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Item Type	Article
Authors	Colreavy-Donnelly, Simon;Ryan, Alan;O'Connor, Stuart;Caraffini, Fabio;Kuhn, Stefan;Hasshu, Salim
Citation	Education Sciences 12(7), 435
Publisher	MDPI
Download date	2026-10-24 21:46:26
Item License	https://creativecommons.org/licenses/by-nc-sa/4.0/
Link to Item	https://doi.org/10.34961/researchrepository-ul.22059164

education sciences

MDPI

Article

A Proposed VR Platform for Supporting Blended Learning Post COVID-19

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Abstract: The COVID-19 pandemic caused a shift in teaching practice towards blended learning for many higher education institutions. This led to the rapid adoption of certain digital technologies within existing teaching structures as a means to meet student access needs. This paper is an attempt to summarise and extend pre-COVID-19 pedagogical research to leverage digital immersive technologies for blended teaching in the post-pandemic era. This paper forms both a review of these methodologies and a case study of the *I-Ulysses Virtual Learning Environment* as an example of a platform that leverages such immersive digital technologies and employs instrumental use of VR. To further clarify, the purpose of the paper is to describe and propose a distance learning solution with immersive VR qualities; this is what the *I-Ulysses* environment represents, as the main obstacle to learners of site-specific information during the pandemic has been lack of on-site accessibility. Furthermore, this is of key importance, because Joyce's novel takes place in historical Dublin, where access to the physical location of the story is indispensable to a reader.

Keywords: audio-visual technologies; blended learning; pedagogy; virtual learning environments; virtual reality

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Citation: Colreavy-Donelly, S.; Ryan, A.; O'Connor, S.; Caraffini, F.; Kuhn, S.; Hasshu, S. A Proposed VR Platform for Supporting Blended Learning Post COVID-19. *Educ. Sci.* **2022**, *12*, 435. https://doi.org/10.3390/educsci12070435

Academic Editors: Carlos Vaz de Carvalho and Merja Bauters

Received: 27 April 2022
Accepted: 22 June 2022
Published: 24 June 2022

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1. Introduction

The following paper presents a review of the literature in the area of teaching pedagogy, specifically the use of audio-visual technologies, and a case study of the *I-Ulysses Virtual Learning Environment*, employing *Virtual Reality* (VR) (for context: the *I-Ulysses* project is as a virtual reality experience, guiding the user through the unfolding events of James Joyce's *Ulysses* in real-time. *I-Ulysses* aims at providing an educational tool intended to help the user understand key aspects of the book, namely, its relationship to the technology of the day and recreations of the physical spaces of historical Dublin, where the novel is set). In many respects, the COVID-19 pandemic has necessitated a new approach to learning and teaching, with a focus on dissemination through increasingly more technological formats. There is, thus, a need for such a review. The pandemic has had two major implications for teachers in a wide variety of disciplines. *Panopto*, for example, or similar audio-recording technologies have been adapted by a number of higher-level institutions in the wake of the pandemic, as has the need for a blended learning model. Many of these adaptations have been circulating in teaching and learning discourses since before the pandemic, so it is in many respects serendipitous that practitioners in fields of technological education can leverage their expertise here. In fact, many such techniques are ubiquitous in fields such as graphics, simulation, virtual reality, serious learning, and game development, on account of the nature of those subjects [1,2]. Specifically, the authors wish to focus on the nature of the project as a VR project, and there have been numerous recent offerings in this field [3–5]. While embracing audio-visual technologies, it is also important to highlight

cases were they may marginalise certain individuals, and so this is another objective of the review. For this reason, the paper looks, in the Irish and UK contexts, at the deployment of the *I-Ulysses* project, which aimed to combine teaching practice, serious learning, and methods for embodying and representing spatial and social tropes with a VLE. In summary, in terms of the importance of on-site presence and why being physically present in Dublin is important to reading *Ulysses*, linking these concepts is necessary to explain why VR matters here and, subsequently, how it is of potential significance for virtual learning post COVID-19.

2. A Comprehensive Review of Theory Part 1: Pre-2010 Consensus

The following review is split into two parts: the first aims to address the pre-2010 literature on the topic of teaching and learning in a remote context. The second focuses on blended learning methodologies and integration with immersive learning environments and VR. The reason for this is that the former asks a pertinent question: "given the necessity of the technological shift, can technologies help mediate learning materials to enhance student engagement, or are the affordances of this technology transient?" The authors felt it was prudent to leave this an open question, even if the second part, through its practical application of the COI framework, assumes the answer to be in the affirmative. The pre-2010 consensus is equally valid to explore.

2.1. Context: UK and Ireland

The COVID-19 pandemic has profoundly disrupted education delivery, affecting 1.6 billion learners in more than 200 countries [6]. Before COVID-19, distance learning was an important element of modern education, with 35 percent of US students studying partially online in 2017 [7]. COVID forced a sudden transition from planned remote teaching to emergency remote teaching [8]. In the context of Ireland and the UK, this transition was seen as an acceptable compromise since, for example, Ireland has 91.9 percent internet access, and the UK has 94.9 percent. Issues that have emerged include inadequate online teaching infrastructure, the relative online-teaching inexperience of teachers, and the home environment [9]. This lack of professional training for instructors extends to a lack of technical support for content development [10]. A recent survey of lecturers in an Irish HE institute revealed that 77 percent of lecturers had little or no experience with teaching in an online environment, pre COVID-19 [11].

However, simply providing training for instructors in *virtual learning environments*, providing better technical support, and hoping that students can create an appropriate environment for learning at home is not a coherent evidence-based pedagogic strategy. Before considering what improvements can be made in this new educational paradigm, even before researching how technology itself affects educational practice, there must be a deep understanding of educational practice itself. Research into pedagogic practice is fraught with problems, despite uniform opinion that educational research must always have the same focus: how to improve learning, and thereby, how to improve teaching [12]. The difficulties exist because researching education is about researching a complex series of relationships to produce actionable information. There are profound issues in reaching an understanding of the complex relationship between the teacher and student, between the student and their peers, and especially the relationship between the student and their own mind.

2.2. Critical Genealogies

In *Experience and Education*, John Dewey argued that education was of such social importance that it should always be an "arena of struggles, practical and theoretical", always changing and adapting, just as the students and the society they live in changes and develops over time [13] (pp. 241–252). He urged all educators to strive towards continuous adjustment and improvement, acknowledging that educational policymakers had the difficult task of taking all these practical and theoretical struggles and creating a philosophy

of education practice from them. *Critical Pedagogy* scholar Paulo Freire advocated for educational practice to be empowering, that learners should go from "the consciousness of the real" to "the consciousness of the possible", by a learner perceiving possibilities beyond their limiting situation. Students' assignments and projects should be designed in opposition to what he called the banking concept of education, where knowledge was a gift bestowed without any acknowledgement that education is a process of inquiry [14]. While any activity can be educational, the quality of the experience must be judged by what is being learned, judged by how that activity helps the student to make sense of things, how it leads the student to ask further questions, how it engages the student with what is before them [12].

This pedagogic engagement refers to a student's active involvement and participation in educational activities. While "Motivation" is the direction and intensity of one's activities [15], answering the question of "why am I doing this?" [16] (p. 11), ''Engagement" is the behavioural "intensity and emotional quality of a person's active involvement during a task" [17] (p. 147). Engagement entails students' reactions to, and interactions with, the learning material as it is embedded in the physical, instructional, and social environment, and has been studied actively for decades [16–18]. Motivation is an attitude that is much more general than Engagement, which must always be subject specific. Once an educational system creates an educational program, then measuring its success on an individual level requires an analysis of the following factors of engagement: Behavioural, Emotional, Cognitive, and Agentic. [19–21]. In addition, a socio-behavioural dimension should also be included, namely, an examination of collaborative engagement in group work [22]. Järvelä et al.'s study focused on how collaborative learning tasks were central for motivation, and how engagement is different when collaborating [23].

2.3. Remote Learning

What happens when traditional teaching models, based on these psychological models, are mediated through remote learning? Does changing the method of delivery affect learning? If so, how exactly does changing the method of delivery affect how a student cohort learns? To begin to answer this, we need to examine *Constructivism*, a theory from the field of cognitive science and initially based on the work of Jean Piaget [24,25]. *Constructivism* is fundamentally non-positivist, with an "epistemological view of knowledge acquisition that emphasises knowledge construction rather than knowledge transmission, where the learner is conceived as the one building and transforming knowledge" [26] (p. 6). The focus is on cognitive development and deep understanding, rather than learning skills. It must be emphasised that when *Constructivism* is applied to pedagogy, it is a psychological theory of learning and not a description of teaching. *Constructivism* describes how structures, language, activity, and meaning making come about, emphasising that the individual's construction of knowledge is stimulated by internal cognitive conflict as they strive to resolve mental disequilibrium. Learning is not the result of development; learning is development [27]. *Constructivism* describes how activity and meaning making interact [27].

An underlying assumption with this is that, while individuals change as they continue building on an ever-increasing foundation of knowledge, the cognitive process of learning continues to function in much the same way throughout their lives. How does this understanding of the psychology process of learning affect the design of post-COVID-19 pedagogic practice? Rovai and Downey risk stating the obvious with "a well-designed online course offers an active-learning environment in which meaning is socially negotiated and students are actively engaged in the learning process" [28]. Unsurprisingly, the *VLE* has become a classroom with a reciprocal empathy between student and teacher, although there is emerging evidence that this new pedagogic setting leads to a reduction in engagement because of a lack of direct interaction, while simultaneously leading to an increase in engagement because of recordings made available for asynchronous learning [29].

2.4. Learning Styles

In addition, Buckley et al. [29] observed that engagement was now individualised, and no longer a communal effort. This is a potentially dangerous development, as *Social Constructivism* views the origin of knowledge construction as being at the social intersection of people, the sharing, comparing, and debating between learners and mentors [30]. In contrast to Piaget's focus on individual constructions, the socio-cultural approach emphasises the socially and culturally situated context of cognition, the social origins of cognition, how an individual's appropriation of language is a mediating tool to construct meaning. Collective actions become the focus, where "learning occurs as people participate in shared endeavours with others, with all playing active, but often asymmetrical roles in socio-cultural activity" [31] (p. 7). In addition, while asynchronous learning facilitates flexible learning, and while this is a positive development, the lack of direct contact between student and teacher has diluted the positive aspects of the student/teacher relationship [32].

Perhaps technology can compensate by facilitating the different ways that students learn best? Consider first that *Constructivism* defines 100 learners as 100 individuals who all learn differently, their cognitive processes profoundly affected by their individual knowledge and individual experiences, even though so many life experiences are shared. Advocates of *Learning Styles* reduce complexity by positing that individual learners can be grouped into types, so that 100 learners can become 4 or 5 groups. Advocates suggest that curriculum design should be leveraging this in an advantageous way, insisting that their perspective is evidence-based and not simply the result of a desire to reduce complexity in the interests of efficiency. However, according to John Geake, "studies of educational effectiveness of applying any of these ideas in the classroom have failed to find any educational benefits" [33] (p. 1). Riener and Willingham go further and assert that there is no credible evidence that *Learning Styles* exist. They reason that it is individual ability, background, knowledge, and interest that overwhelmingly affect learning, and the focus on *Learning Styles* comes at the cost of attention to those factors [34].

2.5. Summary and Signposts to Virtual Reality

While subject-specific ability obviously varies from individual to individual, according to *Learning Styles* theory, an educator should be able to improve learning performance by matching instruction to a student's learning style. If learning styles is a neuromyth, then educators should simply continue to present information in the most appropriate manner for the content itself, taking into consideration the cohort's level of knowledge and the desired learning outcomes [35,36]. The socio-cultural *Constructionist* approach suggests that the purpose of technological developments is to bridge the emotional distance created by distance learning. While social distancing has been necessary because of COVID-19, and distance learning will continue post-COVID-19, we must remain focused on using technology to facilitate learning and understanding. A learner's understanding is not constructed at the site of information; understanding is constructed with the information [37], constructed by the individual in a social context. So a question to be answered of this discourse is, given the necessity of the technological shift, can VR and immersive technologies help mediate learning materials to enhance student engagement on an intellectual level by reflecting something innate about the content of the material? Furthermore, can technology leverage access to esoteric cultural information in a way that opens it up more, whilst also creating greater social interaction combining the aforementioned dimensions and the teacher and learner in a time of social distancing? This then brings us to the discussion of the *I-Ulysses: Virtual Learning Environment* and *Virtual Reality*, as VR enables the removal of both learner distance and access to site-specific cultural information. This is centrally important in reading Joyce's *Ulysses*, as the city of Dublin is effectively another character in the story.

The authors would also like to draw attention to [5], where the authors likewise identify issues with teaching modality in the era of COVID-19, but in the context of teaching Physics. This demonstrates, in the authors' opinions, the potential for use of emergent techniques and the need for adapting and innovating. In this new era of blended and online teaching, a

range of paradigms can and should be established across diverse subject disciplines. As a result, there is a need for a taxonomy and consolidation of such techniques.

3. A Comprehensive Review of Theory Part 2: *I-Ulysses* and Randy Garrison's Blended Learning

3.1. Psychoacoustics and Virtual Reality

In his work *Acoustic Territories*, Brandon LaBelle [38] focuses on sound culture and everyday spatial experience in urban settings. LaBelle is an installation artist and his work focuses on practical acoustical work and sound engineering in simulated spaces. A tentative connection between this work and James Joyce's classic *Ulysses* can be read in the way he discusses the flaneur and his analysis of Michel DeCerteau's theories of psycho-geography. LaBelle notes how, "leaving the house, the dynamics of sound and auditory experience open up towards a realm of greater public interaction conditioned by rhythms and the mobility of being on the go" (p. 6). The locomotive urban experience that LaBelle describes in the informal public life of the "Sidewalk chapter", with its unique set of acoustic and audio-spatial relations, maps the auditory experience of a city walker. It joins this experience to the social and public spheres of city life in a way that echoes Joyce's description of his main character Bloom's journey.

"...Opening the window of my apartment on a warm sunny day, the acoustical shape of the overall room is flooded with overall input, re-mixed by the passing of cars, the humdrum of voices, birds in the trees, and the breeze...leaving the apartment, I jump out into this mass of sonority, like a tumbleweed... the sidewalk seems to overwhelm or disregard the dichotomy of silence and noise with a general hubbub rising and falling through the day and night...pockets of intensity, zones of volume, shifting gradations of acoustical flow that makes the sidewalk a sort of sound membrane contoured by the noise of the street on one side and the buildings on the other...the sidewalk throbs with acoustic life, and the walker, I suggest, beats back..." [38] (p. 88). Like Bloom, whose imagination actively reciprocates the city life, LaBelle notes that the city walker is not a passive receiver of audible cues, but also pre-empts and organises them, "beating back as a physical body" (ibid).

In 2011, the *I-Ulysses* project sought to represent the specifically aural features of Joyce's novel, in a format akin to LaBelle and DeCerteau's acoustic and psycho-geographical maps—specifically, as a video game experience, in which the user could experience the sounds of the novel, rendered in a realistic 3D spatial environment [39–41] which maps the environment in 3D and also allows a smartphone user (see Figure 1) to interact with it in a manner as if they were there. Similar projects had looked to represent the events in a format akin to a walking tour experience, but none had explored the use of immersive *Virtual Reality* technologies to that end. At the time, the value of such a project was further aided in the use of smartphone technology, wherein a user could experience the game while walking around the actual setting of the book, and an interplay of those elements can be key to the experience. The format of the project took a similar format to the popular mobile game *Pokemon Go* Figure 2 (2014), but with more academic and serious learning trappings and which predated the Nintendo game by a number of years.

At that time, creating a virtualised learning environment with a blend of real, virtual, and augmented components was largely novel and experimental for typical teaching practice. However, with the onset of the COVID-19 pandemic, the need to create a virtual experience for a learning environment was pushed to the forefront to tackle obstacles of physical presence, raising the value of such a tool. Specifically, the integration of a psychologically realistic VR environment, wherein spatial and audio cues could be presented and discussed in a social classroom setting, would be key and serve to create an immersive learning experience. This has vast implications also for the delivery of blended learning material and the curriculum as whole, which was an area the project explored comprehensively in respect of how the game could be used as a virtual classroom—specifically, the creation of a site-specific, realistic VR spatial experience, where access to

the location is an issue. What follows is a case study of such work, aiming to address issues raised in Section 2.

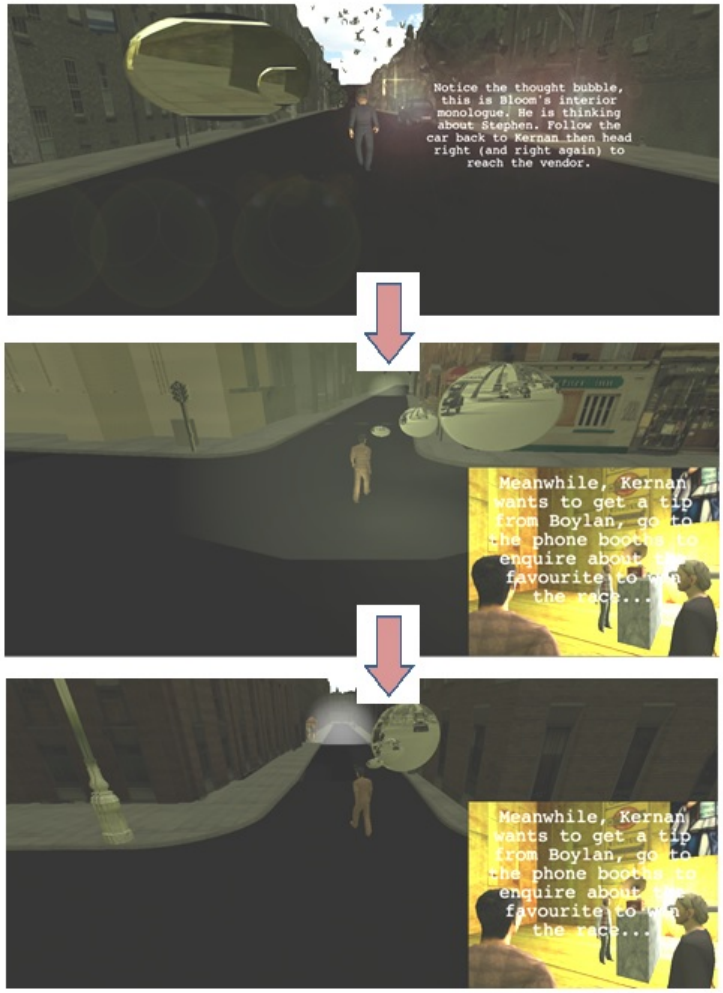


Figure 1. *I-Ulysses: the Game*.



Figure 2. *Pokemon Go* (all rights reserved).

3.2. Methodologies: Blended Learning

The central objective of this section is to show how the *I-Ulysses* educational model could be used in practice. This section utilises examples of teaching techniques and Randy Garrison's discussion of the operational and instructional tenets of the COI [42,43] to discuss what blended learning is, what the *Community of Inquiry* (COI) is, and how it serves as a practical framework for implementing a blended learning that addresses the issues in Section 2. Blended learning is a term that describes both a specific learning model in education and a model for developing ICT learning resources for classroom settings. This blended learning methodology is employed in an enhanced, interactive learning setting. Blended learning, like digital humanities, uses both teaching and humanities computing methodologies. Randy Garrison notes the popularity of the emerging blended learning methodology by outlining that it is an approach and design that merges the best of traditional and web-based learning experience to create and sustain vital communities of inquiry that many higher-level institutions are quickly positioning themselves to harness for its transformational potential [44].

The blended learning model is accompanied by an implementation framework known as the *Community of Inquiry* paradigm. The paradigm is used as a method to blend learning resources and materials together into an integrated, practical learning setting. Blending learning represents a unified framework that merges the public and private worlds in a framework that avoids the confusion of separation into theory and practice [44]. The *Community of Inquiry* (COI) is a tripartite model divided into three categories, or presences of the learning and teaching method (Figure 3 and Table 1). These are the social presence, the teaching presence and the learning/cognitive presence. The COI serves as a means to practically implement the social and cognitive aspects of education studies in a blended learning context. Because the mediation and modality of a learning material represents a further dimension of its understanding, this has lent value to the use of ICT in classroom environments and, in this case, the *I-Ulysses* project.

Garrison states that, "blended learning is more than enhanced lectures. It represents the transformation of how we approach teaching and learning. It is a complete redesign of the educational environment and the learning experience" [44] (p. 6). Blended learning represents a potential model for implementing ICT in teaching practice. The COI seeks to implement an instrumental framework for that blended learning, where the use of ICT is innovative and not substitutive, focusing on how specific ICT tools can provide new understanding in participatory learning settings. The value of such paradigms in the context of the COVID-19 pandemic and specifically, in the case of *I-Ulysses*, is in being able to map a virtual environment and fold this into a virtual, online curriculum, delivered in a virtual, or partially virtualised, classroom.

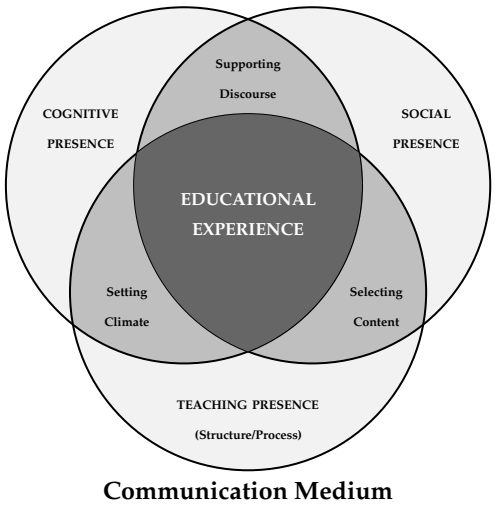


Figure 3. The Community of Inquiry paradigm [44].

Table 1. The COI [44].

Elements	Categories	Indicators
Social Presence	Affective Expression	Emoticons
	Open Communication	Risk-free expression
	Group Cohesion	Encourage collaboration
Cognitive Presence	Triggering Event	Sense of puzzlement
	Exploration	Information Exchange
	Integration	Connecting ideas
	Resolution	Apply new ideas
Teaching Presence	Design and Organisation	Setting curriculum and methods
	Facilitating Discourse	Sharing personal meaning
	Direct Instruction	Focusing discussion

Blended learning is a participatory learning model that combines educational theory, curriculum, and humanities computing. The blended learning model's ICT-invested approach is similar to the analytical and "synthetic" models of Patrick Svenson, Susan Hockey, Matthew Kirshenbaum, and Willard McCarty [45–47]. Their *Digital Humanities* philosophy employs ICT in an instrumental humanities framework. The philosophy underpinning blended learning involves a similarly holistic and instrumental dimension. The research of academics working in education theory and the digital humanities is transferred between the fields, whilst also yielding new research models for working with digital practice-based scenarios.

Garrison also notes that one of the main areas where blended learning enables new understanding is in distance learning, or providing remote classroom environments where tutors are encouraged to thoughtfully integrate face-to-face and online learning and fundamentally rethink course design to optimise student engagement [44]. Garrison concludes that this crossover with distance learning is not the only benefit that ICT can afford the classroom, but that it is central in a learning format in which verbal, visual, and aural information is communicated and disseminated electronically. As Garrison notes, "Blended learning recognises the strengths of verbal and text-based communication and creates a unique fusion of synchronous and asynchronous, direct and mediated modes of communication" (p. 6). The *I-Ulysses* project uses specific curriculum testing scenarios developed by Garrison [42,43].

3.3. Critical Paradigms: The Arranger and the Blended Learning Model

In this section, several aspects of the blended learning methodology will be related to the specific methodology employed in the *I-Ulysses* project. Aspects of Joyce's work shall be discussed and the COI will be used as a model to examine and interrogate the methodology employed in the project, with reference to Section 2. The concept of the *Arranger* [48], an idea from Joyce studies, will be noted as an analogue to a number of the aforementioned concepts, and will be discussed after the tenets of the COI are established.

The first tenet of the COI is the social presence. The social aspects of online learning represent a significant dimension of the COI and the blended learning methodology. As discussed before, Garrison notes that one of the central capabilities that ICT learning enables is the creation of remote classrooms and distance learning. Joyce studies has undergone a dramatic shift towards online media in recent years, as Joyce social and academic networking has a significant online presence. With the ability to communicate and share information directly, manuscript studies and archival research are now being conducted in a predominantly electronic format, evidenced by the *James Joyce Collection of the University at Buffalo*, which holds most of the archive materials relating to Joyce, moving all of its materials online. The movement of manuscript work into an online setting has had an important effect for literary studies, namely, that the academic discussion of the original work has also shifted online in response. Many of Joyce's larger works are read in reading groups, and in a reading group, social presence is a key factor. In terms of the

virtual classroom setting, there is a natural fit for reading literature together in groups and connecting that setting to a literary online community.

The second tenet of the COI is the cognitive presence. Joyce encourages a reader to conceptualise and deconstruct meaning in a self-reflexive and recursive fashion. Joyce's works have an open-meaning structure, with the possibility of a variety of different, hypertextual interpretations. Each interpretation can be organised into a hierarchy of individual associations and meanings. Joyce's interior monologue technique portrays an individual's inner thoughts and embeds them within the wider array of collected experiences. With the use of ICT, it is possible to sustain a network of meaning in a way that does not privilege one particular reading. It is possible to organise and structure these meanings within a hypertextual framework that can propagate new understanding. An online classroom is also reflective of collective experience and verbal communication in a wider, electronically enabled setting. With digital media tools, it becomes possible to explore the visual and aural dimensions of Joyce's work and to connect them to *Ulysses*' hypertextual structure. This gives the class the added benefit of seeing the techniques used in practice, while connecting them to the higher networks of meaning from the book, thereby fulfilling the cognitive tenet of the COI.

The final tenet of COI is the teaching presence. The *I-Ulysses* project provides a learning guide to *Ulysses* that is interactive and can be studied as part of a Joyce course or English curriculum that complements audio-visual resources and references and supports the effort of the teacher in the classroom. When the user interacts with the *I-Ulysses* environment, they do so in a manner that takes them through the physical space of Dublin virtually, while simultaneously exploring the threads of *Ulysses*' narrative in the environment. This has the added benefit for the tutor that when they focus in on a specific aspect of the text and environment they do not disrupt the overall flow of the environment for the students. In this way, the *I-Ulysses* project preserves the instructional and operational frameworks of the blended learning model while making the experience of using the environment a participatory experience.

3.4. Practical Scenarios: An Analysis and Overview

The many threads of meaning in *Ulysses* correspond to nodes or juncture points of meaning; Joyce provides a topographical overview of Dublin whilst conveying a complex arrangement of events through the presence of an *Arranger* [49]. In the *I-Ulysses* project, the teaching presence of the COI mediates the *Arranger* presence and the teacher in the classroom has the objective of conceptualising the *Arranger* for the class, using illustrative scenarios from the environment. Examples of these scenarios will be noted shortly, and the areas of intersection between the blended learning methodology, the COI, and the *I-Ulysses* project are shown below in Table 2.

As part of the project, the author undertook an *Enterprise Ireland*-sponsored feasibility study in 2014 to assess the value of spinning the project out into a commercial start-up. During this process, some valuable resources were developed to assist in developing the marketing and distribution platforms of the environment. Some of the content developed for the feasibility is of direct relevance to this section, particularly areas of resource management in an e-learning curriculum, which Garrison points out as being a topic of the blended learning framework [44]. One of these resources was a promotional *Facebook* page (see Figure 4) that linked to a survey about the project. The page is used here as an example of an e-learning resource that could be useful for a tutoring purposes, using the environment in an educational context. In its current format, the page shows images and videos from the environment, but could be expanded into a more diverse range of formats, including maps, reading materials, interviews with scholars, other linked data images, music, and recordings of the book being read. Focus groups, interviews, surveys, and seminars were also organised via this platform, and a survey was hosted there using the *Survey Monkey* platform.

The tutor would draw student's attention towards Joyce's use of the interior monologue technique to focus on the experience of different characters by going inside their stream of consciousness. The tutor would discuss each of these presences and have the students read through the book as characters from the novel. After they played through relevant segments of the environment, they could later go online, consult the relevant section of the website, and discuss what they had learned in class that day. Each of the relevant presences in the text would refer to a specific waypoint in the environment and break down the significant themes and tabs in the interior monologue section. Most importantly, the tutor can illustrate these scenarios in a 3D VR environment that represents the city from the book in a realistic way, in a format that would not be possible with restrictions of physical location.

Table 2. *I-Ulysses* COI framework overlap.

Tenet of COI	Description	Implementation in *I-Ulysses*
Social Presence	Use of social media, reading groups, and classroom setting	Offering the possibility for a wider engagement with *Ulysses* in a virtual format, involving several participants and complementing reading the book aloud in a classroom/reading group setting
Cognitive Presence	Developing curricula that encourage formation in a recursive manner, with respect to the structural and cognitive aspects of learning; use of ICT to facilitate this bridge of meaning	Use of links in the environment, drawing the user's attention to use the *interior monologue* of meaning technique, the multi-linear structure of the novel, and connections between key events and characters
Teaching Presence	The role of the teacher in facilitating meaningful learning interactions	Equating the teaching presence/designer of the environment with the *arranger* of the text, the layered level design of the environment mirroring *Ulysses'* multi-linear storyline



Figure 4. Promotional materials.

The class could look up the relevant headings in the interior monologue tab, which the tutor or students in the class could regularly update. The involvement of the group in this manner creates a learning community which can tap into the already vast online resources devoted to Joyce. This functionality complements features from the environment; for example, embedded in the environment is a recording of *The Croppy Boy*, a representation of a gramophone, footage of the *Royal Ascot Cup*, and images of *Gentleman Jim Corbett* from

Patrick Dignam's interior monologue, forming a multi-media resource. Each *Waypoint* from the environment refers to a specific theme or technique from the book, and the imagery and sound effects can support the structure of the set learning themes in a way that complements the environments' key screens. Obviously, the capacity for exploring the physical locations noted in a virtualised environment is of value to those who cannot physically attend those locations, but the network of information hosted in such a format also adds considerable value to the VLE.

Key aspects of the character, such as their motives, what the specific character was thinking, and giving clues as to why they may think in a particular way, draws attention to the different character's points of view and uses multi-linear storytelling techniques. Examples of such story nodes can be seen in Figures 5 and 6. The key to Joyce's use of the monologue is the joining together of different characters' points of view. By hosting these elements in a network that the student can easily visualise as part of the game, the format of the book is made easier to understand and a cognitive link between the space of the environment and the themes of the book is created.

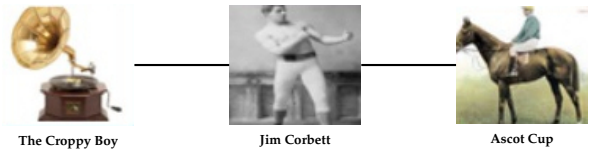


Figure 5. Story nodes.

In *Ulysses*, the *Arranger* [49] gives hints and clues as to its presence: subtle alterations in Joyce's use of the style that he developed and examples of this are evident in the use of the pigeon ("Rocoocooe") and the operation of the record machine sound effects interspersed throughout the interior monologue (Figure 6). The *Arranger* is an analogue for Joyce, the designer and architect of *Ulysses*, connecting ideas and motifs together in a hyperlinked order. The techniques that Joyce employed naturally lend themselves to an electronic learning context. The presence of the *Arranger* organises the narrative into different strands and builds the story around an assumption that the reader will follow the narrative pattern, trying to learn more about *Ulysses* by solving its puzzles.

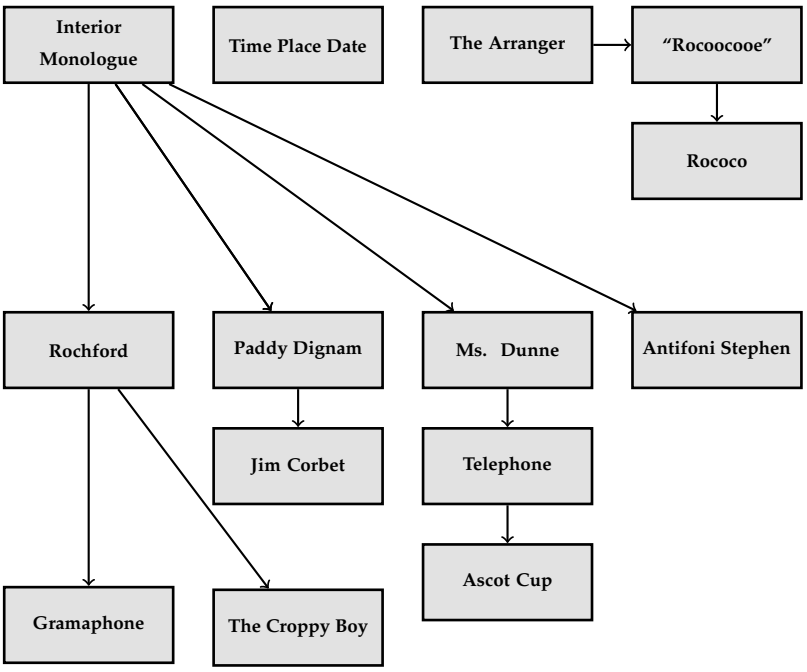


Figure 6. The Arranger.

The designer of the environment is comparable with the novelist, as they are trying to visualise the narrative through connecting sound and spatial geometry in a way that illuminates its presence as the narrative architect of the text. With the use of game development tools, the separation of the different narrative strands through use of context-sensitive thought bubbles and multiple views through the same space meaningfully enhance participatory engagement with *Ulysses*. The ability to provide imagery, music, dialogue, and hyper-linked content can facilitate the *Community of Inquiry* paradigm of the blended learning methodology. For example, maps and illustrations can be linked with the 3D VR environment (Figure 7), and it becomes possible to explore the locations of the historical Dublin of the story without being physically present.

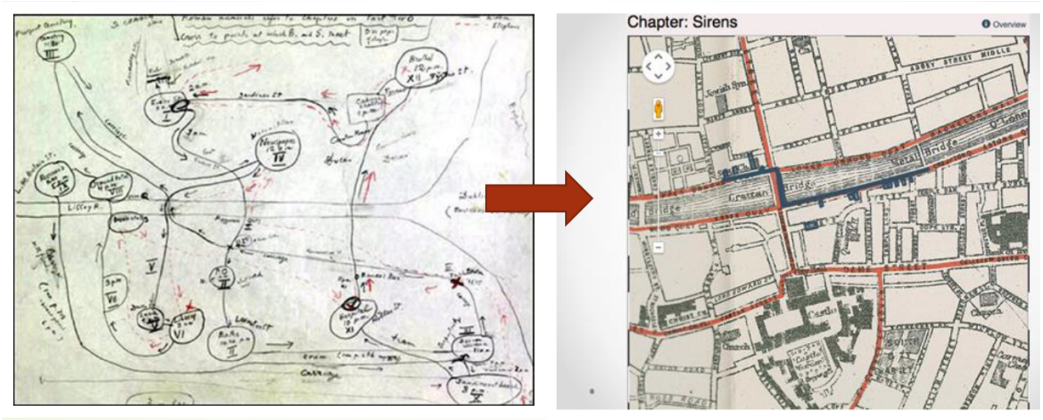


Figure 7. Maps and illustrations [41].

Specific examples of relevant technologies, such as the trams, the gramophone, and phone conversations, are provided in a spatial setting, facilitated through use of the game. Key points where this technology fits into and complements the other techniques, such as the use of the interior monologue and switching between characters, can be structured in a way that complements the experience of reading the novel. With the addition of the virtual format, the user is able to see the relevant scenarios unfolding in real time as they play them, while not having to worry about physical location. Thus, linking back to the discussion in Section 2, the *Arranger* becomes an excellent analogue for both Joyce, the architect of the VLE, and the teaching presence: mediating and interlineating those presences into a workflow, complementing the social dimensions of a participatory VLE with VR technologies.

3.5. Survey Scenarios: Classroom and User Samples

While the tutor is interacting with the environment, or using it as part of a classroom activity such as a reading, they can focus in on specific facets of the book without disrupting the overall flow of the experience. The virtual scenarios were based on the author's interactions with students and tutors who teach Joyce and were informed by several user-test samples and focus groups that focused on improving the interface. In total, there were seven samples; eighteen students of English from the National University of Ireland, Galway, thirty students from the University of Vienna, nine students from the School of Computer Science at Trinity College Dublin, and members of the public at the James Joyce Centre in Dublin, Ireland. The first sample at the James Joyce Centre consisted of seven participants: they were Joyce enthusiasts, a journalist writing for a national newspaper, and students at University College Dublin studying Joyce. The subsequent samples consisted of seven and five participants, respectively, all of whom were members of the general public without extensive knowledge of Joyce. Each sample played the game and filled out a questionnaire, detailing areas that they felt needed improving. The questionnaire is included in the *Appendix B* here [41]. In the Introduction, it was noted that the main objective of the environment would be to facilitate the user's understandings of

the innovative storytelling techniques that Joyce employed in *Ulysses*. This list of learning outcomes was derived by compiling each of the unique storytelling devices employed by Joyce and dividing them into three broad effects or modes: the interior monologue (or thought bubble), the multi-linear storytelling technique, and the use of back stories. The responses of the attendees from the focus groups created a re-evaluation of the initial stated learning outcomes, referred to now as learning objectives.

By interacting with the environment, the users from the groups were better able to: (A) note the difference between interior monologue segments from *Ulysses*, the dialogue, and the environment in a visualised, aural context; (B) discern the character's motives in an educational context; (C) explore the back stories of each character in a way that connected their shared experiences to the wider environment of the city; (D) discover more about the cultural world of Joyce's *Ulysses* and Joyce's main works in an educational context; (E) describe a multi-linear perspective on the events of the chapter, rather than focusing on a single story-facet at one time in one place; (F) describe the events of "Wandering Rocks" in a way that emphasised the space, setting, use of sound effects and the interconnectedness of key events and characters from the book; and (G) evaluate how Joyce used sound to connect events across different spatial, geographical, and temporal locations in the city.

The respondent samples stated that being able to see the difference between the character's imagination and reality, while having corresponding thought bubbles to delineate these elements of the experience, made the experience more enjoyable and informative in the context of seeing the technique represented from the book in a virtual format. The respondents also argued that they felt the use of the map and the presentation of the city provided a good overview of the space of the book and the character interactions occurring within it. The consensus was that the environment, from a graphical point of view, made an effective use of the urban environment and that it felt as if the user were walking around the actual space of Dublin. A respondent from the Vienna test noted that the ability to see the streets of Dublin in a visualised context, while also exploring the narrative of the book, made the experience of using the environment more engaging and was comparable to a walking guided tour of the area. Below, a picture is reproduced, showing how the students would use the tool: walking around the real Dublin with this virtual guide, pretending to be Bloom Figure 8.



Figure 8. *Cont.*

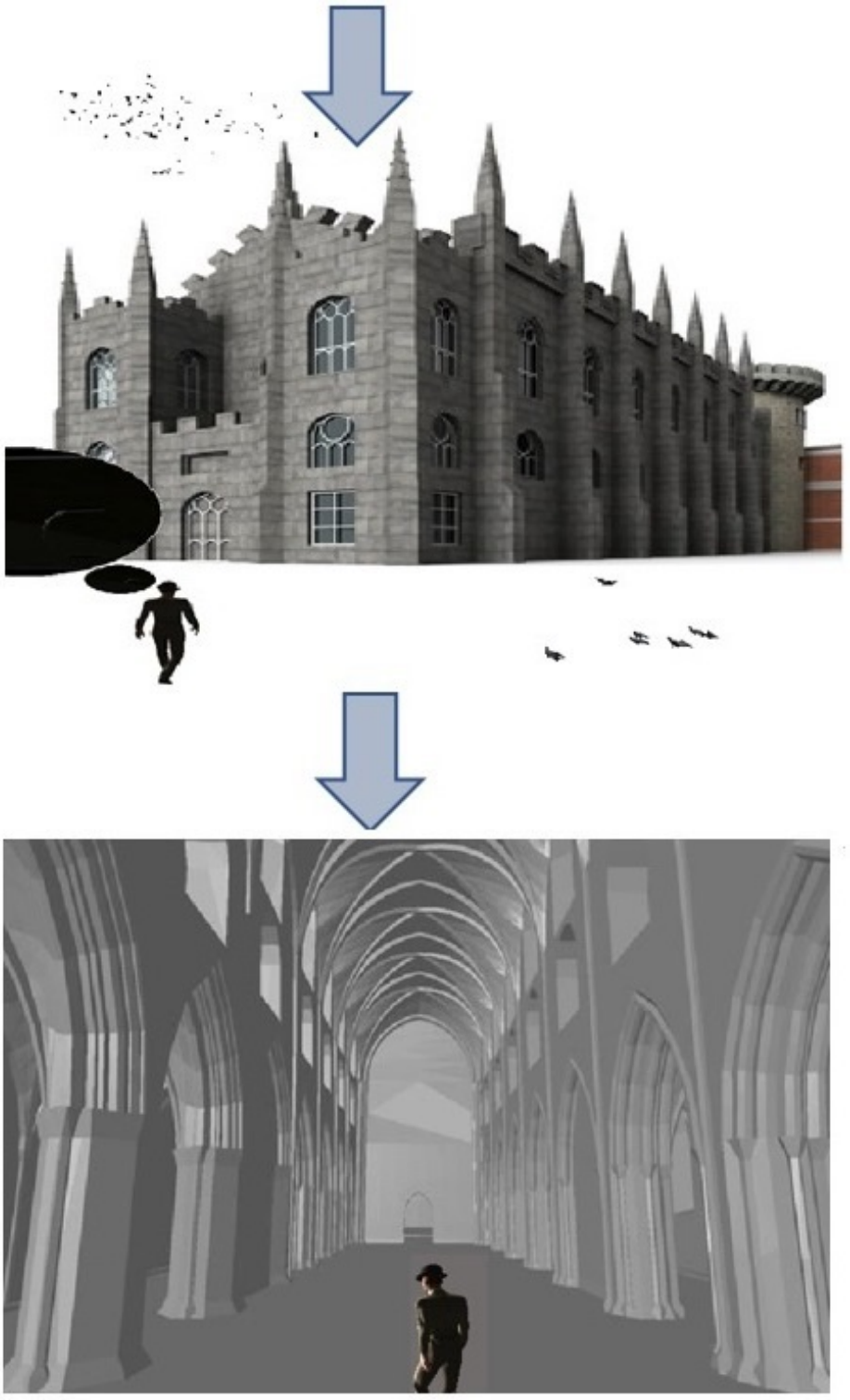


Figure 8. Virtual walking tour: note that this is an illustrative scenario from the thesis, and is not representative of the actual *I-Ulysses* experience [41].

4. Conclusions

This paper sought to provide a review of the literature in the area of teaching pedagogy, specifically the use of audio-visual technologies and VR, contrasted through a case study providing a retrospective analysis of the *I-Ulysses Virtual Learning Environment*. As argued, the COVID-19 pandemic has necessitated a new approach to learning and teaching materials, with a focus on dissemination through increasingly technologically focused

formats. There had, thus, been a need for more environments such as *I-Ulysses*, which both consolidate blended learning frameworks and offer the potential for virtual environments, where access to a location may be a concern, but also the teaching, social, and engagement aspects of participatory learning are enhanced. The intention in Section 2 was to set up the issues with such a technological delivery of a VLE and to suggest possible solutions and a template for going forward, using the *I-Ulysses* project as a formative example, with integrative case studies focusing on its employment within a blended learning framework. As noted, the *I-Ulysses* environment has a distinct learning focus and combines this learning faculty with potentials offered by interactive game development media and the mediating presences of the blended learning COI. The *I-Ulysses* environment creates an immersive, interactive experience that can be a model for equivalent platforms in the post-COVID-19 era.

Author Contributions: Conceptualisation: S.C.-D., S.O. and A.R.; Methodology: S.C.-D., S.O. and A.R.; Formal analysis and investigation: S.C.-D. and A.R.; Visualisation: S.C.-D. and F.C.; Writing—original draft preparation: S.C.-D., A.R., S.O., F.C., S.K. and S.H.; Writing—review and editing: S.C.-D., A.R., S.O., F.C., S.K. and S.H. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Acknowledgments: We would like to thank Paul Fagan for the use of an illustrative map and for helping conduct a focus group with students of the Cultural Studies seminar at the University of Vienna. We would also like to thank, again, the Inside Joycean Dublin Project and Severn Partnership Ltd. for use of illustrative 3D scenarios of Dublin and Christ Church employed in the original thesis.

Conflicts of Interest: The authors declare no conflict of interest.

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