ASSESS INFORMAL LEARNING, THROUGH TECHNOLOGY, IN SCIENCE CENTERS OR SCIENCE MUSEUMS

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RESEARCH PLAN

TRAINING IN THE KNOWLEDGE SOCIETY

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INTRODUCTION

Science exhibitions are an effective tool for tech research and education, both in the production and design phase as well as in the informal settings as science centers and science museums, as they are used to promote informal learning in visitors. Many research in the past (and present) is focused on teaching and learning science in this environments, led by researchers in the area of Pedagogy and Education but we also believe that in informal settings as Science Centers and Science Museums, this specific approach from a technological point of view should be also profoundly studied. Educational virtual environments (VEs), since presence is correlated with higher levels of cognitive performance and emotional development, factors that contribute to knowledge construction (Mikropoulos, T.A. & Strouboulis, V. 2004). Technology can serve as a medium for visitors to feel connected throughout their museum experience. This creates an opportunity for both educators and museum facilitators to promote interactive viewing experience (Kim, A.K. & Harris, E, 2019; Kim, A.K. & Michael C. 2019). Findings suggest that different resource designs are associated with different levels of engagement-related behaviors, and designs for guided exploratory learning have the potential to support students' progress towards conceptual understanding (Nils Petter Hauan & Jennifer DeWitt (2017). Studies also show that the latest human-computer interaction (HCI) innovations have made many technologies, e.g., virtual reality, personal digital assistant, biometric authentication, e.g., fingerprint scanner available to us and have made our lives convenient, secure etc. (Hasan, M.S. et al., 2017). Virtual Reality Environments can be means of enhancing, motivating and stimulating learners' understanding of certain events, especially those for which the traditional notion of instructional learning has proven inappropriate or difficult (Pan, Z. et al, 2006). In museum settings, forms and techniques of digital interactivity have become a common practice directly impacting the visitors' experience of exhibitions and their content, arguably encouraging participation, empowerment, alternative approaches to engaging with dominant histories, on-going and controversial issues, and a degree of liberation from didactic models of knowledge production. (Ntalla, I. 2017). Our major object of study is the Bragança Ciência Viva Science Centre, in Bragança, Portugal (from now on referred to as CCVB) a 15-year-old non-profit scientific and technical association whose founding members are the National Agency for Scientific and Technological Culture - Ciência Viva, the Bragança City Council and the Polytechnic Institute of Bragança (IPB). The CCVB's primary mission is to disseminate science and technology in society and promote educational and scientific literacy. It aims to become a more recognized pole of knowledge, in cross-cutting areas and of proven importance for society. This research based on the analysis of exhibits innovation will unequivocally contribute to the development of attractiveness improvement of CCVB, through offering purposeful exhibits and activities focused on young and adult education, based on consolidated projects aiming for a more effective learning. This mission is supported by the facilities that host a permanent exhibition, with interactive exhibits dedicated to major themes such as Environment and Energy, at the main building, and with the historical, cultural and ecological heritage of the Northeast of Portugal, at Casa da Seda (Silk House). The CCVB bases the diversity of its offer both on the thematics and depending on the target audiences, in the most comprehensive scientific dissemination actions possible. It is recognized as an exceptional channel for communicating current issues and it is an ideal space to involve citizens in the democratization of knowledge and the promotion of favorable changes in their behavior, facing extremely pertinent issues, such as energy sustainability and the preservation of the environment (the European Union's strategic priority for 2020 and the United Nations Framework Convention on Climate Change COP21). CCVB is also part of the National Network of Ciência Viva Science Centers, consisting of 21 Centers spread across the continent and islands. CCVB also belongs to the ECSITE (European Network of Science Centres and Museums) whose main objectives include to inspire and empower science centers, museums and all organizations that involve people with science, to promote their curiosity and actions, and also to foster creativity and critical thinking in the European society, emboldening citizens to engage deeply with science. Science center exhibits are typically highly interactive, involve a wide range of target groups, have a specific purpose of being educational and engaging, and set requirements for robustness and ethics. The exhibits open up for different modes of embodied interaction, where users can participate and collaborate in different forms and degrees, and where digital and physical design materials and spaces merge. Science centers can also work as a stage for transdisciplinarity, where natural science meets arts and humanities (Wideström, J., 2020). A socio-scientific issues-based exhibition should be designed with a focus on increasing public engagement with science and relevance science centers in society, and it should convey various kinds of information contextually and make visitors share their own opinions with others in an exhibition space (Yun, A. et al. 2020).

HYPOTHESIS AND PRINCIPAL OBJECTIVES SOUGHT

Theoretical design research on science centers, summarized in the Design of Experience - DEX Framework (Ocampo-Agudelo et al., 2017; Ocampo-Aguedo, J & Maya, J. 2017), suggests that the visitor experience in a science center is based on five building blocks: physical, institutional, personal, relational, and social. Our hypothesis: which exhibits are more effective in an informal learning experience? We would like to test our hypothesis based on the visitors' perspectives in the Braganza Ciência Viva Science Center (and 3 other European museums in a smaller scale) as we plan for and to develop science exhibitions appropriate for our public. We also want to access how the engaging process in a learning experience is directly related to its location and understand at what level and how everyone that has the experience values digitalization of contents. Interactive exhibitions which can be tried by touching and playing between space and technology themed exhibition areas in science centers for visitors are among the places that make the greatest contribution in terms of informal education (Sirtkaya Uzun, A. & Ertas Besir, S., 2022). The Braganza Ciência Viva Science Center, where most of this research will be developed, offers 26 interactive exhibits focused on 3 major themes: 1. Presenting scientific principles connected to the production and manufacture of SILK, research of its properties and the silkworm ecology (n=6) [Exhibits: Metamorphosis, Magic Book, Inside the Silkworm, Legend of the Princess, The Silk Factory and Spinning and Playing] 2. Presenting scientific and technical principles and solutions connected to Sustainability (n=11) [Exhibits:Tech Platform Silkhouse, Silkhouse Interactive, SmartRiver, Rocket, Environment and Quality of life, Snails Race, Ecological Footprint, Birthday Cake&Wind Energy, Recycling, Facilities Tech and Electricity (outdoor)]. 3. Presenting scientific principles related to Fundamental Sciences such as Biology (Biodiversity) Physics (Astronomy), Geology, Geography and Climate Science (n=8) [Exhibits: Virtual Douro, Natural Park Montesinho Timelapse, Tornado, Google Earth, Tree of Life, Natural Landscapes, Solar System and Origin of Life and Magnetism]. We also want to analyze exhibits impact on informal learning in 3 other museums, from Italy, Spain and France, in a smaller case study, as a part of this research, as we are involved in European projects with institutions from these countries. This research has as a main objective to contribute to the field of science communication as it can provide recommendations to the setting up of new exhibitions having, in the center of this research, how visitors valorize (more digital or more analogical) the educational science exhibits. We will study this based in their own answers (evaluating their experience). Staff facilitators and educators can also help visitors and families learn more from museum exhibits by giving them information about exhibits, as well as by concurrently challenging and encouraging visitors in their interactions with exhibits. (Pattison, S.A. et al, 2017). This process of collecting data is, in itself, a way of promoting with our visitors new ways of thinking and acting towards more engaged and critical citizenship, that has been the purpose of many pedagogic principles that preceded and motivated the concept of global education. Thus, a global education can open the path to a better understanding of the globalized world and foster participative civic engagement in finding solutions to common challenges, as a society. We can develop, after this research is concluded, with the Polytechnical Institute of Braganza and with science-based projects, new approaches to exhibitions, recommending its production and design, considering the data collected with different target-groups of visitors and the specific context of our science center (geographical location, dimension, funding, resources – financial and human). Overall objectives also include: - Improve the basic skills of individuals by managing new technology and information; - Consolidate specific skills (in terms of cultural literacy, science and technology and community development); - Integrate of experienced knowledge in their lives; - Improve personal motivation and critical reflection in science issues. The 2030 Agenda and the 17 Sustainable Development Goals (SDGs) are nowadays the main international reference framework linking human rights with sustainable development and in SDG 4 – Quality Education, is mentioned the role of global citizenship and education in developing individual competences to reach the defined targets of the Agenda, namely: "By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development" (United Nations, 2015). As a result, the education process, either in formal or informal contexts, has been affirmed as an instrument against discrimination and exclusion, and their access has been facilitated as a mean of promoting justice, freedom, human rights, and peace. Finally, the research is in line with the Horizontal priority related to innovative practices in a digital era as it addresses innovatively the connection between reality–virtuality. It will sustain the taking up of digital and virtual or digital-based technologies and of innovative and open pedagogies in science education, training, tourism, social and cultural heritage.

METHODOLOGY

First, we will be making a systematic literature review as it must follow a method that systematizes the work done, making it reproducible and reliable. Therefore, for a review to be considered scientific research, it must be systematic, i.e., it must sum and analyze the evidence in a structured, explicit, and systematic way concerning the research questions posed (García-Peñalvo, F. J. 2022). This implies that the method used to find, select, analyze, and synthesize the primary sources must be precisely defined and documented (García-Peñalvo, F. J. 2022). The systematic literature review approach has become the most powerful and accepted method to address the development of the much-needed state-of-the-art, applying the foundations of evidence-based research. For example, an academic work, such as a PhD thesis, is strengthened in its contextualization when it has a systematic literature review. In this way, the formulation of its hypotheses and contributions will be much more robust, and its results are more likely to be shared in the form of an academic article (García-Peñalvo, F. J. 2022). For the reasons presented in García-Peñalvo, F. J. (2022) we will be using a qualitative approach, after we analyze and implement the appropriate systematic literature review that will certainly lead us in the right methodology, implementing protocols that assure bioethics and biosecurity. We predict that the target group can be: all learners/visitors that visit and have access to scientific and educational interactive learning environments but they will be analyzed both as a whole and separately, so we can compare different age, sex, socio-economic, people with physical disabilities or ethnic groups. In an ideal setting, everyone that has more contact with modern technologies applied in learning processes, such as VR or interactive content,a s in the science center or museum (Yung, R. & Khoo-Lattimore, C., 2019). CCVB and its partners are environments that promote educational and scientific knowledge dissemination. Providing access to scientific information and educational activities for people with different social backgrounds is part of our mission. This includes allowing less favored people to access recent technologies, such as people with less economic power or physical disabilities. Establishing contact between different social status audiences and recent technologies promotes inclusion by allowing unrestrained access and interaction with technology that otherwise would not be possible by people from disadvantaged layers of society. We also need to analyze if engaging in a learning experience directly related to the location where it happens. The European dimension of the research is a key factor in achieving the expected results. The whole project idea indeed is based on a transnational comparison of approaches, issues, solutions, and good practice in the implementation of innovative strategies for informal learning. The ethical code adopted will be the Ethical Guidelines for Educational Research from the British Educational Research Association. (BERA) (2018).

MATERIAL MEANS AND RESOURCES AVAILABLE

This work is carried out in the PhD programme: Training in the Knowledge Society (García-Peñalvo, 2013; 2014; 2021), with its portal being the main tool for communication and visibility of progress (García-Peñalvo et al., 2019b).

This thesis is developed in the GRIAL Group of the University of Salamanca (García-Peñalvo et al., 2019a; GRIAL Group, 2019). The results of this thesis will be openly accessible (Ramírez-Montoya et al., 2018).

We also have access to the Bragança Ciência Viva Science Center and its visitors and also some visitors in a defined period of time on the other 3 European museums we will visit in the context of different European projects. All the material resources are available, as well as digital access to scientific platforms. We also have access to the IPB facilities if needed.

TIMING SCHEDULE

FIRST YEAR (2021/2022)

- Deliver the Research Plan;

- Presenting a paper in the Portuguese Science Communication Conference (SciComPt 2022) - Açores 12th and 13th of May 2022, intitled "Silkhouse 2.0: Renovation projets of digital content for science communication";

- Attending the ECSITE Conference (2nd to 4th of June) Heilbronn Germany;

- Systematic Literature review;

- Submit a paper for TEEM 2022;

- Design the quantitative (if applied) and qualitative approach to this study (questionnaires, target-groups, observation)

SECOND YEAR (2022/2023)

- Attend (and hopefully) present a paper at TEEM 2022 (October 2022)

- Collect data from the target groups

- Organize in Bragança, for the first time, de portuguese Science Communication Conference (11th edition) as promoters (CCVB and IPB)

- Attending and present a paper at the ECSITE Conference 2023.

- Submit a paper for TEEM 2023 and attend the conference

- Data base analysis

THIRD YEAR (2023/2024)

- Finish the data base analysis

- Attend and present a paper in the Portuguese Science Communication Conference (SciComPt 2024)

- Attend and present a paper at the ECSITE Conference 2024.

- Write and deliver the final script

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