

Using Augmented and Virtual Reality in the Early Childhood Curriculum

Augmented Reality (AR) and Virtual Reality (VR) technologies have much to offer the early childhood classroom. AR apps enable virtual objects and artefacts to be layered over the physical environment, whilst VR fully immerses the user in a virtual world. In this document, we explore some of the research undertaken by researchers in the DigiLitEY Cost Action, and examine the ways in which AR and VR might be used in early years classrooms.

Marsh and Yamada-Rice (in press), drawing on their studies of children's use of AR and VR apps (Marsh et al., 2015; Yamada-Rice et al., 2017), outlined five key principles which should underpin the use of AR and VR in the classroom. These are discussed throughout this document.



Principle 1:

The use of AR and VR needs to lead to learning experiences that are rich, meaningful and build on the affordances of the technology.

Whilst AR and VR can create ‘Wow!’ moments, their use should be designed to develop learning in meaningful ways. This is best done if the activities are embedded in classroom projects. For example, in the MakEY project, which involves DigiLitEY researchers from several countries, VR was one element in a rich and varied set of activities based on the Moomins, characters developed by a Finnish author, Tove Jansson.

The children watched a professional puppet show based on the Moomin stories and then created their own illuminated shoebox puppet theatres, writing playscripts to be used with these. The children also created their own clay models of the characters. These were imported into the Qlone app so that they became 3D digital models. This allowed the models to be 3D printed, and also taken into the VR app Google Tilt Brush. The children then donned a VR headset and use the app to create a VR version of the Moomin valley (see Figure 1 as an example).

This project enabled learning to take place across a range of subjects, including language and literacy, design and technology, art and science. In this way, the VR experiences offered opportunities for integrating knowledge and developing key skills.



Figure 1: A Moomin character in a virtual Moomin valley



Figure 2: Vai Kai dolls

Principle 2:

The use of AR and VR in the classroom should enable children to engage in playful approaches to literacy learning, in which meaning and affect are key.

Play is an important element of any early childhood classroom, and AR and VR apps can be used in a range of playful ways.

In the German element of the MakEY project, Dylan Yamada-Rice, Deborah Tartaruga Feliz and Justyna Zubrycka are enabling children to play with the attractive, wooden Vai Kai dolls (see Figure 2) (vaikai.com) in the physical world, and then import these into a virtual world and enable the children to create a playworld for the dolls using Google Tilt Brush. This activity is highly enjoyable for the children and facilitates their emotional attachment to the dolls, as they look after it in both physical and virtual environments. Also of interest is the way in which children create worlds for the Avakai in the physical and virtual space that are very different to one another, as the affordances of each domain cannot be replicated in the other.

Principle 3:

The use of AR and VR in the classroom should lead to productive as well as consumptive practices.

Both of the examples above demonstrate how VR content can be used to produce texts and artefacts, so that children are not just consuming ready-made virtual worlds, or AR and VR games. There are many apps that foster such creativity. In Marsh et al.'s (2015) study, children in one school used the Aurasma (now HP Reveal) app to create videos in which they retold stories they had written and/or drawn on paper. Then, during parents' evenings, parents could use their smartphones to hover over the paper-based text and link up to the video, which delighted both them and their children.

Principle 4:

The use of AR and VR in the classroom should foster the development of critical literacy skills

Critical literacy enables children to ask key questions about the world about them, exploring issues of power, identity, social justice and other aspects of life. AR and VR apps can be a valuable tool in this regard, as they enable children to undergo experiences and put themselves in the shoes of another, creating many opportunities to ask critical questions about that experience. This is featured in Berson, Berson, Carnes and Wiedeman's (2018) powerful account of the use of a VR film of a holocaust survivor, Lala with a primary grade class, which enabled the children to think about prejudice and how it impacted on people's lives.

Principle 5:

The use of AR and VR in the classroom should build on children's encounters with these technologies outside of the classroom

It is valuable for children's out-of-school learning to be recognised in classrooms, so that the knowledge and skills they have already developed can be built upon in appropriate ways. Not all children, of course, have access to AR and VR content at home, and so it is even more important to enable them to explore these technologies in school so that they do not get left behind in the use of these technologies in the digital age. Many children had fun with the app Pokémon Go, which enabled them to find virtual Pokémon monsters embedded in the physical environment. A similar app that can be used for educational purposes is Geo AR.

The equipment needed for the use of AR and VR in the classroom need not be high-end. A tablet or smartphone can be used for AR apps, and Google cardboard glasses, or equivalent, are fine for many VR experiences. Cardboard VR headsets can also be made by children, which is a good activity in its own right, as it enables children to understand how VR works. If you do wish to invest in equipment that will enable the use of Google Tilt Brush and other apps that require hand movements, then you will need a system such as the HTC Vive or Oculus Rift, which can be costly if you need to upgrade your PC/ laptop to ensure capability.

There are many AR and VR apps that are being used in creative ways in classrooms around the world. Some of the apps that DigiLitEY researchers have found of value are:

- Figment AR
- Google Blocks
- Google Tilt Brush
- HP Reveal
- Qlone
- AR Kit
- Moodys
- Surreal
- Orb
- Google Expeditions

Mark Anderson and Steve Bambury have created a 'Period table' of iOS apps for VR and AR (see Fig 3).

THE PERIODIC TABLE OF iOS APPS FOR AR AND VR *to try today!*

■ STEM ■ GEOGRAPHY ■ ART ■ SCIENCE
■ CREATIVITY ■ STORY TELLING ■ TEACHING ■ HISTORY

PLEASE NOTE THAT APPS USING APPLE'S AR KIT WILL ONLY WORK ON DEVICES WITH AN A9 CHIP OR ABOVE

CREATED BY MARK ANDERSON @ICTEVANGELIST / CURATED WITH STEVE BAMBURY @VIRTUALTEACH ICT EVANGELIST

Figure 3: Figure 1: AR and VR apps for Education. An interactive version of this table can be accessed here: <https://ictevangelist.com/the-new-periodic-table-of-ios-apps-for-ar-and-vr/>

The WEARVR website hosts all VR content by platform: www.wearvr.com

Questions of health and safety

There have been questions about health and safety with regard to children's use of VR, given that its use may affect eyesight and balance (Dylan et al., 2017). However, there is little research in this area to date, which means that no definitive guidance can be offered. In the absence of such guidance, we would recommend using VR technology for short periods of time only with young children. In the MakeEY activities described above, children generally spent no longer than 10–12 minutes using the headsets. This guidance will be updated as research evidence emerges in this field.

We also recommend that for devices without trackers for body movement, it is better for children to sit down as they use the headsets.



References

Berson, I.R., Berson, M., Carnes, A.M. and Wiedeman, C.R. (2018). Excursion into empathy: Exploring prejudice with virtual reality. *Social Education*, 82 (2) pp96-100.

Marsh, J., Plowman, L., Yamada-Rice, D., Bishop, J.C., Lahmar, J., Scott, F., Davenport, A., Davis, S., French, K., Piras, M., Thornhill, S., Robinson, P. & Winter, P. (2015). Exploring play and creativity in pre-schoolers' use of apps: Final project report. Accessed at: www.techandplay.org.

Marsh, J. and Yamada-Rice, D. (in press). Augmented Reality and Virtual Reality in the Language Arts curriculum. *Language Arts*.

Yamada-Rice, D., Mushtaq, F., Woodgate, A., Douthwaite, A., Harris, W. Holt, R., Marsh, J., Milovidov, E., Mon Williams, M., Parry, B., Riddler, A., Robinson, P., Rodrigues, D., Thompson, S. and Whitley, S. (2017). Children and Virtual Reality: Emerging Possibilities and Challenges. Accessed at: <http://digilitey.eu/wp-content/uploads/2015/09/CVR-Final-PDF-reduced-size.pdf>



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