Title of paper:

Designing for inclusiveness in EdTech projects: the case of the European University of Technology's XR VR Team

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Abstract

This paper will present the case of the XR VR project team within the European University of Technology (EUt+). The team is tasked with developing an extended reality (XR) virtual reality (VR) approach to help students and staff overcome language and cultural barriers in international mobility. The aim of the project ultimately is to enhance the experience of physical student mobility and to ensure international opportunities for students are more inclusive. As research on the problem is still in progress, the team found themselves constructing their own understanding of designing for inclusiveness in the project. This paper presents the case through a qualitative case study methodology involving reflective journals of project participants, a focus group discussion and documentary analysis connected to the project. The findings from the study show how the understanding of 'inclusiveness' is constructed through social interactions and consequently how designing for inclusiveness in digital projects in education is a journey influenced by evolving meanings. Our study makes important contributions to the students with disability literature and technology in education literature.

Keywords:

Educational Technology, EdTech, XR, Extended Reality, Inclusion, European Universities, European University of Technology, EUt+

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Introduction

Inclusive education is based on the need for educational institutions to transform their cultures and practices to ensure learning of all students, promoting their participation and seeking to eliminate the processes that lead to social exclusion (Martins, Morges and Gonçalves, 2017). Inclusion is fundamental for achieving quality education for all students and for the development of a more democratic and sustainable society (Moliner, Yazzo, Niclot and Philippot, 2019).

Diversity is valued when universities are aligned with the principles of inclusion. Inclusion recognises that all students bring things of value to the learning environment (Perera et al. 2019). In addition, it removes barriers linked to exclusionary practices and works proactively to respond to the needs of all learners (Gale and Mills, 2013). Inclusive practices can enrich the curriculum and the success of all students. Learning-centred approaches and Universal Design for Learning (UDL) have been shown to be effective in inclusive contexts (Larkin, Nihill and Devlin, 2014).

This paper will present the case of the XR team within the European University of Technology (EUt+) and their development of an extended reality (XR) virtual reality (VR) approach to prepare students to overcome language and cultural barriers to international mobility. The aim of the project ultimately is to add a social space demension and to enhance the experience of physical student mobility in EUt+. The XR VR project will help EUt+ address the central issues of multilingualism and multiculturalism as the university partners form closer bonds. The challenge for the team from the outset was how to meet its objective for inclusivity in an already complex task. Starting the work of the team involved parallel issues of relationship building and specification development. Integrating principles of universal design added to the multi layered considerations needed to meet the project specifics for functionality and the development of a shared space that would support improved and extended learning possibilities and an improved international mobility experience for all.

Adopting a constructivist approach (Hammersley, 2013), this study explores the infancy of developing an XR VR approach with inclusiveness at the heart. Constructivism requires researchers to focus on the processes that lead to the construction, constitution and character given to independent objects and the relationships between them. Events in the

early part of this project focused mainly on social interactions across international institutions, interactions with experts on access and widening participation and universal design for learning, and social network interactions. The study explores how these interactions and communication led to learning and socially constructed views of inclusion and designing inclusive technological platforms.

The research design of the paper involves a qualitative single case study adopting multiple sources of data collection (Yin, 2009). Data is collected through documentary evidence, reflective participant accounts and a focus group discussion. The findings contribute to the literature on disability and digital learning. They also inform a wider understanding of inclusion when referring to the digital setting. The study also has important practical implications.

Literature Review

Socially constructed learning about inclusiveness in education – the educator perspective

According to Lourens and Swartz (2016), inclusivity is related to the feeling of being a welcomed member; a student who truly belongs and participates, like any other student. Teaching for inclusivity entails embedding the practices of universal design for learning in the classroom and the syllabus (Griful-Freixenet et al., 2017; Hitch, MacFarlane and Nihill, 2015).

As Gale et al. (2017) pointed out, efforts must focus on knowing more about the educational processes and actions developed by academics and their improvement, to walk towards more inclusive classrooms. Academics need to know what the university expects of them and what to do when they have students with disabilities in their classrooms (Moriña, Perera, and Carballo, 2020), yet we know little about developing training experiences on this topic.

The idea of inclusive education in research is hard to grasp. The concept is complex, broad, and ambiguous (Szumski, Smogorzewska, and Karwowski 2017). It is therefore challenging to study and to construct (Ainscow and Sandill 2010; Forlin 2010). Researchers' understandings of the key concepts and definitions that relate to inclusive education differ between scholars and countries (Brusling and Pepin 2003). Different definitions and complex perspectives affect research on the topic, as well as the possibility of achieving inclusive education in practice (Göransson and Nilholm 2014). Because a vast array of interests are attached to the idea of inclusive education the definitions of the concept differ around the world.

It is not surprising therefore that inclusive education is subjected to multiple definitions that problematise at least cross-national research on it (Hernández-Torrano, Somerton, and

Helmer 2020). Several reviews within the field have contributed showing different approaches to the problem. Inclusion is associated with diversity (Burner, Nodeland, and Aamaas 2018; Devarakonda and Powlay 2016), equity (Goodwin 2012; Shaeffer 2019), equality (Eklund et al. 2012; Lundahl 2016), citizenship (McAnelly and Gaffney 2019), and the universal right to sufficient and adapted education (Gran 2017; McAnelly and Gaffney 2019). In pedagogy and special pedagogy, inclusion has been defined as a student's belonging to a professional, social and cultural community (Solli 2010).

In the social-constructionist view, researchers have studied how the individual relates to the social constructions of history and culture (Sempowicz et al. 2018). Social constructionism has been used to interpret how inclusion theories and principles relate to childhood education (Jamero 2019) and to define the conceptual framework of inclusion (Dudley-Marling and Burns 2014). It has also been used to interpret professional practices that follow the Vygotskyan concept of scaffolding (Armstrong 2019; Walker and Berthelsen 2008) and social norms and tools that reflect social-interactionist approaches and social constructionism in schools (Carrington et al. 2020; Sempowicz et al. 2018).

Developing technological platforms for education

While the interplay of new forms of technology and learning is complex, recent evidence suggests that learning experience design, pedagogy, and practice with embodied and immersive learning technologies can have important effects on learning, engagement, and achievement in multiple educational settings, including formal and non-formal (Georgiou & Ioannou, 2019). Holly, Pirker, Resch, Brettschuh and Gütl (2021) elaborate on the challenging job of designing educational XR and VR platforms to meet the expectations of educators and students.

XR and VR in education have great potential for research and development. XR technologies can be integrated in the learning environment to allow learners to interact with critical elements in a domain without real risk; they can make the "unseen be seen" in ways that 2D media cannot. There is however a need for more research that will continue to contribute to the growing empirical literature on learning experience design, pedagogy, and practice with embodied and immersive XR technologies.

With only very recent exceptions, (e.g. Yiannoutsou, Johnson and Price, 2021) there is little evidence that studies have considered inclusive XR and VR platform development. There are calls for research on XR and VR learning design focused on presenting design principles for learning in these environments that become of paramount importance as XR and VR technologies continue to make their way into formal and informal educational settings (Ioannou, Bhagat, Johnson-Glenberg, 2021).

Developing technological platforms 'for all' in education

Virtual environments are improving their functionalities and the quality of materials, making it easier for students to adapt to these new learning environments. Some studies have revealed that people with disabilities must overcome previous barriers to ensure the appropriate use however (McManus, Dryer, and Henning, 2014; Rodrigoz and Tabuenca, 2020).

Universities are finding it difficult to convert these virtual environments into learning environments that increase accessibility for persons with disabilities, which makes it necessary to guide faculty members in this transition (Crisol-Moya, Herrera-Nieves, Montes-Soldado, 2020). Currently, faculty training programmes in technology-supported instruction focus on accessibility issues rather than on understanding the specific learning needs of students with disabilities (Fitchen et al. 2009). In their study, Greer, Smith and Basham (2014) showed that many of the faculty members who teach with the support of technological resources are poorly aware of how technological platforms can be promising tools for the individualised education of students with and without disabilities. In addition, most faculty members need training to effectively implement individualised and inclusive teaching in a virtual learning environment (Hsaio et al, 2019; Carballo, Aguirre, Lopez-Gavira, 2021). Academic knowledge of how to adapt virtual environments and digital materials to make them accessible is lacking (Perera, V.H.; Moriña, 2019).

From a practical perspective, research on digital accessibility in higher education is in its early stages (Deaton, 2018). With the rise of blended learning, there is an ongoing concern about accessibility, particularly for students with disabilities (Rasmitadila et al., 2020).

Universal design for learning

To use the principles of universal design for learning (UDL) allows learners to feel "a part of" rather than "apart from" their learning" (Solas, 2021). Designing a training programme based on UDL principles contributes to making education inclusive, improves accessibility without the need for environmental adaptations, and engages participants in their learning (Seale, 2020; Herrara, Crisol Moya and Montes Soldado,2019). Universal design can help provide greater accessibility in the virtual learning environment, not only for students with disabilities but for all students (Pittman and Heiselt, 2014). Studies have shown that the improvement of student learning increases significantly when UDL is adapted (Batanero et al., 2019). However, studies focusing on accessibility do not seem to have consistently considered the design of learning materials in digital format (Iniesto, McAndrew, Minocha, Coughlan, 2016). Although it is recognised that there is no single solution that can meet all individual needs, even when responding to the same type of disability (Brito and Dias, 2020), many materials

shared are not adapted at all and thus accessibility of information among under represented groups is often quite low (Batenaro et al., 2019).
Overall, the literature highlights recent interest in developing research on inclusion and higher education (see for example, Salmi and D'Addio, 2021), but knowledge and training are severely lacking (Emmers, Baeyens and Petry, 2020). There are many calls for better insight on the particular issues of inclusion and inclusive approaches such as UD and UDL.

Methodology

The research design of this paper involves a qualitative single case study adopting multiple sources of data collection (Yin, 2009). Data is collected through documentary evidence, reflective participant accounts and a focus group discussion.

On observation and reflection

Schon (1984: 1987) argued that valuable tacit knowledge can be gained through immersion in observational education practice. Analytic reflections may come in a variety of forms, such as: (1) brief reflective writing, known as "analytic asides"; (2) more elaborate reflections on specific events or issues, known as "commentaries"; or (3) sustained analytic "in-process memos," which are often written after completing the day's field notes (Emerson et al., 2011). This study uses a series of observations and reflections as guided by Rolfe et al (2001). Rolfe et al.'s reflective model is based upon three simple questions: What? (describe the experience); So what? (discuss what you have learnt from this experience); Now what? (identify what you need to do in the future in order to make things better and learn from the experience).

On reflexive journaling

Reflexive journaling is a process in which the researcher reflects on the outcomes of the study as well as on the research process itself. This practice can help promote self-awareness as well as maintain credibility (Smith, 1999).

On focus groups

Focus groups are an ideal research tool for studying and employing group communication in action (Davies, 2017). They hold the unique position of approximating an understanding of communication in vivo, but in a laboratory setting (Krippendorf, 2004). Focus groups allow researchers to listen to group-generated language, listen to people bounce ideas off one another and listen to how people influence each other. The use of a focus group for this

study allowed for a dual purpose of collecting research data and providing a valuable reflection event for XR project team participants in their project.

Research setting and context

The XR VR team of EUt+ is a large project team involving 23 participants across 8 universities within the EUt+ network. The project is led by TU Dublin. EUt+ is one of the European University pilots established through the European Universities Initiative of the European Commission. Partners within EUt+ come from Bulgaria, Cyprus, France, Germany, Ireland, Latvia, Romania, Spain. The XR VR project started in March 2021 and focuses on a task within the EUt+ initiative aimed at developing an approach to supporting plurilingualism and multiculturalism through immersive technologies. The approach will support inclusive mobility across the EUt+ network. The first deliverable of the Team is the development of an XR VR Specification document that will support student mobility by preparing students to overcome language and cultural barriers. This paper focuses on the experiences within the first six months of the XR VR project.

Data collection

Overall reflective learning journals were collected from 6 participants. These journals reflected on social interaction events by recording details, date and place of each interaction and reflecting specifically on the questions of: what did I learn? how did I learn it? why does it matter? and what might be done in light of it? This format for the reflective journals ensured participants focused on the processes that led to the social construction of knowledge about inclusiveness in the project. It should be noted that an early decision by the project groups was to emphasise the project on XR rather than VR. The events covered a period of six months between March 2021 and August 2021. Overall 22 social interaction events were reflected on by 6 participants (Table 1).

Table 1: Participant social interactions between March and August 2021

	No of interactions	**Participants**
Assistive Technology for Teaching and Learning practices	2	A, D
Bilateral meetings with experts	8	D, E, F
Keynote speech on Universal Design in Higher Education	3	B, E, F
Presentation to XR Team by UD/UDL expert	2	E, F
Conference	2	E, F

Padlet discussion	2	C
Student interactions	1	C
Workshops	2	D, E

Data was also collected from the focus group discussion which was organised to last for two hours. Seven participants joined the focus group. Participants were asked to reflect on inclusiveness and designing inclusiveness into the XR VR project in the introductory part. The main part asked participants to discuss social interaction events connected to the XR project during each month from March 2021 to August 2021 from the perspective of how their knowledge about inclusiveness was constructed. Notes and documentary evidence was referred to during the focus group to guide and help participants reflect back to each month of the project. The wind down stage of the focus group reflected on the general question of when to start designing for inclusiveness in education projects influenced by participant learning and prior reflection. The focus group was recorded and transcribed.

Data analysis and Findings

Data sources were analysed according to the social interactions identified from the reflective journals, the timeline discussed in the focus group and documentary evidence. Overall we identified 5 evolutionary pieces that informed participant understanding of inclusiveness related to the design of XR VR platforms.

Piece 1: Including team members – the participant dimension:

Participants identified that at the outset of the project they were concerned with overcoming linguistic inclusiveness. This involved not only working across multiple international locations, but moreover the challenge of how to translate into technical terms across this multidisciplinary and multilingual project team. This was highlighted by Participant E who reflected that:

> '*Sometimes I know for a fact that when the technical colleagues were talking about things I could see they were nodding to each other and I was lost - because they know what they're talking about. So there was a kind of a micro level of inclusiveness.*'

Participants described reaching 'a wall' at this time. Technology was an important social tool for creating a more inclusive team at this stage. Multiple participants voiced the role of Padlet "where we constructively built our questions and our different understandings" (Participant C) at this time.

Piece 2: Including multiculturalism and plurilingualism – the taught dimension:
Once a shared communication tool (Padlet) reduced barriers, participants were asked to share their expertise through partner presentations on the know-how they could contribute to the project. By this time it was understood that the most visible objective of the project was to assist students with multicultural and plurilingual learnings. Inclusivity at this stage included cultural and lingual inclusiveness in the taught experiences for students. It was suggested at this stage that:

> *'the scaffolding and that group formation process, then I suppose, once we started being more comfortable with each other as well that helped to move the process along in terms of our shared vision and our understanding.' (Participant C)*

Piece 3: Introducing inclusive multiculturalism and plurilingualism – the inclusive taught dimension:
As knowhow and technical expertise was shared, a vision was starting to emerge about what the project would entail. The need to develop a platform that not only supported inclusive learning, but also supported inclusive mobility, was realised by the team after maybe two months. Participant C highlights how "It started off with linguistic and cultural, but it gradually opened up the spectrum, and it started focusing on gender and also disability." Design approaches such as UD / UDL were introduced to project participants through bilateral meetings and through expert presentations to the project team.

Piece 4: Including everything – a practical problem:
Introducing principles for inclusive learning to the project team sparked keen interest among members and encouraged some to explore and engage in other social events to build knowledge and understanding about inclusiveness and universal design. Team meetings started to interrogate how UD / UDL could be developed within the project to ensure inclusiveness from the outset. Once this was introduced, the concern to 'design for all' started to become overwhelming for project participants.

> *'What feels overwhelming is how to cater for all these different groups and also the range of ability or disability that each one might have because thinking about what you can do, what you can access or you cannot access.' (Participant C)*

Although the project team embraced the ambitions on inclusiveness and the principals of UD and UDL, tensions between the theoretical and the practical started to emerge. This was

in particular because research is still very conceptual in this area. There was very little empirical evidence to rely on.

Piece 5: Technology to create human interactions:

Boundaries for the project needed to be established, limited not only by capabilities and resources for the project, but also driven by user stories and more bottom up approaches. Reaching a consensus across the project team on what designing for inclusiveness in HEI technological projects means and when to start thinking about inclusiveness was realised in this time. Table 2 highlights the journey of project participants in the development of the project.

Table 2: The construction of inclusiveness in technology projects for education

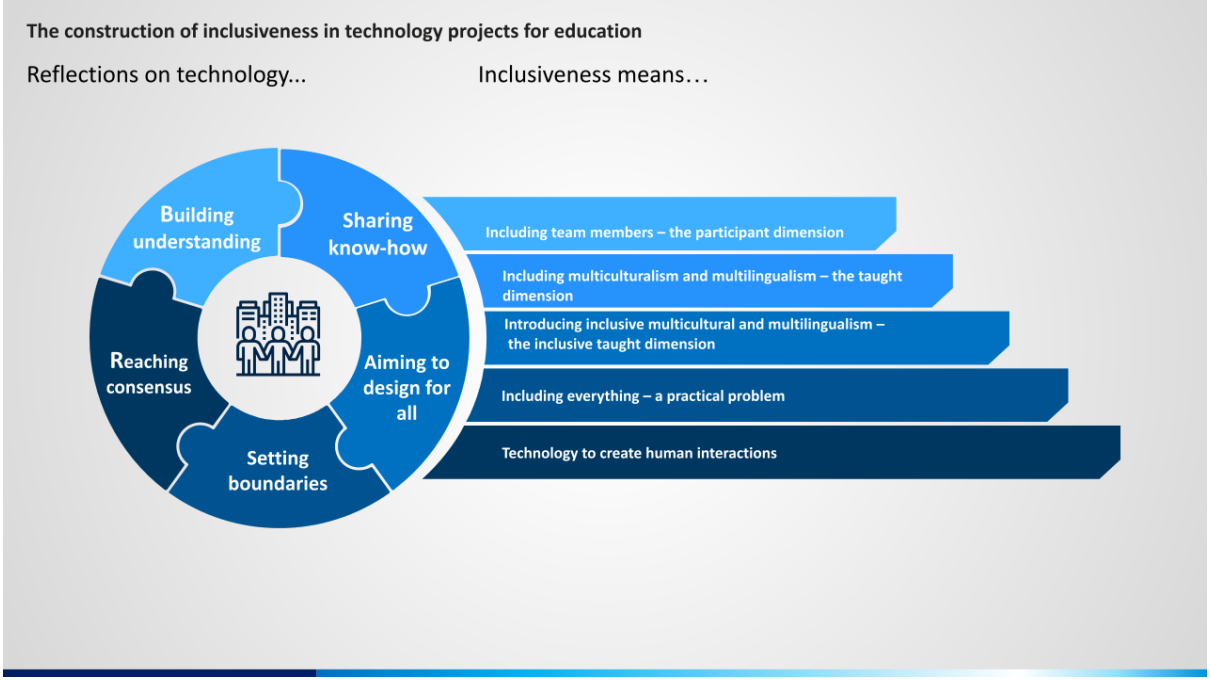
	Reflection on technology	Social interactions	Inclusiveness means …
Piece 1	Building a common understanding around the technology to be used – figuring things out	Meetings between project team members ….	Building understanding – the participant dimension
Piece 2	Sharing technological knowhow – integrating project objectives	Plus ….presenting technical knowhow	Sharing knowhow – the taught dimension
Piece 3	Introducing inclusiveness ambition – designing for all	Plus ……meetings and interactions with UD/UDL and related experts on widening participation	Aiming to design for all – the inclusive taught dimension
Piece 4	Concern about technological boundaries, resources and capabilities	Plus ….. seeking out further social interactions to understand inclusiveness	Setting boundaries – a practical problem
Piece 5	Thinking about humans interacting through technology	Plus …..creation of user stories to direct focus. Consideration of need for bottom up input.	Reaching consensus - T echnology to create human interactions

Discussion and Conclusion

This project team set out to develop an XR platform to support multiculturalism and multilingualism in EUt+ with inclusivity at the heart. Principles of Universal Design are considered in the design piece . Because of the lack of empirical evidence in the literature regarding the design of an inclusive XR VR platform, the team had to rely on the construction of their own understanding of inclusiveness and the embedding of UD/UDL principles into the design phase of the project. Conceptually, creating inclusive technological experiences for students energised the team, but as this paper shows it also added layers of complexity and challenges in the process.

We think about the construction of participant understanding of inclusiveness among the XR team as a jigsaw. As our understanding of inclusiveness evolved in the infancy of our project, pieces of the jigsaw were built until a consensus in understanding emerged. A key theoretical contribution of our paper is to show the wider understanding of inclusion when referring to the digital setting and the process for the construction of its meaning (Figure 1).

Figure 1: Piecing together the construction of inclusiveness in technology projects for education.



The study identifies the process and timeline of social interactions that helped to construct project team participant's conceptualisation of inclusiveness in technological platforms in higher education. This is an evolutionary process starting with team members and a concern about technological and technical inclusiveness. It evolves then towards taught

elements integrating multiculturalism and multilingualism into the experience for students. From this it moved to a student approach, recognising diversity of student populations and a desire to ‘design for all’. In the final stage, inclusiveness moves from the conceptual to the practical where the importance of user stories and bottom up influences is recognised both to understand needs from the student perspective, but also to respond to those needs within capabilities and resources within the project and institutional parameters.

Our study responds to Holly et al. (2021) helping to elaborate how designing educational VR platforms can meet the expectations of educators and students. It also responds to problems of how materials can be adapted in technological platforms for underrepresented groups (Batenaro et al., 2019). Ensuring inclusiveness in HE institutions, can help students with disabilities who might fall behind to realise their full potential (Salmi and D’Addio, 20202). According to Booth et al. (2002), there are three important pillars that need to be accomplished in order to establish an inclusive learning environment: inclusive culture which grounds the other two pillars, inclusive practice and inclusive policy. This study has demonstrated that an inclusive learning culture can be built bottom up through an open and collaborative plan where all views are welcome. Considering the establishment of the XR group as an inclusive learning group, we aspire to create and implement inclusive policies and recommendations for Higher Education Institutions.

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