

Panel Session—Co-creative Virtual Reality Content Development in Healthcare: Tackling The Content Availability Problem

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Abstract—Virtual Reality (VR), blanket term used for all the reality-virtuality spectrum, is exploding in proliferation, especially in healthcare. The core challenge of this explosion is the timely and cost-effective provision of bespoke content. Co-creative approaches can facilitate this endeavor by making the educators active participants in the development process reducing development overheads and democratizing healthcare digital content creation. This panel session aims at health educators, VR technologists, developers and technology enthusiasts. It will present, and actively engage its audience with co-creative methods and approaches, providing them with the gateway experience that could become useful for introducing such methods in their institutions and workflows. The panelists are cross-disciplined educational technologists/medical educators with extensive experience in the field of technology enhanced learning (TEL) who have implemented such methodologies in practice. The workshop will follow a mixed format. A brief “observations from the field” introduction to the topics of VR TEL and co-creation will be followed by an introduction to real world healthcare VR projects and resources. In these, realistic examples, the participants will engage in hands-on storyboarding and non-technical design and development tasks, in order to acclimate with the co-creative process and become able to explore it for their own use cases.

Index Terms—virtual reality, co-creation, healthcare, education

I. AIMS AND TARGET AUDIENCE

From the first steps of VR its potential in healthcare was quickly identified. One of the older citations for VR in healthcare dates back to 1995 [1]. In the decades that passed, a large and ever-growing body of literature [2], [3], [4], reflected an ever-growing interest from the healthcare educators’ community for VR medical education content. This panel explores a novel solution for the challenge of rapid content creation and availability in the prolific VR healthcare education toolset. The aim of this work is to demonstrate to its target audience the role of co-creative workflows and participatory design culture as a seamless knowledge sharing mechanism between healthcare learners, educators and technologists. This will actively engage its audience with co-design techniques such as collaborative storyboarding, enabling technologies and workflows for VR content creation without technical programming skills. This panel aims at all audiences that engage, or are interested in healthcare immersive VR

technologies. These include *healthcare learners*, *healthcare educators*, as well as *technologists*, or *IT entrepreneurs* who are in or interested in entering the healthcare sector.

II. TIMELINESS AND RELEVANCE

Virtual patients, and virtual/augmented/mixed reality (VR/AR/MR) have been shown to improve both the educational and affective states of healthcare students [5]-[8], thus increasing interest. These technologies’ sensory immediacy results in an intuitive anchoring of the core information to the learner and facilitates model construction based on solid science evidence [9], [10]. This model building contributes to stable, deep topical awareness and eliminates the risk of logical errors [11]. There is now a substantial body of immersive content in the medical industry. The Royal College of Physicians described virtual reality (VR) as a “...powerful educational medium for defined learning objectives...” in 2019, citing many applications in medical education and surgery [12].

In terms of resources, The global virtual reality industry was worth USD 3.10 billion in 2019 and is projected to be worth USD 57.55 billion by 2027, while the healthcare market was worth USD 1.56 billion in 2018 and is expected to be worth USD 30.40 billion by 2026. [13], [14]. These figures show the demand for immersive technology in healthcare education, but also the considerable resource overhead that such content requires for production, testing, and distribution. According to a 2019 survey, the cost of planning and conducting a VR training exercise for hospital personnel on evacuation protocols is \$106 387.00 [15], which is feasible considering the reusability of the VR material, which significantly decreases its per trainee cost over time. The aforementioned complexity in medical training, on the other hand, easily renders certain tools useless and limits their reusability potential.

Participatory design methods and co-creation strategies help exactly with this problem of content production and distribution [16]. The methodology’s key idea is a versatile team coordination as described in the SCRUM, AGILE development paradigms [17], [18], but with semantic back-ends embedded in widely available game development platforms. The key breakthrough that makes this approach possible is the common use of visual programming methods and the abundance of modelling tools (e.g., narrative storyboarding).

III. PANEL DESCRIPTION AND SESSION PLAN

A. Panel Description

The panel will follow a mixed format. It will be coordinated by the first author of this work (P.A.). Its first part will offer a series of small introductory presentations from the panelists. This part will kick off with a brief outline of XR in medical education through a description of the ecosystem of currently active research and innovation projects that inspired, devised and currently implement this overall co-creative approach. It will follow through with a brief outline of the co-creative approach for digital content design. It will conclude with an outline of the technological and narrative tools that facilitate these co-creative approaches. The second part of the panel, spanning 20-30 minutes, will consist of a short storyboarding hands-on interactive session with the audience. In this, the participants, using digital online tools, will refine, with the guidance of the panelists, an example medical resource through a short teams based storyboarding session. The detailed timetable of the panel is presented in Table I. Standard time-keeping practices will be maintained. The facilitator will be responsible for the timetable and he will be warning each presenter at the 3 minute and 1 minute mark. For the duration of the facilitator's own presentation the second author (SK) will be responsible for timekeeping.

TABLE I. PANEL AGENDA AND SCHEDULE

<i>Title</i>	<i>Type</i>	<i>Presenter/ facilitator</i>	<i>Duration (mins)</i>
XR in Medical Education A co-creative ecosystem of healthcare immersive resources.	Presentation	Panagiotis Bamidis	10
Co-design in medical education	Presentation	Stathis Konstantinidis	10
Narrative and technical tools for Co-creative medical resource development.	Presentation	Panagiotis Antoniou	10
Storyboarding an XR medical education resource.	Hands-on participant activity	All	30

B. Panel Topics

1) XR Medical Education- A co-creative ecosystem of healthcare immersive resources. This short presentation will outline the current state of affairs in XR medical education resources. It will describe the overarching effort of implementing streamlined participatory design techniques in several use cases as they have been implemented in three currently running EU funded projects that the panelists have firsthand knowledge through their participation and activities. The CoViRR strategic partnership aims to co-create virtual reality reusable e-resources through participatory design techniques for European healthcare organizations providing low cost, but effective virtual reality reusable e-resources. The ENTICE knowledge alliance leverages co-creative methodologies in order to build a content creation pipeline for medical experiential content in order to develop, evaluate and proliferate edu-centric immersive learning resources and tools for well-defined learning objectives using tangible and intangible resources (AR/VR/MR, 3D printing). Finally, the ESCAPE4HEALTH strategic partnership introduces the

playing of Escape Room scenarios within virtual/mixed/augmented reality environments fostering pedagogical/methodological advances through co-creation in the form of Living Lab and multi-stake holder engagement approaches.

2) Co-design in medical education. The appreciative inquire approach will be explored as part of the co-creation of immersive content. Based on Wegner's "communities of practice" theory [19], frameworks and methodologies such as ASPIRE [20], ADDIE [21] and Pipeline development [16] using examples will be presented. Benefits and challenges on the effectiveness and the quality of digital resources will be discussed.

3) Narrative and technical tools for Co-creative medical resource development. The bulk of medical education use cases can be streamlined in contemporary game development engines using simple narrative tools (e.g., storyboarding) so that case specific instantiations of them can be created by the non-technologists, such as the medical educators. This short presentation, using implemented examples, will describe how educators and learners can easily adapt, adopt, and participate, if trained correctly, as peers, in a co-creative content development pipeline for medical education resource development [16].

C. Storyboarding Session

In this storyboarding session the participants will be split in groups of 3-5 people and will be provided with a narrative scenario for a specific medical education case. They will be called upon to create a series of mock-up "VR viewports" (storyboards) for the case, that will convey the user experience they would like to have. The case provided to them will not require on their part specific expert medical knowledge, so both medical learners, technologists and medical educators of any level will be able to participate. At the end a short debrief of the content created will follow and reflection on the experience.

IV. PANELIST CONTRIBUTIONS

The panel will consist of Panagiotis Antoniou (PA), Stathis Konstantinidis (SK) and Panagiotis Bamidis (PB). Panagiotis Antoniou is a postdoctoral research associate in Medical Education Informatics. He has experience in implementing educational digital content and conducting formative and summative assessment in technology enhanced scenario based learning episodes. He has participated as freelance research associate and technical manager in several research and innovation projects regarding immersive content creation and use in healthcare education. He has authored more than 40 scientific publications in journals and conferences several of which are in the field of technology enabled educational content creation and repurposing. From evaluating web based VP experiences [22] to VP ports in MUVes [23] and recently to augmented [24] and mixed reality [5], along with devising participatory methodologies for these media [16] PA will provide the current technologist's/practitioner's view on the challenges of bridging the gap between the educational narrative and the technological realities of immersive media. His practical, implementation based viewpoint will also allow him to facilitate both the hands-on storyboarding session and the overall panel.

Stathis Konstantinidis is an Associate Professor of eLearning and Health Informatics and has great experience on more than 35 EU co-funded projects from different roles, serving as the project co-ordinator in four and PI for the University of Nottingham in additional five all focusing on digital innovations in healthcare and education. His publication record includes more than 80 peer reviewed scientific publications in journals, conference proceedings and books and he is a co-editor of the “Digital Innovations in Healthcare Educations and Training” book. He co-chaired many conferences and special sessions, and he is an Associate Editor in Health Informatics Journal. His expertise on co-creation spans across different types of educational resources including, RLOs, Virtual Mobility Learning Packages, Virtual Patients, 360° interactive videos/VR, conversational agents, Internet of Things in Education, and others underpinned from online pedagogical principles and the computer scientist theoretical background.

Panagiotis Bamidis is a Professor of Medical Physics, Medical Informatics, Medical Education with a focus on technology driven innovations in healthcare and technology enhanced learning. In the last 10 years, he has been the coordinator of over 6 large European projects (e.g. www.meducator.net, www.epblnet.eu) as well as the principal investigator tens of national and international funded projects. His publication record consists of more than 120 international refereed journal papers, and over 400 international peer reviewed conference papers, with over 4500 citations. He is both a member and a participant in the governing bodies of several international academic and policy-setting healthcare organizations. PB will offer a birds-eye view of the current state of the art in XR for healthcare. Based on his experience and current involvement he offers insights on emerging trends on immersive media, based on healthcare policies’ evolution and potentialities.

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