Implementation of 360° videos in higher education: Guide for policy makers

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https://www.sepa360.eu/
Published in October 2021

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CONTENTS

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CONTENTS

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What 360° videos are?

360° videos are immersive, spherical video recordings where a view in every direction is recorded simultaneously. During playback on a normal flat display, the viewer has control of the viewing direction like a panorama. It can also be played on head displays or projectors arranged in a sphere or some part of a sphere. A virtual reality headset, also known as a head-mounted display (HMD) offers the best quality and most impressive feeling of immersion for a 360° video viewing experience.

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What can you do with 360° videos?

360° video production may change the way we perceive and interpret video content. We can place viewers in the center of the action and give them the freedom to choose their viewpoint making each experience unique to them. The viewers have control of the viewing direction. By using 360° videos, it is possible for viewers to experience the full location and to engage further with the material presented. Some advantages of 360° videos are:

- 360° videos give a sense of physical presence to learners. A surround-view can help viewers to experience the depth of details.
- A viewer can experience the scenario.
- Viewers can focus on various aspects simultaneously.
- The retention rate of immersive videos is higher since they put the viewers in a real-life practical situation.
- Viewers tend to get deeply involved in the content.

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Where can we use 360° videos?

Even though 360° video technology is not new, its use is not very widespread. Here are some areas where it can be applied easily and at a relatively low cost:

-In the educational system at all levels:
- Virtual tours (complex scenarios that are difficult to explain with images, words, or even convectional video in the fields of civilly, mechanical, and electrical engineering)
- Class recording for pre-service teachers
- Evaluation of educational interventions
- Research and data collection
- Surgical education training in the medicine field

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-In competitive and recreational sports.

- Athletes at all levels need constant guidance in their training. By recording their 360° videos in action, they can review themselves, see where they did wrong, what are their strong points and improve.
- Coaches can use 360° videos in a similar way to monitor the progress of their athletes or their teams.

-In Army forces.

- Army forces can use 360° video for the development of a safe environment to execute specific training or tactics.

- In Real estate

- Virtual tour (construction site, property, etc.)

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Benefits from using 360° videos – What is the research evidence - why it is worth including 360° videos

Benefits from using 360° videos

Research has yielded that 360° videos provide an interactive educational tool, suggesting that an interactive design and development procedure could strengthen the positive aspects of the learning experience and decrease the negative ones (Preece et al., 2015). Moreover, users of the 360° video are provided with round views and are enabled to interact and communicate with the virtual world surrounding them, thus experiencing an enhanced sense of immersion (Ranieri et al., 2020). Hence, 360° video produces an illusion of a perceptual experience where users feel as being a part of the virtual world around them (Hodgson, 2019). It has been suggested that 360° videos positively affect the emotions related to the learning climate, are providing value for money, and make e-learning more efficient (Ulrich et al., 2019).

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Furthermore, the training of practical skills can be optimized by the 360° videos which engage the user both visually and auditory, thus overcoming the barrier of distractions that might inhibit the learning and teaching effectiveness. Ulrich (2019) also argued that 360° videos could be more appealing to teaching institutions compared to "regular" videos in that they cost the same, but provide much more benefits.

A review of the literature by Ranieri et al. (2020) found further evidence suggesting that the use of 360° videos enhances the learning process. More specifically, evidence showed that the use of 360° video relates to higher classroom engagement for the students, greater lesson attentiveness, greater attainment of information, and as a result a deeper learning of the educational material, as well as an increased knowledge transfer across subjects.

360º videos, either on their own right or combined with other immersive technological tools, offer students the opportunity to discover novel views and environments, and to be introduced to emotions and conditions that would be unattainable otherwise. The combination of 360º videos with other cross-reality technologies can create a modern learning environment for students that facilitates the experience of interaction with virtual content. Such environments offer experiences that are genuine, realistic and get the attention of the students and enable the interaction, communication, and exploration of virtual contents (Kilteni et al., 2012). At the same time, students experience a feeling of belonging and embodiment (Kilteni et al., 2012). For that reason, 360º video could be considered a novel learning tool that can provide educational settings with great benefits and enhance students' engagement in the learning experience.

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Existing evidence on the use of 360° videos

According to Ranieri (2020) research in the application of 360° video in educational settings is in its infancy but it progresses fast. Below will be represented some indicative studies to highlight the progress of the relevant research as well as the main research findings.

IMPROVING TEACHING IN HIGHER EDUCATION

An exploratory case study about the utilization of 360° video in educational settings was conducted by McKenzie et al. (2019) in order to understand the impact of the integration of 360° video into the content of the class and educational settings on teachers and students. In specific, researchers carried out classroom experiments with the use of 360° video in order to identify whether they affect the participants' feelings of presence with the content of the class and how the incorporation of 360° video impacts the teaching experience. Results revealed that 360° videos can provide an alternative immersive means of content presentation for students and facilitate the improvement of their sense of presence. It was also shown that these interactive and immersive experiences could constitute a distraction of attention from the teachers and that the required file size and quality of image for the learning environment should be considered.

Hodgson et al. (2019) assessed the utilization of 360° videos and immersive virtual reality applications in higher education. Participants were undergraduate students attending undergraduate courses who used VR as a learning method. It was shown that participants evaluated the 360° videos and VR positively. Furthermore, they reported a higher learning satisfaction, experiencing at the same time greater opportunities for rehearsing professional skills. Lastly, students declared that 360° videos and VR can promote interaction, interest, and curiosity, and reinforce professional competence.

Ulrich et al. (2019) conducted an experimental study with the use of 360° videos in 81 physiotherapy students. The results showed that 360° videos were equally effective with regular videos and traditional teaching on enhancing academic outcomes. Nevertheless, traditional teaching was equal or more effective than 360° videos and regular videos on learning satisfaction and internal and external perspectives on learning satisfaction. Lastly, although 360° videos were more effective in offering presence than regular video, neither involved any interactivity, resulting in being equally or less effective than traditional teaching

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Effect on subjective experiences

A study by Rupp et al. (2016) examined the immersive experience of educational 360° videos and the effect of VR expectations on the subjective experiences. The authors supported that the immersive experiences could improve the learning experience through an increase in the interest for the educational content. Results showed that more immersive experiences resulted in greater feelings of presence. Nevertheless, it was found that the novelty of the experiences might be overwhelming for the users, leading to a reduced retention of information.
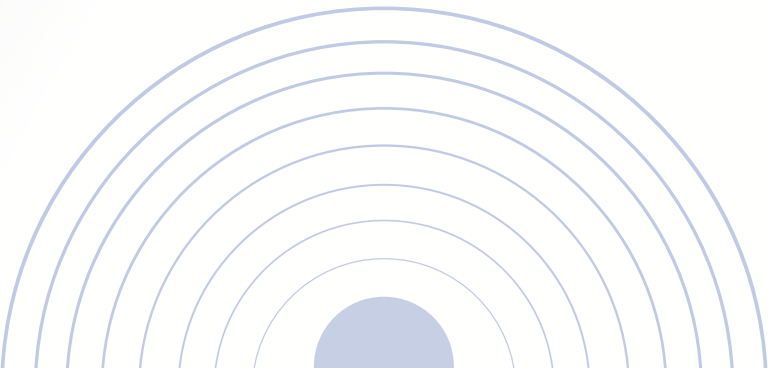
A study in the context of physical education

A study in Physical Education Teacher Education examined the use of the 360° videos for the description of a preservice teacher activity (Roche & Gal-Petitfaux, 2017). The researchers tried to determine the kind of activity that would be used by the students while watching 360° videos and subsequently the design that would be the most convenient for a teacher learning environment enhanced by video, in order to learn how to teach physical education. Results revealed that 360° videos are an innovative tool for the utilization of video in the training of teachers since it offers the opportunity of an immersive experience to the preservice teachers. Lastly, it was found that the design of 360° videos enhanced environments might result in the creation of immersive situations that serve to learn concerning teaching physical education. However, the in-depth understanding of the situation would require the utilization of wide angles or points of view by the 360° videos.

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Effects on language learning

Berns et al. (2018) sought to develop a language learning application by utilizing 360° videos, in order to provide students with a learning environment that is immersive and interactive. The researchers investigated the premises of 360° video applications and chatbots for the development of an immersive experience, in order to facilitate the language competencies of the learners. Students taking part in the assessment neither rejected nor questioned the application's premises. Furthermore, they demonstrated a positive attitude towards the application, which concerned its impressiveness and attractiveness but not its novelty.

Impact on attentiveness and information retention

Harrington et al. (2018) wanted to assess the effect of 360° operative videos on surgical education attentiveness and the maintenance of information. They run a cross-over research comparing a 360° video with two dimensional (2D) videos in regard to the perceptions of students. According to the results, 360° videos demonstrated significantly greater benefits for engagement and attentiveness compared to 2D videos. However, no significant differences were found in information retention. Notably, participants reported that the total experience of the 360° videos were more immersive, and they described it as beneficial to learning and entertaining.

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360° videos and marketing experiences

Violante et al. (2019) conducted a study for the utilization of interactive virtual technologies, 360° videos in particular, in engineering education. The objective of the study was to assist other researchers and professionals in identifying an effective methodology for the design and use of 360° videos as interactive learning content which will facilitate greater engagement of the students. Participants reported that 360° videos were highly immersive and engaging environments and resulted in greater initiation, involvement, and action. It was also found that students felt more creative and less worried and distracted because they focused on the contents of the 360° videos. Lastly, participants reported greater levels of interest, concentration and enjoyment which facilitate optimal learning.

Influence on information processing

The use of 360° videos may also affect audiences' as it includes new audiovisual grammar (Dooley, 2017). In this sense, Barreda-Ángeles et al. (2020) examined the importance of immersive presentation in the audiences' cognitive processing which closely relates to learning by facilitating information obtainment and process. Results showed that immersive presentation of narratives through 360° videos induces emotional arousal and feelings of presence. In addition, researchers suggested that a thorough design of the overall experience would significantly benefit the development of immersive narratives, which not only provide information to the audiences but also enhances their engagement.

Scoping reviews on 360° videos

A scoping review by Snelson and Hsu (2020) analyzed twelve articles with content in nine different areas promoting immersive learning. Immersion emerged as the most important feature of 360° video in education, as some type of experience with immersive VR was included in all studies. Researchers suggested that 360° videos are highly related to both the role of VR and the notion of immersion in educational settings. Although mixed results were found about the effect of 360° videos on learning, it was shown that participants exhibited enjoyment during the whole experience. Snelson and Hsu argued that certain types of learning might be more appropriate and could benefit more from the use of 360° VR video.

A systematic literature review by Ranieri et al. (2020) aimed to identify the current use of 360° videos in different educational settings and the occurrence of relevant issues and opportunities. It was shown that, although research in 360° videos is at an initial stage, it could provide a supplementary educational tool for the increase of the satisfaction and involvement of the learners. Furthermore, researchers suggested that there is a great need for more studies assessing the learning outcomes resulting from the utilization of 360° videos in educational settings.

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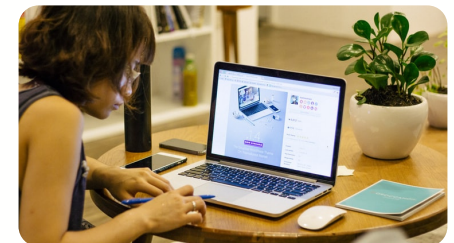
Conclusion

Overall, although it is impossible to fully replace traditional teaching with technology, 360° videos constitute a modern technology which can be utilized for the enhancement of the learning and teaching procedure. They provide an immersive and interactive experience that could benefit and enrich traditional teaching. Moreover, they offer a tool that can be used in mixed learning styles and methods (e.g. flipped classroom), in order to provide an enhanced learning experience that is immersive and more engaging for the students. Lastly, when applied in a learners-centered way, 360° videos can provide an important educational tool that fulfills the current needs and requirements of the educational settings.

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Integrating 360° videos into existing curricula – Different models for integration

Introduction:

As we have seen previously in this manual and in the first manual, 360° videos are a multipurpose learning tool that can be used in a variety of different contexts. The SEPA 360° Erasmus+ project has identified three distinct didactical or pedagogical designs when the use of 360° videos can add value to a student's learning. These include:

1. **Lecturing/Instructional designs**

In this didactical design, 360° videos are used to record and disseminate information in the sense of a classic lecture or an instructional video. They may facilitate the comprehension and communication of complex subject theories or concepts of a discipline. An example of this design can be found here: https://www.sepa360°.eu/didactical-design/).

2. Modeling:

In this design 360° videos are used to model or illustrate specific behaviors, tasks, or skills such as administering an injection for a nurse. It is used in order to increase comprehension, enable learners to undertake or reproduce the task, and to reflect upon it. A video-based model shows the desired performance which often involves motor skills. This might be an expert performing a task in a flawless and error-free mode or a novice exemplifying common mistakes and pitfalls. An example can be found here: https://www.sepa360°.eu/didactical-design/

3. Exploration:

In this design pattern, 360° videos are used in order to provide access to a place or location the viewer might not have access to or is unable to visit. Such videos have the ability to transport learners to explore any place: natural landscape, internal environment, or mixed environment (internal and external). It puts a learner in control and encourages discovery. An example can be found here: https://www.sepa360°.eu/didactical-design/)

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Although there are other approaches to using 360° videos in the Higher Education curriculum, the three designs we have identified above suggest this technology will be particularly effective as a learning and teaching tool when it is carefully mapped against the learning objectives, learning outcomes, and competencies that underpin the curriculum at a program or even at a module level. This mapping activity might be undertaken at an institutional level where all disciplines and subject specialisms are required to identify opportunities linked to each of the three designs where the adoption of 360° videos would be particularly effective. Alternatively, mapping might occur at a more granular level – for example in a particular subject discipline or programme - in order to pilot and evaluate the use of this technology on a more manageable scale.

-In the examples below we explore both approaches.

An institutional approach to the integration of 360º videos in the curriculum: PXL Hasselt
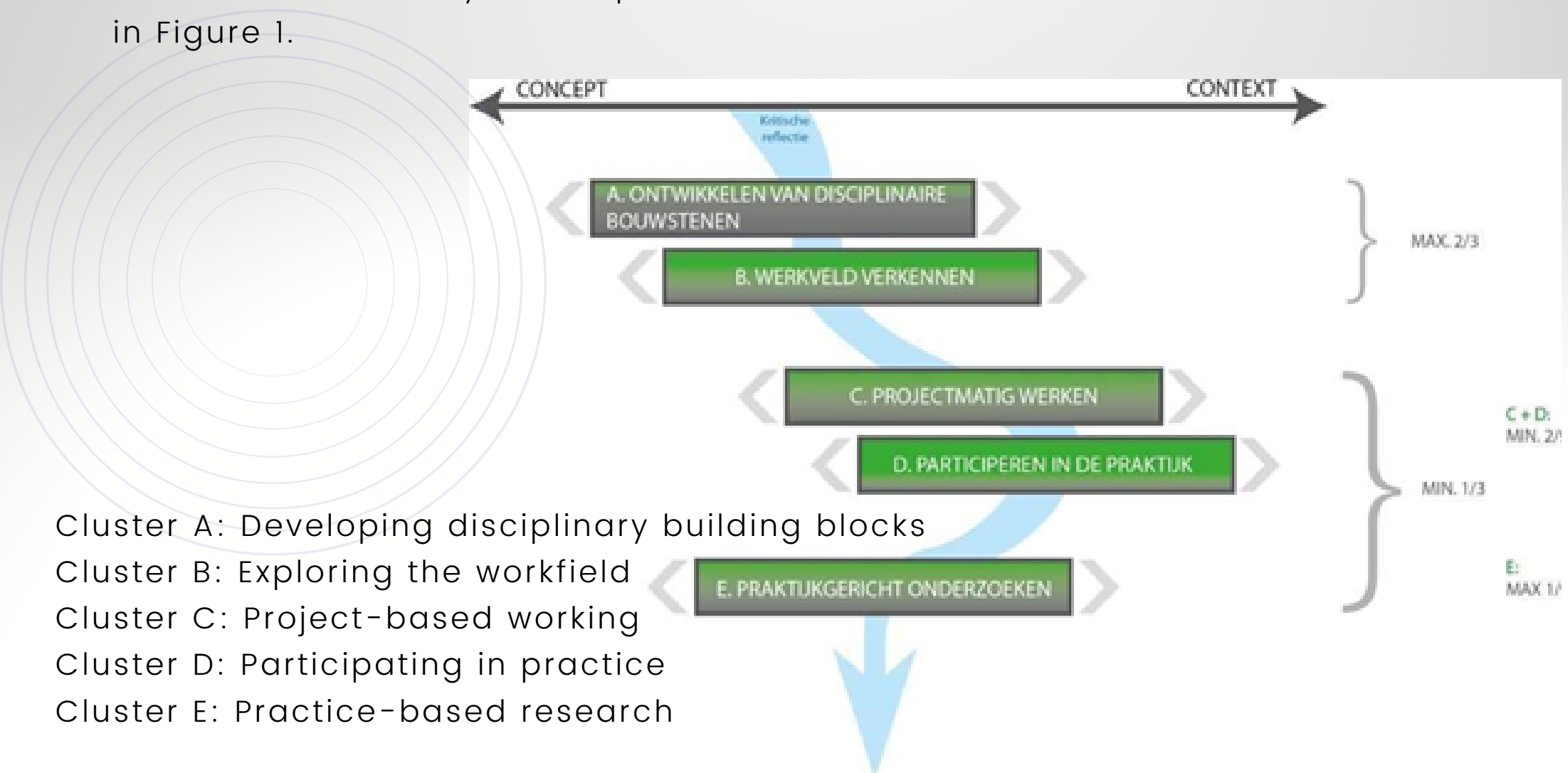
Background

Like many tertiary education institutions across the world, senior leaders and policymakers at PXL Hasselt are aware of the increasing need to make their programmes and tuition relevant to the needs of a changing world and non-traditional learners. The institution serves the needs of a diverse group of learners across its various communities and focuses particularly on professional and vocational contexts where students are expected or required to undertake work-based training and placements. Traditionally these placements, or internships, have been viewed by students as distinct elements of the programme, separate and somewhat disconnected to the learning that is undertaken on campus. This disjunction between the theoretical and practical elements of the programme is recognized as a problem across the world and research indicates it is one of the major barriers and challenges facing tertiary education institutions in the 21st century.

In response to this challenge staff at PXL Hasselt has developed an institution-wide educational strategy to make their programmes more authentic and meaningful for learners (Authentiek leren) and 360º videos are playing an important role in helping to deliver this strategy.

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The approach

The Authentic Learning approach ['De authentieke leerbenadering'] adopted by PXL Hasselt consists of five core elements or educational contexts that all disciplines and subject domains across the university are required to demonstrate, as shown below in Figure 1.

Cluster A: Developing disciplinary building blocks
Cluster B: Exploring the workfield
Cluster C: Project-based working
Cluster D: Participating in practice
Cluster E: Practice-based research

- In **Cluster A**, which is primarily undertaken on campus, students develop the basic building blocks associated with their specific discipline and profession, focusing on case studies and examples that illustrate what they will need to understand and be able to do in their future careers.

- In **Cluster B** students begin to explore the specific context of their future career by visiting the workplace (e.g. a hospital or a school) to view how it is organized and to experience directly the ethos and working practices of their chosen profession or vocation. This is an exploratory visit, not a long-term internship or placement, and students will reflect upon and explore it further with their peers and tutors when they return to campus.

- In **Cluster C** activities, students work in teams to tackle a real-world challenge or problem associated with their future career options enabling them to gain a deeper insight into the world of work that is meaningful and rooted in authentic contexts. Following this, in Cluster D students undertake a placement or internship in a context and setting related to their future career destinations such as a school, a hospital, or a construction site.

- Finally, in **Cluster E** which is largely undertaken on campus, students reflect on the experiences and insights they have gained from their placement, relating these to the other elements of the program (e.g. clusters A, B, and C) in preparation for the time when they will graduate and enter the profession/workplace itself. Hence, the approach adopted by PXL Hasselt is a holistic attempt to integrate and combine the different elements and contexts that students need to master and work in with a view to making learning more authentic and meaningful. It addresses the challenge of making learning more authentic by avoiding the usual distinction and false binary between the university and work-based learning. Both are integrated to varying degrees throughout each of the five clusters (A-E) that constitute the learning experiences of students.

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Integrating 360° video in this curriculum model

Digital technologies, including 360° videos, can be deployed to support student learning across all five of the clusters described above but PXL Hasselt has made a strategic decision to highlight those clusters where the appropriate use of 360° videos will add the greatest value. These have been identified as Clusters A and B.

In Cluster A students have access to a variety of different 360° video scenarios, supplemented and extended with Vivista interactive elements, to support their exploration of the work context they plan to adopt as a career. They use these video scenarios as resources to support them in understanding the nature of the profession they plan to enter and the challenges and problems associated with this.

In a traditional university setting students would experience the Cluster B activities by making a physical visit to a workplace setting linked to their chosen career. However, this is not always feasible or even desirable (e.g. during a pandemic) and colleagues in PXL Hasselt have developed a series of 360o video resources to enable students to undertake this activity without leaving the campus.

A disciplined approach to the integration of 360° videos in the chemical engineering: The University of Hull

An alternative approach to integrating and using 360° videos in Higher Education is that adopted by the University of Hull where a single discipline subject - in this case, chemical engineering - has been used as a testbed to pilot and explore the wider value of 360° video technology.

The initiative has been led by Dr. David Sowden, a lecturer in the Department of Chemical Engineering where he has strategic responsibility for learning and teaching in areas of professional skills and process safety management. He also supports colleagues in the development of innovation especially in the area of blended learning.

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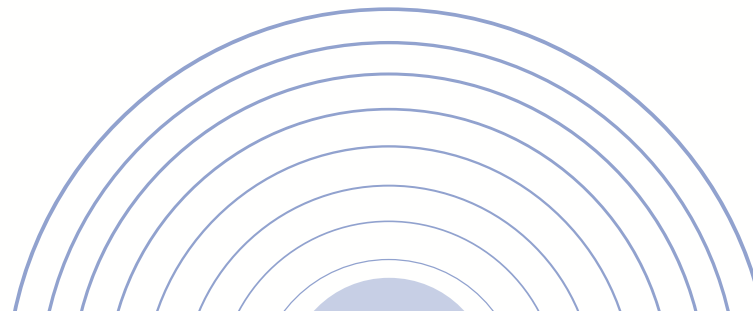
The challenge: Many of the students undertaking Chemical Engineering at the University of Hull are required to undertake a number of practical, site-based activities linked to their specialist discipline area. One of these includes a visit to a local safety training facility that replicates the technology and safety challenges facing qualified chemical engineers on a petrochemical plant. Given the large size of the cohort (in excess of 500) this involves several full-day visits to the site which is both time-consuming and costly given the cost of transport and access to the facility itself.

During the recent COVID pandemic, this was also impossible to undertake and the department faced a serious challenge in ensuring students had the necessary experiences and qualifications associated with this element of the course. Hence the interest in and need to use an alternative approach and the decision to pilot a 360° video simulation of the safety plant.

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Requirements for and contribution of IT services

The requirements for creating 360° videos are technical in nature and require collaboration among educators and IT professionals. Importantly, it requires time to get familiar with this technology. IT services are important in effectively integrating 360° videos in the educational practice of higher education institutions. The contribution of IT services can be briefly summarized in the following actions:

- IT professionals need to learn and become familiar with the use of 360° camera, video editor and player (vivista), and headset or VR headset (https://www.sepa360.eu/how-to-get-started/)
- IT services can create and provide instructional guides on how teachers can make their own 360° videos.

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- The digital learning platforms of universities (e-learning) need to be designed to host courses incorporating 360° videos.
- The digital learning platforms need to fulfill the requirements allowing hosting of undergraduate and postgraduate courses integrating 360° videos of all departments of universities, as well as courses of other university entities (Lifelong learning, Libraries, etc.).
- Define rules of accessibility to these courses. Taking into consideration that 360° videos film actual people, access should be allowed only for educational purposes; university staff and students, and external users who are certified as external partners of the hosted courses.

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Costs for integrating 360° videos into existing curricula

The cost for integrating 360° videos depends on the technological equipment of each university/department/lab and how compatible it is with creating 360° videos. The average cost of buying a camera with the necessary equipment for shooting ranges from 400€ to 1000€ (see https://www.sepa360.eu/how-to-get-started/choose-your-360°-video-camera/)

The average cost of creating a 360° video depends on the subject and the type of video intended to be produced. 360° videos can vary from a simple recording of lectures or specific situations and environments to videos with complex interactions such as the provision of information, addition of images and videos, and knowledge testing for participants. In this sense, the cost of working hours can vary and may depend on each university/department/lab resource and the availability of working hours.

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Typically, an important cost for utilizing such innovative approaches is the cost of the related softwares. Importantly, vivista editor and play video, that are used to add enrichments to the videos, can be downloaded free of charge from the SEPA 360° project website (https://www.sepa360.eu/vivista-360°-video-editor-player/). In order to effectively use vivista, the minimum PC specifications are:

- **Graphics Card:** NVIDIA GTX 1060 / AMD Radeon RX 480 or greater
- **CPU:** Intel i5-4590 / AMD Ryzen 5 1500X or great
- **Memory:** 8GB+ RAM
- **Video Output:** Display Port TM 1.2
- **USB Ports:** 1x USB 3.0 port
- **OS:** Windows 10

Intellectual properties (IPR)/Copyrights

As the IP4GROWTH consortium (2016; Intellectual Property Management – A Guide to Relevant Aspects) has acknowledged management of Intellectual Properties (IP) has become important for higher education institutions as, in order to address the needs of the market, they move away from purely basic research and give focus on research evidence that can be used commercially. Furthermore, the development of online education resulted in several higher educational institutions providing online courses, either as part of their courses (e.g., MSc courses) or through dedicated platforms for online education (e.g., Coursera). Taking into consideration that 360° videos can be used in such courses it is essential to develop appropriate IP management procedures and strategies for establishing and managing IP portfolios and defining ownership of rights.
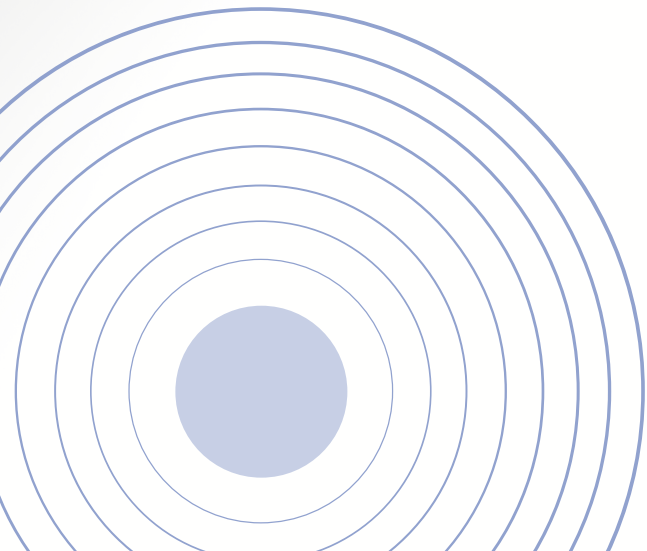
Intellectual Properties rights

According to EU tenets about IP rights (https://europa.eu/youreurope/business/running-business/intellectual-property/rights/index_en.htm), IP helps organizations, institutions, and entities protect their product, as others need their permission to use. In this sense, the quality of the product remains guaranteed and its development is clearly defined. This may give a competitive edge to your institution as the innovative material (360° videos) your institution is producing can offer an advantage in the provided courses over the courses of other institutions.

Thus, it would be beneficial to establish an IP portfolio where information about the conditions of IP is clearly described. Such a portfolio would allow quick, easy, and thorough access to all information pertaining to existing IP rights in the institution (IP4GROWTH consortium, 2016; Intellectual Property Management – A Guide to Relevant Aspects).

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Copyrights

An important aspect of IP rights is the copyright of the produced material. The IP4GROWTH consortium (2016; Intellectual Property Management – A Guide to Relevant Aspects) suggests that copyright protection has both economic (having control overuse of the product) as well as moral (acknowledging contribution in the development of the product) benefits. In order to obtain a copyright, it is proposed to attach a copyright notice to the product. Typically, the phrase 'all rights reserved' or the symbol © are used to denote that a specific product is copyrighted.
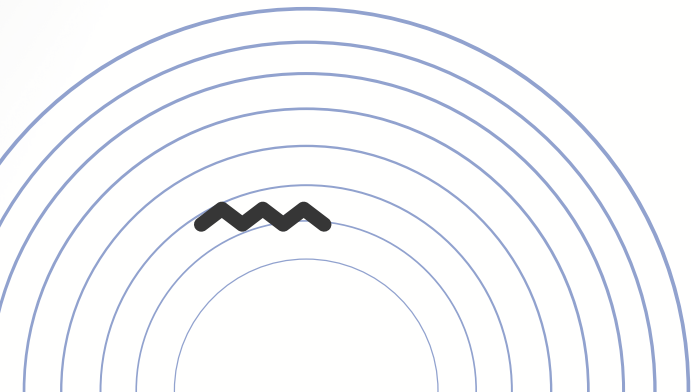
Conclusion

360° videos are considered innovative and effective tools for enhancing teaching in higher education. As such, they may give a competitive edge to the courses provided by a higher education institution. In this sense, it is important to safeguard their use by developing appropriate IP rights procedures and copyrights.

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