Emerging Educational Technologies for Cross-Cultural Collaboration: Current Perspectives and Future Directions

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ABSTRACT

Emerging technologies, such as virtual worlds, virtual reality, and augmented reality, may have the potential to facilitate cross-cultural collaboration between students from schools and universities in different countries and cultures. Due to the increase in internationalization in education, the development and implementation of such technologies is now required. However, as yet, the particular challenges and future opportunities associated with the use of such technologies has not been fully investigated. We have conducted interviews with teachers in Ireland and China, to establish their perspectives on the use of of emerging technologies, their current practice, and their future needs and hopes. We found that both teachers had experience with the use of emerging technologies, but only the teacher in China was based in a school which implemented such technologies formally, and this was only in recent years. Novelty was identified as a major reason why students would be expected to embrace emerging technologies in the future. The teacher in China also pointed out potential challenges relating to the availability of high-speed internet in parts of China. We suggest that future research should investigate the perspectives of teachers in Ireland, China, and other countries, on the use of emerging technologies for cross-cultural collaboration, in order to develop a more detailed understanding of the specific needs and challenges such international digital collaboration will bring about.

CCS CONCEPTS

• **Applied computing** → **Collaborative learning**; *Interactive learning environments*; • **Software and its engineering** → *Virtual worlds software*;

KEYWORDS

Educational technology, Virtual worlds, Virtual reality, Collaborative learning, China, Ireland

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1 BACKGROUND

In recent years, emerging technologies, such as 3D games, Virtual Reality (VR), new generation Virtual Worlds (VWs), and Augmented Reality (AR) are identified as being suitable for a range of educational contexts [5, 13, 14, 17]. A range of potential benefits are associated with the use of these emerging technologies in education, both in schools and universities. For example, well-designed video games are recognized to embody many principles which may facilitate effective learning [10, 14]. Additionally, VR and VWs may provide a sense of presence to learners, the opportunity to design flexible, interactive learning environments, collaborative learning, and may provide learners with optimal feedback [17]. Another potential use of such emerging technologies stems from the fact that they are generally facilitated via the internet: this may allow the possibility of increased international collaboration, and VWs are a recognized tool for distance education [18, 19].

1.1 The virtual cloud campus

Several of the authors of this paper have previously developed a virtual cloud campus to improve the experience of Chinese international students at an Irish university [21] This consists of a gamified VW developed in Terf ® [2], designed to improve language and cultural understanding between Chinese and Irish students. The platform — illustrated in Figures 1 — 4 — was developed through extensive consultation with groups of Chinese students (including those already in Ireland, and those preparing to move to Ireland), to determine what features would be required to meet their specific needs. The platform provides a context-specific learning environment with a range of features, including:

- File sharing
- Video and audio chat
- Group and private text chat
- The ability to record sessions and take screenshots
- Bilingual (Chinese and English) learning environment
- Multiple rooms (including a social room, game room, etc.)
- 3D model of the university campus
- Collaborative games (Python applications)
- The ability to save data to an external server

Figure 1: Virtual cloud campus; bilingual context-specific learning environment

Figure 3: Virtual cloud campus; 3D model of university

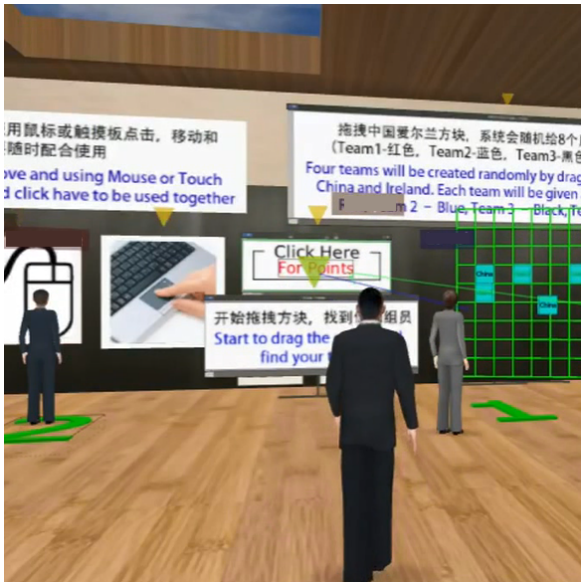

Figure 2: Virtual cloud campus; collaborative cross-cultural games

Figure 4: Virtual cloud campus; social room

1.2 Emerging educational technologies in secondary education

While the primary aim of the virtual campus described in the previous section is to improve the experience of Chinese international students who will attend a university in Ireland, similar software may be used to facilitate cross-cultural classrooms for remotely located students to learn together with students from other countries and cultures. Such online cross-cultural interaction between groups of children from different cultural backgrounds has many benefits, including increasing positive intergroup attitudes [4, 20]. It therefore seems plausible that a virtual cloud campus to enable cross-cultural collaboration between remotely located students in secondary schools would be extremely valuable. In this paper, we present the results of interviews with teachers in Ireland and China, focusing on their current use of emerging technologies in an educational context, and their views on the future use of such technologies. Our aim is to present qualitative data from two international

contexts that may support findings from previous quantitative research on the use and affordances of emerging technologies for cross-cultural collaboration in education, and to identify potential issues that must be addressed in the development of emerging educational technologies.

2 PARTICIPANTS, MATERIALS, AND METHODS

We conducted two semi-structured interviews: one with a teacher in China and one with a teacher in Ireland. Interviews were conducted using a combination of methods: face-to-face meetings, video calls, and email conversations. Interviews were conducted in January 2017. The emerging technologies discussed in the interviews were 3D games, Virtual Reality (VR), Virtual Worlds (VWs), and Augmented Reality (AR). Questions asked were as follows:

(1) Name?
(2) Gender?
(3) In which school do you currently teach?
(4) What is your teaching subject?
(5) Would you consider it beneficial to collaborate with a teacher in Ireland/China using new technology?
(6) What experience do you have with using new technologies in teaching?
(7) Have you ever used virtual worlds in your teaching?
(8) Would you like to do so in future if supported to learn about virtual worlds?
(9) What age groups are you teaching at the moment?
(10) What technologies are you using with your students?
(11) Have you used new technologies with your students in the past?
(12) To your knowledge, are your students using 3D games or 3D virtual world games out of school hours?
(13) Do you have experience to show that students play 3D games or other virtual tools/platforms specifically in order to benefit from the opportunity to collaborate, either in study at school, or in their private lives?
(14) When did your school begin using new technologies?
(15) If your school is not using new technologies: do you think your students would be interested in 3D games/Virtual Reality/Virtual Worlds/Augmented Reality? Please provide details to support your responses.
(16) Have the students in your school engaged in any kind of cross-cultural collaborative learning using new technologies? If so, please describe these activities.
(17) If your school is not using new technologies: would you be interested in exploring the use of such technologies in the future?

3 RESULTS

3.1 Interview 1

Tian (pseudonym) teaches Information Technology at a large public school in China. Her pupils are 12 — 18 years old. She has taught at this particular school for almost 5 years. She believes it would be beneficial to collaborate with a teacher in Ireland using emerging technologies. Tian uses a range of methods and tools in her classroom, including micro-learning, flipped classrooms and interactive whiteboards. Tian said that teachers in her school have some experience of using emerging technologies in their teaching. Her school began implementing such technologies at the end of 2013. For example, large touchscreens are installed in the school, on which videos can be played to aid teaching. Students can view and manipulate 3D models of, e.g., the Great Wall of China, historical figures, and biological structures, either on the screens or on personal tablets (provided by the school). However, students in the school currently do not interact with these 3D models using an avatar (i.e. immersed in a VW), but solely by interacting with models on touch screens. Tian would like to learn new skills regarding the operation of emerging technologies if technology and training were provided. But she has concerns concerning the potentially prohibitive cost of such technologies, and the requirement for high-speed internet, which is not commonly available in schools in parts of China. While Tian said that she does not know if her students used 3D games or VWs/VR out of school hours, she believes that they would be interested in using 3D games, VR, VWs, and AR; when asked to explain why, she said that her students would have strong curiosity about new things. Tian added that, while her school has a regular student exchange program with schools in the USA and Britain, there is no collaboration using VWs or other emerging technologies. However, as an Information Technology teacher, she expects to have more opportunities to collaborate with teachers from different cultures using such technologies, and is interested in researching advanced technologies and exchanging knowledge and experience with teachers from other countries. Tian believes that the adoption of new technologies in teaching will be important to keep up with the development of modern society.

3.2 Interview 2

Sean (pseudonym) has over 10 years teaching experience in Science and Mathematics. He currently works in an all-boys secondary school in Ireland, where he teaches Biology, Physics, and Chemistry. His students are 12 — 18 years old. Sean would like to collaborate with a teacher in China using emerging technologies, especially with younger students, who have a more flexible curriculum. Sean is personally very interesting in emerging technologies, and has previously collaborated with researchers and designers to develop 3D VWs. Sean said that he has moderate experience of using VWs and 3D games in teaching, but not primarily in a classroom setting. He suggested that this was due to a lack of such technology being available in schools. However, he expressed a desire to use VWs for teaching in the classroom in the future. For example, he views the ability to build 3D models of subject matter as a way of enhancing the experience of visual learners. Sean's pupils do use emerging technologies out of school hours; specifically, he noted that some pupils use AR applications (such as Pokémon GO [15], a popular AR game) on smart phones. But he believes that these students view these applications solely as games, and do not consider the fact that they are examples of, e.g., in the case of Pokémon GO, AR. According to Sean, emerging technologies are not widely used in the school. While he recognizes that some teachers may occasionally use such technologies, there is no school-level policy to implement their use. However, Sean said that he believed that

3D games, VR, VWs, and AR would all be engaging for students. Interestingly, he based this statement on his belief that students are often engaged when there is a change in instruction style. While Sean has no experience of cross-cultural collaborative learning during his time in the school, he reported that there was previously a Chinese language learning program in the school. Sean believes that emerging technologies have unlimited potential. He stressed that such technologies would present an optimal way of engaging pupils who have a visual learning style, and those who are less motivated to learn via traditional methods.

4 DISCUSSION

Both teachers have used emerging technologies, and would like to use them more in the future, including to collaborate with teachers and students in different countries for cross-cultural learning. Both note that training and technology needs to be supplied to facilitate this. While the school in China has taken steps to formally introduce emerging technologies, the teacher in Ireland noted that there was as yet no policy to do so in his school. Yet both teachers believe that their students would embrace such technologies. Both teachers cited the novelty of such technologies as the main reason why they believed students would welcome them; this is particularly interesting, as such technologies have been widely available for a relatively long time (e.g., Second Life, a popular VW, had over 6 million users in 2007 [6]). One teacher — in Ireland — noted the potential for emerging technologies to facilitate learning for students with different learning styles. It is interesting to note that, while the school in China currently uses more emerging technologies than the one in Ireland, the Chinese teacher worries that the lack of high-speed internet in parts of China would be a challenge to the introduction of such technologies in future (this teacher is based at a school in a major city). While China does have a National Broadband Plan, the plan's potential effectiveness remains uncertain, in part due to its over-reliance on state-owned carriers, political involvement, and concerns about the implementation of governmental policies in the country [12].

One teacher (in Ireland) suggested that emerging technologies may be particularly effective for students who are unwilling to learn or who have visual learning styles. The effectiveness of learning styles-based instruction — i.e., based on the idea that different people prefer to process information in different ways, such as primarily visual or primarily kinesthetic — is called into question by recent research [8]. However, taken alongside the teacher's remark that emerging technologies may also benefit children who are unwilling to learn, we can identify a broader point: emerging technologies may embody a range of features that traditional approaches to education do not, and which may provide more effective learning for certain students. Several authors have identified specific requirements of effective learning environments for various kinds of students, which may be facilitated by the emerging technologies discussed in this paper. For example, twice exceptional students — i.e., intellectually gifted students who also have one or more learning difficulties, such as dyslexia — may benefit from engaging in contextualized, real-world problems via simulation tools [16]. In addition, virtual reality can provide a safe environment in which people with autism spectrum disorder can learn social and life skills [9]. Emerging technologies can therefore also facilitate inclusive learning and collaboration, not just across cultures, but also across the abilities and specific needs of students with disabilities.

Finally, as suggested by one teacher (in China), we note that the rapid development of emerging educational technologies may mean that research and development in this field occurs quickly. While the interviews reported here did not involve much discussion of augmented reality or mixed reality, these are rapidly emerging technologies which may have an increasingly important role to play in educational contexts. Augmented reality and mixed reality do not provide a virtual environment (as in a virtual world), but rather add an additional layer of visualization to the real world. This may be particularly effective in providing contextualized learning environments, since the context in which the learning material is provided is simply an enhanced version of some real-world context. Based on previous research by several authors of this paper [11, 22], we intend to explore the possibility of augmented and mixed reality for cross-cultural collaboration in education in our future work.

5 CONCLUSIONS AND FUTURE WORK

This paper provides qualitative data from teachers in Ireland and China on the potential challenges faced in the introduction of emerging technologies — in particular, virtual worlds — for cross-cultural collaborative learning in secondary schools. By conducting in-depth interviews with teachers who use — or would like to use — such technologies, we identify specific challenges and opportunities. However, it is important to remember that the results presented here are from only two teachers. Ultimately, this work should be used as a pilot study to inform the development of a questionnaire, which could then be administered to a large sample of teachers in Ireland and China. It is important that the development of virtual worlds and other emerging educational technologies for use in an international context is based on the needs of users, which, crucially, may differ in different cultures and educational contexts; and a questionnaire based on the results of the interviews reported here could therefore help to inform the development of such future software. In future work we aim to develop and distribute such a questionnaire.

Additionally, while the interviews conducted here focused mainly on the use of online virtual worlds accessed through a computer, recent developments in virtual reality and augmented reality should also be taken into account in future work. The use of virtual reality headsets in both research and education is likely to become more widespread as technology becomes more affordable and easier to use[7], and platforms such as Google Daydream[1] and Windows Mixed Reality[3] may increase the availability of virtual and augmented reality to schools for similar reasons. Any future investigation of these issues should take account of these recent developments, in order to determine teachers' preferences and needs in the context of state of the art approaches to virtual and mixed reality.

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REFERENCES

[1] *Google Daydream.* https://vr.google.com/daydream/ Accessed: 2017-07-06.

[2] *Terf® Product Details — 3D Immersive Collaboration, 3D Immersive Collaboration Consulting.* http://www.3dicc.com/product-details/ Accessed: 2017-06-14.

[3] *Windows Mixed Reality.* https://developer.microsoft.com/en-us/windows/mixed-reality Accessed: 2017-07-06.

[4] Andreas Beelmann and Kim Sarah Heinemann. 2014. Preventing prejudice and improving intergroup attitudes: A meta-analysis of child and adolescent training programs. *Journal of applied developmental psychology* 35, 1 (2014), 10–24.

[5] Anke Berns, Antonio Gonzalez-Pardo, and David Camacho. 2013. Game-like language learning in 3-D virtual environments. *Computers & Education* 60, 1 (2013), 210–220.

[6] Maged N Kamel Boulos, Lee Hetherington, and Steve Wheeler. 2007. Second Life: an overview of the potential of 3-D virtual worlds in medical and health education. *Health Information & Libraries Journal* 24, 4 (2007), 233–245.

[7] Davide Castelvecchi. 2016. Low-cost headsets boost virtual reality's lab appeal. *Nature* 533, 7602 (2016).

[8] Joshua Cuevas. 2015. Is learning styles-based instruction effective? A comprehensive analysis of recent research on learning styles. *Theory and Research in Education* 13, 3 (2015), 308–333.

[9] Sue Fletcher-Watson. 2014. A targeted review of computer-assisted learning for people with autism spectrum disorder: Towards a consistent methodology. *Review Journal of Autism and Developmental Disorders* 1, 2 (2014), 87–100.

[10] James P Gee. 2007. *What Video Games Have to Teach us About Learning and Literacy.* Palgrave Macmillan.

[11] Lizbeth Goodman. 2016. Visualisation meets assistive tech: VR, AR, digital materialisation and the tools for imagining and supporting the full potential of human communication. In *Virtual System & Multimedia (VSMM), 2016 22nd International Conference on.* IEEE, 1–9.

[12] Chun Liu. 2016. Building the Next Information Superhighway: A Critical Analysis of China's Recent National Broadband Plan. *Communications of the Association for Information Systems* 39, 1 (2016), 10.

[13] Tsung-Yu Liu, Tan-Hsu Tan, and Yu-Ling Chu. 2010. QR code and augmented reality-supported mobile English learning system. In *Mobile multimedia processing.* Springer, 37–52.

[14] Igor Mayer, Geertje Bekebrede, Casper Harteveld, Harald Warmelink, Qiqi Zhou, Theo Ruijven, Julia Lo, Rens Kortmann, and Ivo Wenzler. 2014. The research and evaluation of serious games: Toward a comprehensive methodology. *British Journal of Educational Technology* 45, 3 (2014), 502–527.

[15] Niantic. 2016. Pokémon GO. (2016). Niantic.

[16] M Elizabeth Nielsen. 2002. Gifted students with learning disabilities: Recommendations for identification and programming. *Exceptionality* 10, 2 (2002), 93–111.

[17] Ilknur Reisoğlu, Burcu Topu, Rabia M Yılmaz, Turkan Karakuş Yılmaz, and Yuksel Göktaş. 2017. 3D virtual learning environments in education: a meta-review. *Asia Pacific Education Review* 18, 1 (2017), 81–100.

[18] Marloes Schoonheim, Robin Heyden, and John M Wiecha. 2014. Use of a virtual world computer environment for international distance education: lessons from a pilot project using Second Life. *BMC medical education* 14, 1 (2014), 36.

[19] Feihong Wang and Barbara B Lockee. 2010. Virtual worlds in distance education: A content analysis study. *Quarterly Review of Distance Education* 11, 3 (2010), 183.

[20] Fiona A White and Hisham M Abu-Rayya. 2012. A dual identity-electronic contact (DIEC) experiment promoting short-and long-term intergroup harmony. *Journal of Experimental Social Psychology* 48, 3 (2012), 597–608.

[21] Bo Zhang, Steve Benton, Will Pearson, Julie LeMoine, Nicola Herbertson, Huw Williams, and Lizbeth Goodman. 2016. Playing 3D: Digital technologies and novel 3d virtual environments to support the needs of Chinese learners in western education: Cross-cultural collaboration, gamification, well-being and social inclusion. In *Virtual System & Multimedia (VSMM), 2016 22nd International Conference on.* IEEE, 1–9.

[22] Bo Zhang, Çağri Çubukçu, Julie LeMoine, Eleni Mangina, and Lizbeth Goodman. 2016. The affordances of virtual collaborative tools and augmented virtual reality gamification tools to enhance intercultural education live and online. In *10th annual International Technology, Education and Development Conference.*