THE DEVELOPMENT OF VR EXPEDITIONS FOR PRIMARY SCHOOL LEARNING

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Abstract

This paper will discuss an active project that is centered around the development and implementation of a teaching tool that will provide primary school pupils rich opportunities in experiential learning which will be inclusive of all learning styles, needs and abilities. This project represents a dynamic collaboration between the IMaR Research Centre based within the School of STEM at the Institute of Technology Tralee (IT Tralee) and teaching staff form a cluster of four Irish primary schools. Through the use of a Virtual Reality and Augmented Reality (VR/AR) tool and the development of VR ‘expeditions’ and enhanced learning environments will be created to enable novel learning of the Primary Language Curriculum – English and Irish – in Ireland. This project and the virtual reality experience it provides will engage and motivate all learners and provide them with the opportunity to engage with the wonders of our world without leaving the classroom. The project uses VR enabled low-cost digital devices for the creation of a virtual, highly engaging collective learning environment for each student in a class that can be controlled by the teacher. Within these environments, the teacher leads the students, controlling the pace and level of advancement to suit the learning requirements of the syllabus and student ability. The system is based around the Google Expeditions software, which is available for use by schools, free of charge. This software is run on low cost, tablet style devices, housed in a low-cost headset ‘holder’ with all units being tied together through a wifi gateway. All content within the system can be fully vetted and controlled by the teacher at all times from a ‘master’ tablet. The Google Tour Creator tool is an addition to the Expeditions platform, which allows the easy creation of immersive 360⁰ VR environment which will be used in this project to create bespoke Expeditions to enable the optimum and engaging delivery of the Irish Primary Language Curriculum – English and Irish.

Keywords: Virtual Reality, Augmented Reality, Immersive Learning.

1 INTRODUCTION

The use of Virtual field trips in the classroom has become a popular application of VR technology for learning. The Google Expeditions [1] application has made VR technology and experiences accessible to teachers to transport students to faraway and even inaccessible parts of the planet. The Google Expedition app is free to download on IOS or Android and teachers can invest in some of the low-cost cardboard headsets that can be attached to a smartphone. With these simple headsets, students can actively explore anything from the inner human body to outer space.

Google Expeditions enables teachers to bring students on virtual trips to places like museums, underwater, and outer space. Expeditions are collections of linked VR and AR content and supporting materials that can be used alongside existing curriculum. This project uses a commercially available VR/AR solution provided by Redbox VR [2], see figure 1.
These trips are collections of static images created with 360° panoramas and 3D images annotated with details, points of interest, and questions that make them easy to integrate into the learning curriculum already used in schools. Through the use of this type of easy to use and accessible VR/AR tool, the pupils benefit from rich opportunities in experiential learning which will be inclusive of all learning styles, needs and abilities. This project and the VR experience it provides engages and motivates all learners and provides them with the opportunity to engage with the wonders of our world without leaving the classroom.

The main advantages of using VR in the classroom are as follows;

1. Active rather than passive experience,
2. Immersive experience means no distractions,
3. Immediate engagement: useful in today’s world of limited attention spans,
4. Exploration and hands on approach aids with learning and retention,
5. Helps with understanding complex subjects/theories/concepts,
6. Suited to all types of learning styles, e.g. visual.

In Section 2 of this paper we will discuss the main learning objectives of the project. This is followed in section 3 by an overview of the observations and challenges. Section 4 will describe how new bespoke immersive learning environments can be created to allow the delivery of the Irish Primary School Language Curriculum, while section 5 will discuss a how we will evaluate the success of the project and what lessons were learned. The paper is concluded in section 6.

2 VR PROJECT LEARNING OBJECTIVES

This project has four participating primary schools in Co Kerry, Ireland and has the following objectives; (1) Implement the Primary Language Curriculum – oral language, writing and reading [3]. This project will impact positively on the children’s learning across all curricular areas as language is the foundation of all subject areas. This tool will be a vibrant stimulus to ignite their imaginations which will translate into the oral and written form. (2) Increased knowledge and skills development, increased motivation, development of positive attitudes. (3) Broadening the scope of resources available to the teacher, increases the engagement of teacher as well as pupil, greater sense of achievement for teacher, opportunities to further develop the relationship between teacher and pupil. (4) Development of assessment opportunities for and of learning, KWL, learning styles more easily identified using digital technologies such as VR/AR. (5) Provision of an innovative tool to engage pupils visually which will in turn lead to greater stimulation and engagement. (6) Collaborative approach to the project, i.e. cluster of schools, Institute of Technology, Tralee and Lero (Irish Software Research Centre) – sharing of good practice between teachers and schools, sharing of expertise, opportunities for Continuous Professional Development (CPD). (7) Showcasing of positive impact of collaboration between schools. (8) Showcasing of work samples, video and pictorial records of project. (9) Developing a bank of age/class appropriate exemplars of good practice using VR/AR in subjects such as Visual Arts, History, Geography, Science to develop and reach the progression milestones of the oral language, writing and reading curriculum. (10) Improvement in overall standardised results in English and Irish. Table 1 outlines some of the objectives and advantages of using VR/AR in the class room.
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<tr>
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<th>Table 1: Table of Objectives and Advantages of using VR in the Class Room</th>
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<td>Expand Your Offerings</td>
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<td>Foster Social Relationships Among Students</td>
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<td>Solve Student Learning Challenges</td>
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<td>10</td>
<td>Demonstrate That Your School Is Technologically Advanced</td>
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3 VR PROJECT OBSERVATIONS AND CHALLENGES

The consortium has purchased 3 sets of 30 student VR kits that can be shared amongst the schools in the cluster. The kits include 30 student VR devices plus 30 VR viewer headsets. The IMaR Research Centre at IT Tralee are responsible for procurement, commissioning, installation and maintenance of the school kits throughout the 3 years of the project and will provide technical support and training to the primary school teaching staff. IT Tralee have committed to working with teachers at the start of each school year to provide additional training and outline supports available throughout the year. It is envisaged that each semester teachers will be presented with new features of the system allowing continuous enhancement of the learning experience for the students.

A schedule for sharing of the kits has been agreed upon by the cluster and will be reviewed at the start of each school year. To date this system has worked well with each school receiving adequate access to the equipment. The teaching approaches implemented will be child centered. The use of this digital tool will allow more experiential based learning that will allow greater scope for the learner to lead his/her learning and opportunities for his/her voice to be heard.

This project will provide great scope for self and peer assessment.

- The impact of the project will be determined from standardised assessment results, interviews with pupils, feedback from all stakeholders including class teachers, SEN teachers, SNAs, principal and parents.
3.1 Project Communications Plan

The cluster meets monthly in either one of the schools, in the Tralee Education Centre or in IT Tralee to discuss progress, finding and issues arising. A blog will be set up which will be regularly updated by each participating school - it will include details of lessons using VR/AR, teachers’ reflections on lessons – what worked well, what I would change the next time etc. A project website has been created to host this blog [www. http://primaryvrexplorers.com] and content is currently being generated. Once sufficient initial outcomes have been documented by the project team, reports and blog posts will allow the dissemination of the project findings to the general public. Participating teachers will also be in contact via email throughout the duration of the project.

3.2 Initial Digital System Implementation

The following tasks were undertaken by the IMaR Research Centre at IT Tralee in preparation for project kick-off in year 1:

- Evaluation of VR class systems available
- Pre-Procurements actions (quotations, negotiations, technical evaluation etc.)
- Assisting lead school in final procurement
- Initial system set-up, evaluation and trouble-shooting
- Initial trials in each school, ensure schools IT system is correctly configured for deployment, and any alteration made.
- 1 Day training course for primary school teaching staff in each school
- Follow-on support to ensure teacher confidence in the system

3.3 VR Interactive Learning Pilot

It is intended that schools will focus on one Progression Continua in the English and Irish curriculum in each of the three years. Other subject areas such as History, Geography, Science, Arts will be fully integrated and lessons will be developed with the aim of reaching the Language milestones.

- Year 1 – Oral Language
- Year 2 – Writing
- Year 3 – Reading

The six step School Self Evaluation Approach will be followed in which we identify our focus in the area identified above in September of each year, gather evidence from standardised test results, teacher observation, pupil questionnaires, parent questionnaires each year, analyse and make judgements as to how we will use the VR/AR tool to develop a set of activities/lessons for the following months to improve the learner experience and learner outcomes in the identified areas in October. An improvement plan and report will be written in October. This plan will be put into action from November to May each year and the impact will be evaluated in June of the three years.

An initial training session at the start of the project in Year 1 will be conducted by the IMaR Research Centre in IT Tralee as part of the project kick off. The IMaR Research Centre in collaboration with the cluster schools, will determine further training needs for the cluster schools in Year 1.

3.4 Project Outcomes and Deliverables

Year 1 – increase in oral language competencies measured using the Drumcondra English profiles – oral language indicators [4].

Exemplars in oral language development in all class levels using VR/AR.

Increased motivation, engagement, attendance by pupils in those classes. CPD by all teachers involved.

Opportunities for all teachers involved to reflect on and discuss Year 1 experiences, identifying any required modifications for Year 2.

Year 2 – improvement in the writing competencies of pupils measured using the Drumcondra English profiles – writing indicators.
Exemplars in writing development in all class levels using VR/AR.

Increased motivation, engagement, attendance by pupils in those classes. CPD for all teachers involved.

Opportunities for all teachers involved to reflect on and discuss Year 2 experiences, identifying any required modifications for Year 3.

**Year 3** – improvement in reading competencies measured using Micra-T [5] or Drumcondra Reading Test.

Opportunities for all teachers involved to reflect on and discuss Year 3. A final project report and set of recommendations for other schools interested in using VR will be produced at the end of the project.

A showcase showing the process of the project to take place in the Tralee Education Centre once each year – videos, blog posts etc.

## 4 TOUR CREATOR – THE PRIMARY LANGUAGE CURRICULUM

Google Tour Creator [6] is an addition to the Google Expeditions platform which allows users to easily create their own 360⁰ immersive environments through the use of a 360⁰ camera and a basic PC. A newly developed tour can then be imported into the Google Expeditions environment and can be used in the classroom as any other Expedition would, broadcasting to student headsets from the ‘master’ tablet and fully guided by the teacher.

The immersive learning environment can be constructed using a Samsung Gear 360⁰ camera and tripod. Once the 360 images were captured, they were designed into a training module using Google Tour Creator, with the resultant content being uploaded onto Google Expeditions, see figure 2.

![Figure 2: Create Tours Hardware and Software Utilized](image)

To address the objective of making the Irish Primary School language curriculum more engaging, a bespoke VR ‘expedition’ has been proposed. Initial work in under way and the proposition is to create VR image content (360⁰ panoramas and 3D imagery) depicting familiar Irish settings such as a farm, a local small village or a local historic site.

Once the image content has been imported into the Tour Creator environment, the scenes can be choreographed into an expedition and suitably annotated with Irish language content, in line with the school curriculum. It will then be possible to create the Expedition and deploy it to the headsets, as a guided tour suitable for use in a classroom. In addition to the VR content, a lesson plan will be developed by the teaching staff of the partner schools which will be distributed with the Expedition.

The outcome of this will be evaluated within the classroom environment, and will form part of the evaluation of the performance of the project and affects the introduction of VR learning environments to the classroom. This evaluation will follow the guidelines outlined in Section 5.

## 5 EVALUATION AND LESSONS LEARNED

The evaluation process is continuous. On completion of this project the Department of Education and Skills will be provided with a template for the implementation of a digital technology – VR/AR in a primary school based on thorough assessment, evaluation, data collection, setting of SMART targets to implement the Primary Language Curriculum at all class levels. This will implemented through sharing of best practice.
Details of all evaluations and results pertaining to the VR/AR digital technology in the classroom pilot will be made available to the Department of Education and Skills for further evaluation.

The project will be evaluated on a term basis, September to December, January to Easter and Easter to Summer Break. The following parameters will be used to evaluate the performance of the project and affects the introduction of digital technology to the classroom is having:

- Motivation levels of pupils
- Standard test results
- Attendance of pupils
- Parental feedback
- Pupil feedback
- Teacher feedback

Action Plan for each year based on the SSE 6 step approach. A final project report and set of recommendations for other schools interested in using VR will be produced at the end of the project.

6  CONCLUSIONS

This paper has described an innovative project around primary school learning using VR technology. It has also described the proposed development of bespoke VR content which will be in line with the Irish Primary Schools Language curriculum. Through this action and evaluation of its reception and effect on learning within the classroom, it is hoped that this project will be used to promote the adoption of such technology in Irish schools.

This paper also presented an overview and observations of the project to date and the benefits and lessons learned were outlined. The evaluation of the use of such technology in the primary classroom, generating knowledge of its effects on curriculum delivery to the whole Irish education sector will benefit. This is especially true as the project proposes to implement and evaluate the technology in each of the 8 primary schools class levels.

ACKNOWLEDGEMENTS

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REFERENCES

[5] https://www.cjfallon.ie/books/micra-t/