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Technical Considerations for Designing and Implementing Immersive Learning Applications

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Abstract. Immersive learning designers and developers constantly need help balancing pedagogical requirements, and user experience needs against available technical resources. A good framework, guidelines, and pipelines help ensure those requirements are met, facilitating the design and development process towards a more agile and faster process where pitfalls can be identified earlier. The proposed workshop and panel will: (a) Initiate a discussion addressing the areas that require immediate consideration for the provision of a knowledge base to support the design and development of immersive learning applications to meet the pedagogical needs while facilitating a more agile and faster approach; (b) propose methodologies, technical considerations and best practices to achieve this goal, and (c) facilitate teams building to work in this direction, extending iLRN available resources and collaboration opportunities.

Keywords: Immersive Learning Application Design, Immersive Learning Development, Framework, Standards.

1 Introduction and Relevance

Immersive learning applications have become increasingly popular in recent years as they offer users a more engaging and interactive learning experience. The global immersive technologies market was valued at USD 21.66 billion in 2021, and it is expected to reach USD 134.18 billion by 2030, poised to grow at a compound annual growth rate (CAGR) of 22.46% from 2022 to 2030 [1]. The Immersive Learning market, driven by the growing demand from learners for more interactive and innovative learning experiences, led to the increasing adoption of VR technology in educational institutions. This development pushes the Immersive Learning market to grow, and it is projected to reach USD 24,319.13 million by 2030 from USD 2,686.87 million in 2022, at a CAGR 31.70% during the forecast period [2]. However, designing and implementing these applications can be a complex task, with several technical considerations that must be considered.

Incorporating immersive technologies in learning and education is at the core of iLRN. As part of this network, we appreciate the benefits of immersive technologies to improve learning as they have all the affordances and the qualities to augment conventional teaching methods and create valuable engagement opportunities for learners. However, one of the challenges designers and developers of immersive learning applications face is the current need for more guidelines, frameworks, pipelines, and standards to drive the design and development of this type of experience. The benefits of providing such tools/or a knowledge base will support designers to focus on the unique details of creating immersive learning applications addressing pedagogical needs and developers to access a knowledge base that would accelerate the implementation process by accessing reusable resources.

We are proposing a twofold event:

a) A **workshop** during the online iLRN2023 conference to initiate a discussion addressing the areas we need to consider when designing immersive learning applications and start unravelling the problem of signposting designers and developers to implement those applications, followed by,
b) A **panel discussion** during the in-person iLRN2023 conference at California Polytechnic State University, where we will present the workshop's output and will help us to develop a strategy for a central technical hub as part of iLRN resources to support immersive learning designers and developers.

2 Aims and Target Audience

The proposed workshop will engage the participants in activities that will help identify the areas we need to focus on developing the required infrastructure to support the design and development of immersive learning applications. The workshop results will be presented as part of a panel session. The panel session will initiate a discussion on the direction and the methodology to work in the coming year to address this issue.

The workshop and the panel are aimed at practitioners involved in designing and developing immersive learning applications and experiences. The proposed events aim to bring together educators, designers, and developers to share objectives and practical issues they face in achieving their goals of designing such learning resources and what tools are required to facilitate this process quickly, effectively, and resourcefully.

3 Workshop Description and Expected Results

The workshop will follow a mixed format of presentations and activities coordinated by the first two authors of this work. We will examine five immersive learning projects gathered from the portfolio of the workshop coordinators, the Serious Games at University of Westminster (UoW) Research Group and BT Research Labs will be used as case studies covering all educational stages – learn, practice, assess, and involving different immersive technologies:

- VR – BT's Immersive Training for Field Force Engineers
- AR – UoW Treasure Hunt; BT's Real-time Augmented Reality Assistance app
- Mixed Reality - UoW Sign Language Project (Immersive, non-immersive)
- 360 Video - BT's Talent Attraction app
- Web VR - Metaverse

Those case studies will help to unravel:

- The pedagogical requirements to support the learners and the learning process.
- User-centred design and development implications imposed by the immersive technologies' hardware and software affordances.
- Issues related to integrating other technologies required to facilitate learning (e.g. analytics, AI, machine learning, image processing, speech recognition, natural language processing).

Then the participants will be given a new use case, and in small groups, they will have to consider the following:

- Learning objectives.
- Immersive technologies technical affordances (software/hardware).
- The type of user interactions (students, instructors, facilitators).
- The type of collected data to facilitate interaction, learning and evaluation.
- Identify the most suitable development platform and tools (frameworks/standards) to be collated for the design and development of the use case.

The workshop output will reveal challenges to be addressed (e.g. the lack of the required infrastructure to guide the design and development of immersive learning applications) and help us conclude the areas we should focus on to support this process. The workshop output will lead to the panel discussion during the in-person conference.

4 Panel Description and Expected Results

The panel will be coordinated by the first author of this work, presenting the context and the output of the online workshop, and initiating a discussion on the main practical issues in deciding the approach to design immersive learning applications. The first part of the panel will be a short introductory presentation from the technical panellists (author #2, author #3, author #4, and author#5) for approximately 5 minutes each, on the main practical issues they encounter in their role related to the design and developing immersive learning applications. After that, the panel coordinator will present a preposition of an outline/mind map that connects the learning requirements to technical considerations for the design and development of immersive learning applications and corresponding tools/resources/frameworks/standards, and it will open the discussion to the audience and the panel on how well that maps the currently required infrastructure gap. We will consider using an online interactive tool to collect feedback and discuss participants' reactions. The panel output will drive a research strategy to work in the coming year/s to address this issue. The work will contribute to the iLRN Knowledge Tree and extend the iLRN resources for designers and developers of immersive learning experiences.

5 Facilitators and Conclusions

The workshop and panel speakers and facilitators include academics and researchers with extensive knowledge in designing immersive learning experiences to effectively engage learners and address learning requirements, as well as a solid technical background in implementing those tools and resources. The panellists have led, participated, and collaborated in several projects on creating technology-enhanced immersive resources for various application domains. In that context, they bring their academic experience and practical insights as kick-off points for the audience to discuss and reflect upon.

Immersive learning designers and developers constantly need help balancing pedagogical requirements, and user experience needs against available technical resources. A good framework, guidelines, and pipelines help ensure those requirements are met, facilitating the design and development process towards a more agile and faster process where pitfalls can be identified earlier. In that context, this panel aims to discuss a proposed approach that will stem from the proposed workshop. It will also propose directions for research work to address this issue and possibly bring teams together to collaborate in this direction.

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