is especially true as the project progresses to implementing the technology into three collaborating industry partners. A final project report and set of recommendations for other AgriTech organizations interested in using VR as part of their training programmes will be produced at the end of the project and will be presented internationally as an extended journal article and conference presentation.

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REFERENCES