NTES 2024

Seminar New Technologies in Education and Society

ABSTRACT BOOK

POZNAN UNIVERSITY OF TECHNOLOGY
Politécnico de Viseu
P. Viseu Educação
Centre for Studies in Education and Innovation
fct Fundação para a Ciência e a Tecnologia
EMRN The European Metaverse Research Network
Eunice European University

NTES 2024: NEW TECHNOLOGIES IN EDUCATION AND SOCIETY -BOOK OF ABSTRACTS

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NTES New Technologies in Education and Society

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GENERAL PROGRAM

School of Technology and Management of Viseu, Portugal

Thursday, April 4th, 2024

16:00 Welcoming session and group meetings

Friday, April 5th, 2024

10:00 Opening session of main programme

10:30 Interactive plenary session: Virtual and Augmented Reality – Opportunities and Challenges

12:30 Lunch

14:30 Interactive session: New Technologies in Didactics – Opportunities and Challenges

16:30 Poster and Demo Session - Augmented Reality (+Coffee Break)

20:30 – Social dinner

Saturday, April 6th, 2024

9:00-10:30 Wrap-up session

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INTRODUCTION

New technologies, like artificial intelligence and virtual collaborative environments, are in our daily lives and are becoming part of the fabric of human interactions and thought processes. They are powerful tools to improve our well-being and development that also challenge and create risks to our known processes and ways of being in the world. In Education, and in other areas, several projects, initiatives, research and general use offer material for critical analysis and planning of future avenues. As in other complex challenges, networked discussions, learning from each other and creating community is an important part of the solutions to be charted. Partners in the European University for Customised Education (EUNICE) have combined efforts to organise the event Seminar New Technologies in Education and Society (NTES), allowing deep discussions based on real and/or research-based uses and cases across different countries and contexts.

This 3-day seminar, featuring plenary sessions, discussions, and poster sessions, will dive into the exploration and discourse surrounding new technologies in education and society. The plenary sessions will showcase new technologies utilized in education, while also serving broader social needs. Attendees will gain insight into the innovative concept of the EUNICE Virtual Lab, explore the opportunities and challenges posed by the Metaverse, Artificial Intelligence (AI), and blended real/virtual teaching approaches. Attendees will also have the unique opportunity to experience the virtual world first-hand through the use of VR headsets.

This seminar aligns with the EUNICE4U project, which aims to develop a shared system of support for pedagogical innovation. One of the primary goals of EUNICE activities is to improve student learning through continuous pedagogical innovation, including effective integration of learning technologies, interdisciplinary teaching methodologies, and challenge-based learning approaches. EUNICE strives to harness the potential of immersive learning, particularly through virtual collaborative environments, as a promising method for delivering distance academic programmes.

The Organising Comittee

BEST PRACTICES IN THE DEVELOPMENT OF INTERNATIONAL EDUCATION PROGRAMMES AND MASSIVE OPEN ONLINE COURSES IN THE AREA OF MODERN TECHNOLOGY

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Abstract

In the contemporary landscape, technology is present in every aspect of our lives, facilitating a fast-paced, predominantly virtual existence. In this dynamic environment, universities face the imperative of introducing innovative educational solutions. Traditional teaching methodologies are gradually giving way to new ways of teaching, a transition further accelerated by the COVID-19 pandemic, now firmly entrenched in our educational reality. The use of new technologies in teaching has already become a matter of course.

European universities are actively embracing diverse solutions to enhance their educational offerings, recognizing education as a common good. This presentation endeavors to showcase exemplary practices in the development of international education programs and Massive Open Online Courses (MOOCs) within the domain of modern technologies. The solutions implemented in the activities of Eunice European University will be presented, as well as the opportunities and challenges involved.

In particular, MOOC courses, which are gaining popularity in European higher education, will be used as an example. These courses will serve as a case study to explore the implementation and reception of those online education formats by students. MOOC courses and other courses delivered in the online mode are accelerating and driving the processes of introducing the concept of microcredentials, which offer many opportunities for both universities and students. The rapid development of the concept of microcredentials is also leading to an open discussion about the challenges it poses to higher education institutions

This presentation will delve into these topics, with a focus on European universities and the first regulatory frameworks of this field.

Key words: European Universities, MOOC, Microcredentials

AN EVALUATION OF THE GRANT POTENTIAL OF MODERN CYBER SECURITY TECHNOLOGIES IN THE CONTEXT OF EUROPEAN UNIVERSITY ALLIANCES

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Abstract

Digital transformation that was accelerated by the COVID-19 pandemic, enriches education in multiple ways and offers accessible to all learning opportunities. In this context, European Commission renewed its Digital Education Action Plan in 2020. The Plan defines how education and training systems can make better use of innovation and digital technology and support the development of relevant digital competences needed for life and work in an age of rapid digital change. The Digital Education Plan outlines two strategic priorities: 1) Fostering the development of a high-performing digital education ecosystem and 2) Enhancing digital skills and competences for the digital transformation. Funding for digitalization processes was secured in the Multiannual Financial Framework (MFF) for 2021-2027 through funding programmes and instruments such as: Digital Europe Programme, Connecting Europe Facility, Horizon Europe and Creative Europe. The presentation focuses on funding possibilities for European University Alliances within EU Digital Europe Programme, specifically in the area of Cybersecurity.

Key words: Cyber security, European Universities.

METAVERSE – NEW OPPORTUNITIES IN NEUROREHABILIATION

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Abstract

Health care is one of the most important factors for the overall, physical, social and mental well-being of the entire world's people. Augmented and virtual realities in healthcare market size was valued at more than USD 2.5 bilion in 2022 and is predicted to register over 21% CAGR during the forest period 2023-2032. Emerging new technologies, if possible, are used in the Health Care area. Metaverse is one such technology, so it is used in many areas of Health Care. Virtual Reality has become a novel method for stroke rehabilitation within the past decade. Through the simulation of everyday activities, individuals recovering from strokes can enhance their self-care abilities in a manner that is typically unattainable in a hospital setting. Among the many applications of Metaverse, we would like to present the use of this technology in the rehabilitation process of the elderly and/or those in the rehabilitation process after various types of injuries or strokes. Currently, the elaborated system is used in the rehabilitation of neurological patients (e.g., after strokes). As is well known, the rehabilitation process in the case of neurological diseases, is a long process, and after a period of hospitalization, then, already at home, the patient must independently perform, often tedious, various exercises. Some of these exercises can be proposed to be performed in virtual reality. Performing these exercises in virtual reality helps to increase their attractiveness and, therefore, their effectiveness (the patient is more likely to perform the exercises in a properly designed, attractive virtual reality). Of course, assuming that the motor requirements appropriate for the exercises set are met.

The process of rehabilitation is initiated early in the acute phase of cerebral ischemia. Later, it continues during the patient's stay in the Stroke Unit. The disabilities caused by stroke vary; thus, there is a need for tailored post-stroke rehabilitation that will be appropriate for the needs of stroke patients and their everyday activities at home. Most stroke survivors are discharged into their homes. Thus, the question of how to design rehabilitation training appropriate for use in the home should be raised. To initiate the process of adaptation in some Stroke Centers (e.g., University Hospital in Poznan), a "model apartments" are arranged for initial patient training. Using different objects like balls, iron, spoons, cups, etc., as physical therapy tools in a "model apartment" supports the patient's everyday activity at home. As technology becomes more pervasive and familiar, it can support rehabilitation in hospital and/or home environments.

The success of post-stroke rehabilitation depends on factors like patient pre-stroke activity, circulatory sufficiency, the severity and location of the stroke, and support from family and caregivers. Active participation of the stroke patient in the rehabilitation process is crucial for optimal recovery. Thus, the need for tailored rehabilitation in post-stroke patients is clearly expressed and guidelines were already addressed as "evidence-based rehabilitation of mobility after stroke (ReMoS)".

As a result of cooperation with Poznan University of Technology, the Virtual Reality (VR) Systems are currently used in everyday practice in the Stroke Unit at University Hospital in Poznan. Stroke patients are mainly older persons who are only sometimes familiar with computer technology. However, unexpectedly, their tolerance of VR is excellent. Currently, we perform a study on the tolerance of VR in stroke patients. A questionnaire was elaborated that included the presence of vertigo, nausea, diplopia, headache, chest pain, arrhythmia, anxiety, and sweating before and after training with VR. Moreover, the use of computer/smartphone/games at home, the educational level and profession are considered. Blood pressure and heart rate before and after VR training are also monitored. Patient evaluation with the questionnaire is performed at baseline and after 7 days of the training. We noticed an excellent tolerance of VR training in stroke patients. Interestingly, some symptoms, like intension tremor, that are present in real-world training, disappeared in VR training.

Key words: Metaverse, Neurorehabilitation.

LEARNING IN CREATIVE COLLABORATIVE VIRTUAL ENVIRONMENTS

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Abstract

IPVerso is a simulator developed at the Polytechnic Institute of Viseu to represent our institution in Metaverse. This project was partially based on the previous experience of the Virtual Art Lab (Sousa, Figueiredo, & Souto-e-Melo, 2022). To create this immersive space, we organized transversal and multidisciplinary co-creation workshops in a creative collaborative virtual environment (Eustáquio & Sousa, 2018). The aim was to develop project-based activities that led to the creation and consolidation of a digital and immersive academic environment. We began with a cycle of workshops that allowed trainees to develop skills that enabled them to create different aspects of the virtual environment - building, optimising 3D models, developing scripts, sound and customising avatars. This was learned based on co-creative projects, using networked technologies (OpenSimulator platform) to boost collaborative work, with articulation between remote and face-to-face teaching. Inclusive, personalised learning was developed, adapted to the specific characteristics of each trainee. The results were the creation of the architecture of the IPVerso virtual environment and the creation of various artistic virtual installations, combining art, research and education; which involved both the acquisition of new skills and the mobilisation of skills developed in new contexts. Enabling these trainees to meet the new challenges resulting from the digital transition, through the development of creative, technological, conceptual and collaborative skills in virtual environments (Sousa, Rodrigues, Rito, & Figueiredo, 2023). The methodology adopted centred on artistic practice, exploration, autonomous learning and co-creation, flexible processes with necessarily unpredictable results (Leavy, 2009). Using an Arts-based research in education (Cahnmann-Taylor & Siegesmund, 2018) approach, we can take the participants' productions as a presentation of results (Leavy, 2017), they reveal a concern with the concept explored in each one, with growth in terms of artistic production and respond to the objectives related to resilience, with adapting to new media and contexts, both face-to-face and at a distance, with the social, cultural and intellectual context of creation and learning in creative collaborative virtual environments.

Key words: Metaverse, IPVerso, creative collaborative virtual environments, Arts-based research.

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VIRTUAL SMART FACTORY: UNLOCKING LEARNING POTENTIAL

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Abstract

Virtual Reality (VR) plays a significant role in smart manufacturing, contributing to increased efficiency, enhanced productivity, and improved decision-making in various industrial processes. During the last few years, VR has emerged as a powerful tool with substantial applications in education and research. VR's immersive and interactive capabilities offer unique opportunities to enhance learning experiences, conduct research, and explore various fields. As VR advances, its impact on manufacturing is expected to grow, fostering innovation, collaboration, and increased competitiveness.
The idea of a Virtual Smart Factory aims to prepare highly qualified staff for manufacturing-related industries with high-level competencies through the creation of a virtual reality environment that provides research, educational, and professional training components: (1) research of advanced manufacturing processes and comprehensive analysis of manufacturing systems using a virtual environment, digital models, and intelligent technologies; (2) learning for students on the design and technological capabilities of CNC machining centers, robotic systems, production lines, as well as manufacturing processes realized on the advanced metalworking equipment; (3) professional training and retraining for engineers working with advanced technological equipment at machine-building enterprises.
Virtual Smart Factory offers a dynamic learning environment that simulates real-world scenarios and enables manufacturers to train their workforce effectively. Based on the selected product list and their manufacturing processes, the equipment list was generated, and the conceptual layout of the Factory was identified. It was a previous step for further justification of production flows. About 50 digital models of machine tools, machining centers, additional technological equipment, tooling, industrial robots, etc., were created for the virtual environment. Determining the safety rules and requirements to virtualize the manufacturing processes was crucial. The core part is the creation of production scenarios, which allow deep learning and understanding of the fundamentals of machine design, structural elements, and their impact on working processes, particularly in kinematics and dynamics. It is crucial to ensure broad technological capabilities that provide decision-making on locating chart selection for workpieces, selecting fixtures based on the design features and manufacturing requirements, rational use of cutting tools, auxiliary tools, measurement tools and systems, etc. Maintenance is also among the vital scenarios. Notably, the predefined production scenarios include loading/unloading workpieces, adjustment of fixtures, setting cutting and auxiliary tools, selecting and changing the robotic grippers, etc. Visualization of working processes is vital for Virtual Smart Factory because it enables stakeholders to gain deeper insights into complex operations, identify potential bottlenecks or inefficiencies, and facilitate more informed decision-making throughout the manufacturing lifecycle. Virtual measurements and quality control provide the ability to assess and ensure accuracy and compliance with standards. Production scenario simulation analyzes various operational situations within a manufacturing environment, such as normal working conditions and emergency situations. Manufacturers can optimize processes by simulating normal working conditions, identifying potential improvements, and training employees on standard operating procedures. On the other hand, simulating emergency working conditions allows organizations to prepare for unexpected events such as equipment failures, power outages, or other disruptions.
This holistic approach enhances workforce readiness and fosters innovation and efficiency within the manufacturing sector.

Keywords: manufacturing innovation, R&D investment, industrial growth, educational policies, digital transformation.

VIRTUAL ENGINEERING IN SIMULATIONS OF HUMAN-TECHNICAL OBJECT INTERACTIONS

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Abstract

The purpose of the article is to present the possibility of teaching in the field of evaluating the interaction of a technical object with the operator (so-called Human Factors) and ergonomic analysis, using modern computer simulation techniques performed in virtual space.
One of the important issues in the design process is the evaluation of accessibility to the various elements of a technical object as well as the comfort of its use. The evaluation of parameters also includes the adaptation of objects to people's manipulation abilities, which is particularly important for people with limited motor skills, as well as the elderly or visually impaired. In the case of computer simulation, in a virtual space, the designer is deprived of many constraints arising, for example, from the construction of real models or the space in which the experiment is carried out. During the design of technical devices, the main focus is on ensuring an adequate level of safety for the user, facilitating (improving) the use of the device and eliminating the potential negative impact of physical and psychological stresses on the body, while ensuring an adequate level of comfort with the device in question.
Virtual evaluation of human interaction with a technical object developed by the designer entails the use of specialized software such as CATIA (Schlund, Kamusella, Knott, et al., 2022), equipped with highly complex computer models of the human body. These often require the purchase of additional modules (beyond the basic CAD system) as well as more powerful computer systems. Both of these are costly. Due to their highly specialized level, these modules are not available to students in an educational version, making their availability limited only to classroom on dedicated computers located in specialized Virtual Engineering or Advanced CAD Design laboratories.
The COVID-19 pandemic in past years has forced the need for everyone to work remotely, as well as significantly changing the ways and means used to teach students. Due to the limited technical resources of the university, it is not possible for eligible students to have constant global access to all resources, especially to specialized computer workstations equipped with a limited number of licenses of advanced CAD systems. This has led to the need to look for new solutions and programs that allow students to work without such restrictions, on their own computers at home. One possible solution is the use of free computer graphics software, such as Blender (Hernandez-Sandoval, Mendoza-Muñoz, Navarro-Gonzalez, & González-Ángeles, 2020), which has the appropriate tools.
This article presents an example of a standard teaching process using an advanced CAD platform in the form of CATIA software equipped with a specialized "Ergonomics Design and Analysis" module. The implementation of such classes will be presented as an example. Then, as an alternative solution, the process of preparing and carrying out computer simulations, made with the use of the free software Blender and a module that allows controlling the model with the help of "Skeleton" (Armature) will be presented. In addition, the use of Motion Capture and 3D scanning systems will also be presented. Finally, a summary of the advantages and disadvantages of the proposed approach (first and second) will be presented.

Key words: digital ergonomics, virtual anthropometric mannequins, virtual engineering, CAD systems.

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CYBERSECURITY OF SHARED RESEARCH AND TEACHING INFRASTRUCTURE

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Abstract

Over the past few years, the popularity of distance learning and remote work has increased significantly (Post et al., 2019). This was due to the outbreak of the covid pandemic as well as technological growth and the widespread implementation of modern technologies into work and education systems. Therefore, in the case of education systems, the introduction of modern distance learning technologies gives the opportunity to learn at any time and place, reduces learning costs by eliminating the need to travel to different universities, increases flexibility in planning classes, and enables the sharing of research and teaching infrastructure. All these goals also guided the creation of the European University for Customized Education (EUNICE) consortium, which brings together ten public European universities located in all four European regions.

The sharing of EUNICE resources (research and teaching infrastructure) is possible through the use of the developed platforms and remote access systems. An example of such a system used in the EUNICE Virtual Lab is the Espresso Labs software (Canned Coffee, n.d.). The Espresso Labs is a cloud-based service with locally deployed controllers that allows to create extensive laboratories based on physical and virtual devices with full support for managing them via a web application. The environment prepared in this way can be used both in the didactic process and in the cases of testing new solutions or conducting research and development activities. The solution on the client's side using remote access requires only a web browser that supports HTML5 to achieve full access. The laboratory environment is fully isolated from the public network by the controller. Therefore, when considering the use of software from a cybersecurity point of view, it is important to secure three key elements of the system. Firstly, the user access to the cloud, through which communication with the system is carried out via the Internet. Then communication between the controller and the cloud and finally – an internal network enabling the connection of laboratory devices.

The user (the client and the system administrator accounts) logs in to the dedicated manager server instance. The system administrator can build the laboratory environment, including adding new devices, organizing them into groups, and deciding on user access to individual devices. The client who does not have the administrator status, is able to see the laboratories on offer, reserve access to the devices or groups and connect to the laboratory infrastructure as part of the reservation. The client can also access the laboratory based on the generated one-time key. Access of this type may be limited to any number of device groups as well as in time. The moment of access itself can be reserved by the key holder or indicated during its generation by the administrator.

The controller attending the lab requires, as a minimum, only Internet access for outbound and inbound traffic of the open HTTPS port (443). This means that it can also be installed in private networks with configured port forwarding on the router.

Communication to individual devices within the isolated laboratory network is carried out using the SSH, RDP and RBF (VNC) protocols.

To sum up, it is important from the point of view of cybersecurity to use up-to-date, safe communication and access protocols and to pay attention to securing the system from unauthorized access.

Key words: cybersecurity, research infrastructure, teaching infrastructure, remote access.

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MATH & AI: FOSTERING CRITICAL THINKING

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Abstract

Artificial intelligence (AI) platforms are catalysing a transformative shift in education, ushering in an era of unprecedented potential for enriching both teaching and learning experiences through innovative technological advancements.
Just as a few years ago with the emergence of graphing calculators, in education we need to be very careful when using Artificial Intelligence tools. It is essential to use them responsibly and critically. In the education sector, it is imperative to consider AI as a fundamental pedagogical aid rather than a direct substitute for teachers. Students should receive thorough instruction on the correct use of AI tools, fostering a discerning attitude towards the information they access, and improving their critical and creative thinking skills. In this context, the role of the teacher is indispensable, serving as a guide and facilitator of learning. Through guidance on the effective use of AI, the development of critical information evaluation skills, and the encouragement of critical and creative thinking, teachers play a central role in preparing students for the skills needed to succeed in an increasingly complex educational landscape.
AI can be used to create interactive and engaging learning experiences that motivate students to engage with the content and feel like protagonists in the learning process.

Keywords: Artificial Intelligence, critical thinking, mathematics.

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PIPVE - A SSENPV'S INCLUSIVE AND EQUITATIVE MANAGEMENT PLATFORM

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Abstract

At the Polytechnic of Viseu (PV), the number of students has been increasing, and it is expected that this trend will continue, as it serves to enhance the literacy of the population within its coverage area and to reduce desertification in the interior region in which it is located. For Students with Specific Educational Needs (SSEN) who attend the PV (SSENPV), it is crucial to develop procedures that minimize the anxiety caused by change and that could facilitate their adaptation, making the period of higher education an inclusive and beneficial experience that promotes academic success and eases the transition to active life. To address this issue, the PV, as a higher education institution guided by equity in its community, particularly by the student community, the SSENPV census is an important step in implementing procedures that respect and cater for individual specificities. Furthermore, the platform's access to information aims to reduce disparities between students and their access to services.

To address the current situation, within the scope of the Inova & Includes project, PV counted on the collaboration of a group of researchers, in partnership with the Computer Engineering course at the ESTGV Superior School of Technology and Management, who created an integrated management platform for SSENPV. This platform, which aims to promote true equality in education in the PV, is based on social impact in several dimensions, and it includes the implementation of several profiles:

- The Informative Profile enables the dissemination of relevant education legislation and other information about Specific Educational Needs (SEN), simplifying information management and streamlining procedures and support measures.
- The Academic Profile allows data registration and updates related to SSENPV.
- The Technical Evaluation and Follow-up Profile facilitates the registration of SSENPV procedural evaluations, automatically sending technical evaluations to authorized users.

Key words: Special Needs Education, Inclusive Higher Education Institutions, Platform, Automatization, Least Privilege Concept.

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CYBERSECURITY OF VIRTUAL REALITY SOLUTIONS

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Abstract

The concepts of virtual reality (VR) [1-2] and augmented reality (AR) [2-4] have garnered significant attention across mainstream media, technical circles, and the scientific community. Virtual reality immerses users in simulated environments through positional tracking and 3D near-eye displays, offering an unparalleled sense of presence within a digital realm. At its core, VR revolves around the creation of user avatars navigating entirely computer-generated worlds. Augmented reality, conversely, blends real-world environments with computer-generated content, enriching users' experiences with multi-sensory modalities such as visual, auditory, tactile, somatosensory, and olfactory stimuli. AR systems integrate real and virtual elements seamlessly, enabling real-time interaction and precise 3D registration of virtual and real-world objects [3]. The overlay of sensory information in AR can either enhance or obscure the natural environment [4].

The significance of these technologies is underscored by their substantial market size and projected growth trajectory. Fortune Business Insights [5] predicts the VR market to reach approximately $165 billion by 2030, while the AR market has already surpassed $20 billion, with forecasts pointing towards an ascent to over $1,860 billion by 2032. Prominent examples of these technologies include the Metaverse and Apple Vision, with the former pioneering a convergence of VR and AR. The Metaverse comprises myriad virtual environments, each imbued with distinct features and characteristics, facilitating user interaction via avatars—a digital parallel of themselves. This digital world amalgamates elements of social media, online gaming, AR, VR, and cryptocurrencies, fostering virtual interactions on an unprecedented scale.

Nevertheless, the rapid evolution of VR and AR presents unique security challenges, spanning from typical electronic device vulnerabilities to potential physical harm and the exposure of highly sensitive personal information. The diverse array of system components creates an expansive attack surface ripe for exploitation. Moreover, VR's emphasis on immersion and interaction renders users susceptible to direct cyber-attacks, exacerbated by the obstructive nature of head-mounted displays, which may hinder users from perceiving real-world threats.

This presentation seeks to elucidate the primary challenges associated with deploying and safeguarding virtual environments, addressing both technical and human-centric facets. A comprehensive analysis of cyber threats and vulnerabilities within VR and AR solutions will be presented, encompassing technical intricacies alongside psychological considerations. Case studies depicting real-world threats to users will underscore the urgency of cybersecurity measures in these domains. Additionally, the presentation will proffer best practices for the development of AR and VR applications and solutions, aiming to establish robust defences against evolving cyber threats [6-14].

Key words: Virtual Reality, Augmented Reality, Cybersecurity, Metaverse.

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SENSORS AS EPISTEMIC MEDIATORS IN SCHOOL AT TIMES OF SCIENTIFIC KNOWLEDGE CRISIS

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Abstract

Nowadays, the ability of each person to be a publisher, for instance in social media, led to the ubiquity of information products with unknown authorship and credibility, as well as to the widespread of fakeness (Hopf et al., 2019). This widespread of fakeness is impacting science, undermining its credibility and the social competences related to make informed choices (Hopf et al., 2019). Education is fundamental to equip citizens with skills and tools to use information critically (Hopf et al., 2019; OECD, 2018). Besides skills to use digital technologies devices, the 21st century citizens need cognitive and meta-cognitive skills, such as critical thinking, learning to learn, and self-regulation, as well as social and emotional skills, such as self-efficacy and collaboration, to face a changing, uncertain, and challenging world, with global crises like the scientific knowledge crisis.

This Poster highlights the potential of electronic sensors to develop critical thinking and problem-solving competences, when they are used as epistemic mediators (tools that facilitate the knowledge building, or epistemic, tasks and processes) in authentic problem-based learning activities. In this context, epistemic practices are considered practices in which knowledge and learning are produced (Eriksson & Lindberg 2016).

Like human senses, electronic sensors are devices that can be used to measure or detect physical, chemical, and biological quantities in the real world (McGrath & Scanaill, 2013). Together with integrated ICT capabilities, sensor systems have been improving in sensing and computational capabilities till today. They became smarter, smaller, mobile, cheaper, ubiquitous (namely in smartphones), and wireless (Shuler, 2009), and, in this way, they have affordances to support everyday school problem solving activities. A set of case studies is presented in this Poster, showing evidences of how electronic sensors can be used in elementary, high and teacher education schools, as human senses extensions, to support students' agency in collaborative problem-solving epistemic tasks, such as asking questions; planning; acquiring data; interpreting data, using critical thinking; making evidence-based suggestions to solve a problem. The importance of teacher mediation in the presented case studies is also illustrated.

Key words: electronic sensors, 21st century competences, problem-solving, school.

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AR-BASED BOOK TO RAISE AWARENESS ABOUT FOSTER HOMES CONTEXT AND IMPLICATIONS FOR HUMAN DEVELOPMENT. A CASE STUDY IN PORTUGAL

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Abstract

Augmented Reality (AR) is a cutting-edge technology that seamlessly integrates virtual elements into the real world, enhancing our perception of reality. Unlike Virtual Reality (VR), which immerses users in entirely simulated environments, AR overlays digital information onto the physical world. This is typically achieved through devices like smartphones, tablets, or specialized AR glasses (LaViola Jr., 2017).The core principle of AR involves superimposing computer-generated images, videos, or animations onto the user's view of the real world in real-time. This augmentation can take many forms, such as 3D models, text labels, or interactive elements. AR applications span a wide range of fields including gaming, education, healthcare, navigation, retail, and manufacturing.

One of the defining characteristics of AR is its ability to blend seamlessly with the user's surroundings, creating an immersive and interactive experience. This technology leverages advanced computer vision, object recognition, and spatial mapping algorithms to accurately overlay virtual content onto physical objects.

The present project aims to present the instrumentation as a storybook app based on AR technology (AR book app) as a pedagogical result of a ludic activity developed with a group of preschool children hosted in a foster home in Portugal. The process of designing, documenting and illustrating this AR book, based on these children's life experiences, was inspired by an Inclusive Education intervention with early childhood in formal education like the works reported by Sekkel and Matos (2014) or Mardles (2017).

The aim was to provide children with an experience regarding all stages of the tool development process, not only the AR book app, which was designed to reach the same intervention experiment pedagogical objectives: improve the children's apprehension of values as collaboration, inclusion, (mutual/self) respect for social/cultural diversity and prevention of attitudes and perpetuation of generational prejudices beliefs. Also, it is important to highlight the relevance of Inclusive Education on formal/informal education as well as the human development is very well documented (Crochik, 2011; Dias, 2018).

Foster homes play a crucial role in the protection and well-being of children and young people in vulnerable situations in Portugal and worldwide. These institutions provide a safe and cosy environment for those facing various forms of adversity, such as neglect, physical, psychological or sexual abuse, and even situations of abandonment. By offering basic care, affection, education and psychological counselling, foster homes contribute to promoting healthy development and rebuilding the emotional fabric of these individuals (Decreto-Lei n.º 164/2019, 2019).

In addition, foster homes play a fundamental role in the social reintegration of children and young people through family support programmes, preparing them for an independent and successful life. These institutions act as a last resort for many children who have no safe alternatives within their biological families (Portaria n.º 450/2023, 2023).

It is essential that the state and society continue to invest in improving and expanding these foster homes, guaranteeing adequate resources and specialised training for their professionals, in order to

ensure an environment conducive to the healthy development and future of these children and young people.

In conclusion, AR presents an innovative frontier that transforms how we interact with the world, offering boundless opportunities across industries. Its integration with daily life holds immense potential. Concurrently, the pivotal role of foster homes in Portugal underscores the importance of prioritizing resources and support for vulnerable children, as the base to shape the future of society. The aim of this project is to promote awareness about this subject, while at the same time exploring AR technology with all its potential to diversify the extent to which a book can be used.

Key words: augmented reality, human development, prejudice, inclusion, foster home.

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SMART MIRROR – PERSONALIZED HUMAN MACHINE INTERFACE

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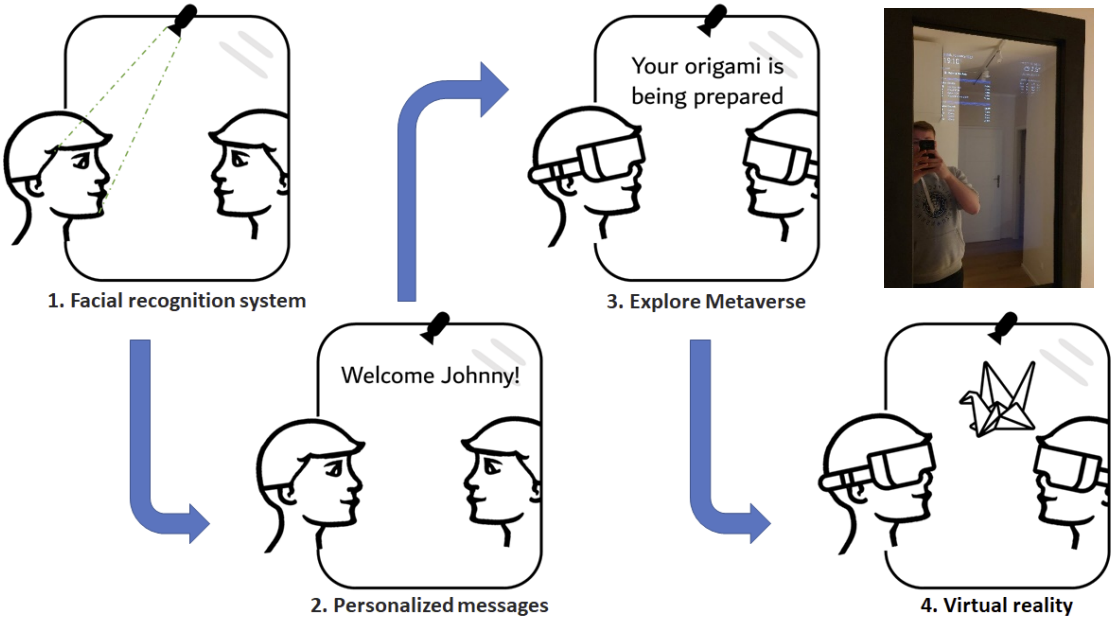
Abstract

Human-machine interaction becomes an important issue in the digitalization era. We want a machine to interact with us in a personalized way. It means that the machine should recognize us and next offer personalized actions.
This work presents a project called 'Smart Mirror', which was designed as part of a larger system that helps people/patients in the rehabilitation process. One of the key features of this smart mirror is its ability to recognize individual faces and personalize the information displayed on the mirror. The mirror interacts with the user, learning their interests and preferences, and displaying personalized content that caters to their specific needs. Additionally, users are able to communicate with the mirror using voice commands, making the interaction more intuitive and user-friendly. In our system, which is dedicated to the rehabilitation of patients, the person interacting with the mirror is offered activities that best suit his/her current state of recovery/rehabilitation.



The mirror can be equipped with features aimed at helping users combat loneliness and social exclusion. It can engage the user in conversations and ask how they feel, what they would like to do, and what interests them. Based on the user's responses, the mirror can suggest personalized activities to help the user feel more socially connected and included.
This project also utilizes the concept of the metaverse by incorporating augmented reality (AR) technology. By using AR, the mirror can create an interactive and personalized experience for the user. It can recognize the user's face, engage in voice communication, and suggest activities based on their interests and preferences. The goal is to use technology to combat social exclusion and provide a sense of community for those who may feel isolated.

Key words: Augmented Reality, Human Machine Interface.

USING DIGITAL CAMERA FOR THE FIRST TIME AT 99 YEARS OLD: BENEFITS OF A PHOTOVOICE PROGRAM

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Abstract

Despite the technological revolution that we witness daily, for some persons the simple act of using a digital camera can be transformative. Based on this principle, this work presents the results of the PERENE project, in which older persons from residential structures and day centers in the central interior of Portugal were challenged to reflect and share aspects of their advanced lives through photographs taken by themselves. The project was based on the photovoice methodology, presented by Wang and Burris (1997) as a qualitative and participatory action research technique, through which people create and discuss photographs as a means of triggering personal and community change. The program took place separately in six Social Solidarity Institutions and involved the development of artistic residencies and involved the participation of 24 older persons, aged between 61 and 99 (mean 82.6, SD 9.2), most of them were women (n=16), widowers (n=15) and had never been to school (n=13). The project developed over several months through the phases of (a) planning (dissemination activities, recruitment of participants, training of professionals and request for ethical approval); (b) implementation (five artistic residencies to support the photographing process and five group sessions to present the photos); and (c) finalization phases (organization of the data to be presented in exhibitions and a book). The topics to be photographed were: (i) Places where I feel good, (ii) People who I like; (iii), Objects with my memories; (iv) What is good for me; (v) What I would like to change around me.
The aim of the present study is to analyze the experience of participating in the program according to the opinion of older persons and of the professionals from the Institutions who participated in the project. At the end of the artistic residencies and group sessions, a researcher conducted a focus group in each of the six Institutions in which the program was developed. Guided by a semi-structured script about the experience of participating in the project, the interview took about 30 minutes with the participants and 15 minutes with the professionals. The information collected in audio format was transcribed and subjected to qualitative analysis according to the reference of Braun and Clarke (2019). The first and second authors read each transcript and identified major themes, which were discussed by both to deepen the reflexive engagement with the data. The authors then coded the transcription in a reflexive, collaborative process, defined sub-themes and selected verbatim extracts in order to better present the meaning of each theme.
Overall, the experience was considered as very positive and rewarding, having led to the learning of something completely unknown to them, the use of a digital camera. In more detail, the first theme presents the benefits at emotional, motor, and cognitive levels, such as to recall memories and to improve the knowledge about the other group members. The second theme presents the main difficulties they had to face, which were organized by emotional, motor, cognitive and sensorial functions. For instance, the vision and auditive deficits and the motor problems in hands caused by stroke. The third topic was related to methodological aspects, such as the importance of the artistic residencies to learn how to use the digital cameras and improvement suggestions. These results reinforce the potentialities of using photovoice with older persons that have been reported in other studies (Mysyuk & Huisman, 2019), demonstrating that even very old persons (one participant was 99 years old) can learn and be interested in new technologies. Furthermore, this study adds evidence

about the benefits and difficulties as well as suggestions for improving the use of photovoice in future studies.

Key words: photovoice, digital cameras, older persons, lifelong learning, participation.

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AUTONOMOUS ADAPTATION OF FOOD PLANS

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Abstract

In nutrition and diet planning, adherence to structured food plans remains a significant challenge, with frequent abandonment due to rigidity, lack of personalization, and evolving dietary preferences. Our work introduces an innovative approach to addressing these issues by implementing Language Learning Models (LLMs) as the technological backbone of adaptive food plan assistants. The design of these assistants supports individuals in making informed food selection decisions by dynamically adjusting food plans based on user feedback, preferences, nutritional goals, and contextual factors such as seasonal availability of ingredients and evolving nutritional science.

The core of our methodology revolves around leveraging the sophisticated natural language processing (NLP) capabilities of LLMs to interpret user inputs, queries, and feedback in a nuanced manner. It allows the system to understand explicit dietary preferences, restrictions, and subtler preferences related to taste, texture, and culinary traditions. By continuously learning from interactions and data gathered by wearable technology, the LLM-powered assistant can propose personalized food plans that are nutritionally balanced and aligned with the user's unique preferences and lifestyle, thus enhancing adherence and satisfaction.

Implementing LLMs in creating adaptive food plan assistants also addresses the challenge of scalability and customization in nutrition planning. Unlike traditional diet plans that require extensive manual customization to meet individual needs, LLM-powered systems can automatically generate personalized plans at scale and adapt them recurrently, making expert nutritional advice more accessible and affordable for a broader audience.

Adopting comprehensive prompt interaction in LLM-powered food plan assistants improves the accuracy and relevance of the dietary recommendations provided. It fosters a deeper connection between the user and the assistant. This approach involves designing conversational interfaces that can understand and generate complex, multi-turn interactions, allowing users to engage in detailed dialogues about their dietary needs, preferences, and feedback. By leveraging comprehensive prompt interaction, the chatbot can ask clarifying questions, offer suggestions, and adjust its recommendations in real-time, creating a highly interactive and personalized user experience. This level of engagement mimics the nuanced conversations with a human nutritionist, thereby enhancing user trust and reliance on the system.

Our system also incorporates an educational component, providing users with insights into nutritional values, the benefits of various foods, and cooking tips to encourage healthy eating habits. This feature aims to empower users with knowledge, making them active participants in dietary choices rather than passive followers of prescribed plans.

Keywords: personalized assistant, nutrition, chatbot, LLM, food plan.

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VIRTUAL LABORATORY- EXPERIMENT WITH A SQUID NEURON

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Abstract

New technologies and artificial intelligence are in our daily lives. They are powerful tools to improve our well-being and development with special attention in education. Some platforms are being developed to encourage and help students to understand concepts that otherwise could be more difficult. This is the case of Labster, available for the students in the Polytechnic of Viseu (PV), with knowledge in chemistry, physics, biology, anatomy, physiology, and ecology, among others, to practice, study theoretical backgrounds, view nonconstitutional parts in the chemical reactions or human and animal bodies. This opportunity of virtual studying laboratory experiments emerged with the pandemic, but revealed to be very important also in traditional face-to-face classes. Inspired by the game-based learning methodology, simulations are interactive and visual, an effective tool for teaching complex concepts, adjusting to a self-first understanding of the theory and experimental features of each experiment, and also to a virtual realization of all the experimental process.
Along with the utilization of the virtual laboratories, it is possible to find several advantages, like the accessibility for all students, provided with access to laboratory experiences regardless of physical location, making it especially valuable for distance learning or when in-person labs are not feasible. Also, it has scalability, which can accommodate many students simultaneously, and flexibility, because students can access the simulations at their own place and time, enabling personalized learning experiences. Furthermore, it is considered safe, as virtual labs eliminate risks associated with handling hazardous materials or operating complex equipment, ensuring a safer learning environment, and interaction because the platform offers interactive simulations that engage students in hands-on learning, promoting a better understanding of scientific concepts and procedures, giving immediate feedback on students' performance within the simulations, facilitating formative assessment and enabling instructors to identify areas where students may need additional support. Although it evolves a fee for the institution, it can be considered cost-effective. In fact, it reduces the costs associated with setting up and maintaining physical laboratories, such as purchasing equipment, chemicals, and safety measures.
As with all online activities, virtual laboratories also have disadvantages, that can be relativized with good outcomes. For instance, simulations aim to replicate real laboratory experiences, they may lack the full sensory experience of a physical lab, including the sensorial sensations associated with conducting experiments. And inhibits the development of physical skills development, such as pipetting, for example. Indeed, virtual labs cannot fully replace the development of manual dexterity and laboratory techniques that students gain from hands-on experience in physical laboratories. The requirements of the software also imply the need for computers or mobile devices with internet connectivity, which may pose challenges for students who lack access to suitable technology or reliable internet connections. And, maybe the most important, the loss of social interaction, the lack of the collaborative and social aspects of working in a physical laboratory, such as peer-to-peer

interaction, group discussions, and teamwork, or disconnection with the teacher. However once the use of the virtual laboratories is pre-preparation for laboratorial activities, these disadvantages are minimized.

In the case of the simulation “Experiment with a Squid Neuron”, students learn about the propagation of an action potential along the membrane of the axon of a neuron extracting the giant axon from a squid and using electrodes to send various electric signals to observe their effects. Through practical experimentation in a virtual setting, students from PV may work with several materials and specific equipment, performing an interesting and useful method that allows them to investigate neurobiology ideas that otherwise would be unapproachable. The overall level of student’s satisfaction is very high, with freedom, but also responsibility, in the learning process, promoting their autonomous work.

Key words: Virtual laboratory experiments, autonomous work.

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PROGRESSIVE SOPHISTICATION OF COMMUNICATION AND INTERACTION IN VIDEOGAMES FOR CHILDREN AND YOUNG PEOPLE WITH AUTISM SPECTRUM DISORDER

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Abstract

Children and young people with Autism Spectrum Disorder (ASD) often struggle with communication and social interaction skills (Hyman et al., 2020). Studies show benefits for people with ASD from playing videogames (Baldassarri et al., 2020; Malinverni et al., 2017). Still, current solutions targeting this audience tend to assume and expose educational goals (e.g., Zakari et al., 2014). We've been researching and developing guidance on how to design videogames with the potential to improve those skills while providing experiences that players can perceived as purely ludic.

Previously, we distilled a set of six guidelines (Alves et al., 2021) that we were able to put into practice in specific games. However, the guideline that suggests to "focus level design on the progressive sophistication of communication and interaction" has been more challenging. To a certain extent this can be attributed to the scale of the projects in which we were able to experiment with that guideline, so far, which did not allow the team to reach its full implementation. We realised that while the other guidelines can be applied right from early stages and in small developments, this guideline, consistently with what it suggests, implies more complexity, at least to include alternate ways to perform some game actions. The acknowledgement of this disparity and the desire to provide tangible instantiations of that "sophistication", led us to dedicate even more attention to this aspect and to systematize some major ideas so that we can share them while we are also working in their application.

A key point of our proposal is that the introduction of more complex ways to communicate and interact is meant to allow players to engage in new strategies (more challenging but also more advantageous), if/when they are willing to try them, but previous alternatives should remain as usable. The specificities of the target users demand a cautious approach to changes and to the anxiety implied by risking and possibly failing. Players should be able to mix the alternatives and go back and forth in complexity, according to what they are prepared to invest in each specific circumstance. Another important aspect is that the unfolding of new alternatives, regarding communication and interaction, should be triggered by each player's behaviour patterns and not directly by the game levels common to all players. This implies to rethink or complement conventional patterns for game level design.

Currently, we are working on ways to enrich the tools for players to communicate and interact. The underlaying ideas are not innovative per se, in the sense that we can reference games (for the general public) that integrate them in some way or context. Our argument is that it is relevant to assemble and redesign them, considering the specific purpose of this research. For instance, in previous experiments we understood that it would be relevant that a player (playing character) could signal other players an interest in their collaboration or proximity. This would support that kind of proactivity (should it emerge) while influencing others to interact. We also consider very worth integrating mechanisms that allow expressing empathy towards other characters, or other emotional displays. Again, many games embed solutions that include predefined messages and/or graphics (e.g. emojis), but the specificities of our target audience require that the system is tailored in a way that is suitable and may contribute to developing this type of externalization of one's feelings. Ultimately, it would be relevant to test a message system closer to an in-game chat, for more advanced levels of communication. Finally, we are also very interested in further integrating trading systems, common to many games, as a way to entice players to interact.

Key words: Autism Spectrum Disorder, children, communication, social interaction, videogames.

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TEACHING CYBERSECURITY TECHNOLOGIES IN VIRTUAL LAB

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Abstract

The European University for Customized Education (EUNICE) unites ten public European universities from all four European regions to establish the EUNICE campus – a distinctive, inter-university environment where students and faculty engage in market-tailored curricula. Cybersecurity stands out as a focal point within these curricula.

Today, the importance of cybersecurity has surged due to the increasing frequency and complexity of cyber-attacks. The emergence of artificial intelligence and machine learning has catalyzed the development of advanced security measures capable of swiftly identifying and mitigating cyber threats. Additionally, the proliferation of the Internet of Things (IoT) has introduced new security challenges, with a growing number of internet-connected devices exacerbating the issue. These factors underscore the criticality of teaching cybersecurity topics.

In order to effectively integrate cybersecurity education into the courses offered at EUNICE university, which operates with a distributed teaching and laboratory infrastructure, the utilization of developed platforms and remote access systems became necessary.

The EUNICE Virtual Lab leverages Espresso Labs, a cloud-based service with locally deployed controllers, enabling the creation of extensive laboratories comprising physical and virtual devices. These labs are fully supported through a web application interface. Access provided by Espresso Labs extends to laboratories within courses such as Introduction to Cybersecurity, Network Security, and IoT Security.

Espresso Labs facilitates the creation of various laboratory scenarios utilizing real devices. Each device is represented as a logical instance with an associated name and class. Configuration of global access to devices is possible, encompassing protocols such as SSH, RDP, and RBF. This includes defining parameters such as addresses and ports for access and authentication. Devices are categorized into classes, delineating their type (e.g., switches, routers, firewalls, computers with different operating systems), and can be organized into logical sets, each of which can be assigned to one or more laboratories. Reservation of a set, specified for a particular laboratory, grants exclusive access to the contained devices for a specific user, who can authenticate using login credentials or a temporary access key.

Espresso Labs is not only instrumental in conducting laboratory classes for configuring network devices but also finds extensive application in creating and sharing laboratory scenarios for IoT Security. Remote access to microcomputers like Raspberry Pi and support for ESP devices are feasible. Users can configure these devices, implement various security mechanisms, and conduct vulnerability testing and detection.

In summary, Espresso Labs offers a versatile platform for accessing various types of teaching infrastructure, irrespective of the device type or manufacturer, enhancing the educational experience at EUNICE university.

Key words: cybersecurity, remote access, laboratory infrastructure, sharing resources.

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