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From Physical to Virtual: Redefining Scientific Events with Immersive Technologies

Anrafel Fernandes Pereira, Marcos Antônio da Silva, Luiz Fernando Ibrahim Rebello Cabral, Maria Fernanda Caravana de Castro Moraes Ricci, Letícia Patrão de Macedo Gomes and Carlos Eduardo Cardoso

University of Vassouras, Vassouras / RJ, Brazil
anrafel.pereira@univassouras.edu.br
marksilva147@hotmail.com
nandoircabral@gmail.com
mariafernanda.ricci@univassouras.edu.br
leticia.gomes@univassouras.edu.br
carlos.cardoso@univassouras.edu.br

Abstract. This study explores the use of immersive technologies in higher education through the case of the 1st Edition of the National Scientific Initiation Meeting (ENIC) at the University of Vassouras, hosted in the metaverse. The goal was to assess the event's innovation, accessibility, and effectiveness as a virtual academic gathering. Using a mixed-methods approach, data were collected from 30 participants via a structured survey and analyzed quantitatively and qualitatively. Results showed that 90% of participants rated the initiative as "Very Good," highlighting its transformative impact on academic inclusion and engagement. While technical support and tutorials received positive evaluations, some participants noted challenges such as unstable connections and suggested improvements to tutorials and platform functionalities. The study concludes that the metaverse offers significant opportunities to enhance academic events by eliminating geographical barriers and promoting collaboration. Recommendations for future editions include optimizing the platform, enhancing tutorials, and expanding interactive features to maximize the potential of immersive technologies in education.

Keywords: Immersive Technologies, Metaverse, Virtual Events, Higher Education, Collaborative Learning.

1 Introduction

Digital transformation in higher education has driven the adoption of emerging technologies to create more inclusive and innovative educational experiences. In this context, the metaverse emerges as a powerful tool for integrating in-person and remote learning modalities, promoting interaction and collaboration in three-dimensional environments [4–6]. These characteristics are particularly relevant in academic events, where knowledge sharing and the exchange of experiences play a central role [6].

The Scientific Initiation Meeting (ENIC – in Portuguese) of the University of Vassouras, traditionally recognized for fostering scientific production and academic integration, found in the metaverse an opportunity to expand its reach and impact. In its 21st edition, held in October 2024, ENIC was partially organized in a three-dimensional virtual environment using the Spatial platform. This format enabled the event to connect participants from different regions and teaching modalities, bringing together 68 participants in a collaborative and interactive experience. Seventeen academic works were presented in fields such as Environmental Sciences, Health, and Exact Sciences, highlighting the interdisciplinary nature of the event. In addition to creating an accessible and innovative space, the event employed well-defined strategies, including the development of detailed tutorials, dedicated technical support, and the configuration of immersive environments that simulated aspects of in-person events. This approach not only facilitated participant navigation but also demonstrated the potential of immersive technologies to overcome accessibility and logistical challenges in organizing academic events.

This study presents results on the impact of conducting ENIC in the metaverse, evaluating aspects such as the event's proposal, technical support, tutorials, and participants' overall experience. Through a quantitative and

qualitative approach, this work seeks to identify best practices, challenges faced, and future opportunities for the use of immersive technologies in higher education.

2 Case Report

The Scientific Initiation Meeting (ENIC – in Portuguese) of the University of Vassouras is a well-established event in the institution's academic calendar, promoted by the Dean of Research and Technological Innovation. ENIC is renowned for fostering the dissemination of research conducted by undergraduate and graduate students, providing a platform for knowledge exchange and strengthening scientific practices. In its 21st edition, held in October 2024, ENIC innovated by being partially organized in the metaverse, marking another step forward in the institution's use of immersive technology. The 1st Edition of ENIC in the metaverse aligned with trends observed in programs such as VR-IPE (Virtual Reality Interprofessional Education) [3], which demonstrate the effectiveness of virtual environments in promoting interdisciplinary collaboration and overcoming geographic barriers. This approach aimed to integrate students from both in-person and distance learning modalities into a collaborative and interactive academic environment, fundamental characteristics for the success of immersive academic events. The event included 68 participants, comprising professors, students, and members of the academic community, and featured 17 academic works from fields such as Environmental Sciences, Applied Health Sciences, Social and Human Sciences, and Exact Sciences, emphasizing the interdisciplinary nature of the meeting.

The Spatial platform was chosen as the primary environment for the event due to its ability to create immersive three-dimensional spaces. The tool provides accessibility through mobile devices, computers, and virtual reality (VR) headsets, enabling participants to interact via personalized avatars, voice communication, and camera sharing. Practices described in [1], which use virtual rooms to promote interaction and collaboration, were fundamental in ensuring that participants adapted to the three-dimensional environment and maximized the proposed interactive dynamics. The virtual spaces were configured with graphical and interactive resources that reflected the identity of the event and the university, such as banners, logos, and digital signage. These elements were strategically positioned to facilitate participant navigation and create an intuitive and immersive experience. Furthermore, the customization of the environment allowed poster presentations and interactions with evaluators to take place in a manner like in-person formats. Figure 1 shows the environment, and all materials are available on Zenodo [2].

The planning of the 1st edition of ENIC in the metaverse followed a structure like that of in-person events, with adaptations to the virtual environment. The stages included: (i) Scheduling and Evaluation of Works: Presentation schedules were organized in advance, and the academic works underwent a rigorous evaluation by a specialized faculty panel; (ii) Production of Materials: Students prepared posters and abstracts highlighting the objectives, methods, and results of their research. These materials were adapted to a digital format to ensure compatibility with the platform used; (iii) Participant Training: Tutorials were developed to help participants familiarize themselves with the platform, covering topics from avatar creation to navigation and interaction within the virtual environment; and (iv) Technical Support: During the event, a technical support team was available to address issues and assist participants, ensuring everyone could fully enjoy the experience.

ENIC in the metaverse not only expanded opportunities for interaction and collaboration among participants but also demonstrated the potential of immersive technologies to transform academic events. The integration of interactive tools, combined with efficient organization, positioned the event as a milestone for the University of Vassouras and a model for future initiatives in higher education.

Fig. 1. Image of the event's closing with some participants, presenters, evaluators, and visitors.

2.1 Data Collection and Analysis Procedures

The data presented in this study were collected from 30 voluntary participants, representing a diverse sample of the 68 attendees present at the online event. Responses were submitted anonymously and online at the end of the event. To assess the participants' experience, a structured questionnaire was administered, consisting of: (i) Five objective questions evaluated on a five-point Likert scale (Very Poor, Poor, Acceptable, Good, Very Good); and (ii) an open comment section, allowing participants to provide suggestions and qualitative feedback about their experience. Tutorials were also made available to guide participants on how to use the platform and facilitate their adaptation to the virtual environment. Participants evaluated the following aspects, organized into five questions: (i) the initiative/proposal of hosting the event in the metaverse; (ii) the execution of the event itself; (iii) the technical support provided to participants; (iv) the tutorials prepared by the technical team; and (v) their overall experience in the metaverse during the 21st ENIC. The collected data were analyzed in two main stages: Quantitative Analysis and Qualitative Analysis.

Quantitative Analysis: Responses on the Likert scales were tabulated and converted into frequencies and percentages to identify general trends. Results were grouped into categories such as "Very Good," "Good," and "Acceptable," highlighting the most positively evaluated aspects and areas for improvement.

Qualitative Analysis: Open-ended comments were analyzed using a thematic approach to identify patterns and insights. Feedback was classified into positive, negative, and suggestion categories, highlighting representative examples provided by participants, such as: (i) Praise for the event's accessibility, as noted by P25: "I liked the initiative of being online, making it easier for distance learners;" and (ii) Identification of technical challenges, as mentioned by P22: "I did not have a good experience at ENIC, as I fell out of the system twice during my short participation."

These combined analyses provided a comprehensive understanding of participants' overall perceptions while identifying practical recommendations for future editions of the event.

3 Results

In this section, we present a quantitative and qualitative analysis of participants' perceptions and experiences during the 1st Edition of ENIC in the Metaverse. The results are organized by each of the evaluated questions. Figure 2 visually presents the Survey results.

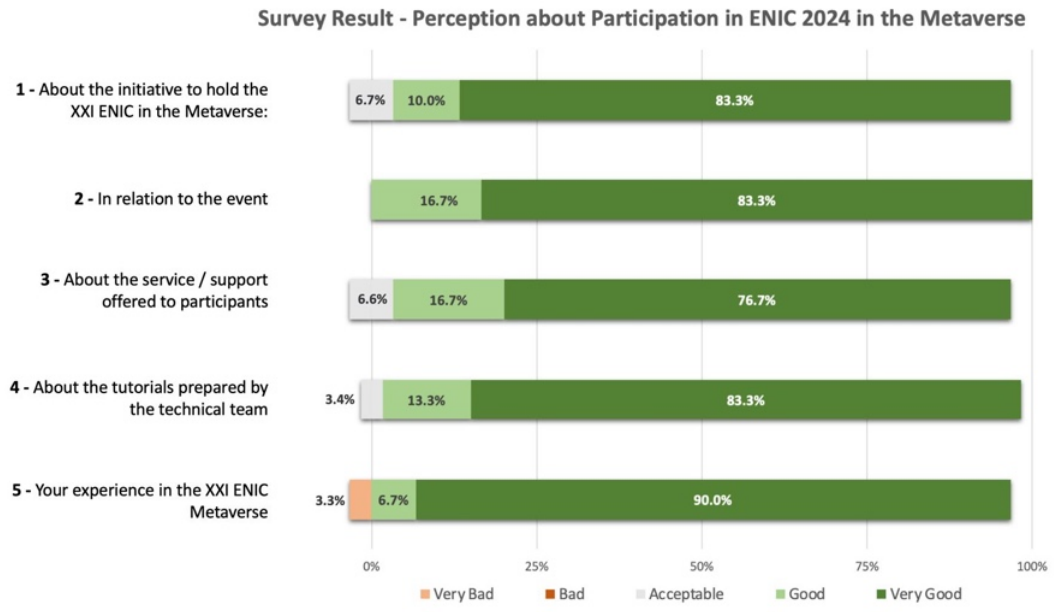

Fig. 2. Perception about Participation in ENIC 2024 in the Metaverse.

Question 01 - Regarding the initiative/proposal to host the 1st Edition of ENIC - Scientific Initiation Meeting of the University of Vassouras in the Metaverse: The proposal to hold ENIC in the metaverse was rated as "Very Good" by 83.3% of participants (25 out of 30), "Good" by 10% (3 participants), and "Acceptable" by 6.7% (2 participants). Comments reinforced the positive impact of the initiative, particularly highlighting the innovation and practicality of the format. Participants praised the experience, such as P3, who described the event as "great, an unforgettable experience," and P13, who noted: "An incredible, unique, and very innovative experience." Suggestions for continuity were frequent, with P10 stating, "It would be great to have more events in the metaverse," and P27 recommending its expansion to other events. The online format was widely praised for its accessibility, as noted by P25: "I liked the initiative of being online, making it easier for distance learners." However, participants who rated the proposal as "Good" pointed out areas for improvement, such as P14, who suggested more detailed tutorials, and P29, who recommended greater clarity in the initial information. Overall, the evaluation shows strong approval, while the suggestions provide valuable insights to enhance future editions, reinforcing the metaverse as a promising environment for inclusive and innovative scientific events.

Question 02 - Regarding the execution of the event: The event's execution was rated as 83.3% (25 out of 30) rating them as "Very Good" and 16.7% (5 participants) as "Good." Participants praised the organization and quality, as noted by P6: "I found everything perfect," and P13: "Everything else was perfect." Suggestions for improvement included enhancing direct interaction between participants and evaluators, with P25 proposing: "It would be interesting to have a direct contact option, like 1x1 chat (text or voice)." P26 also recommended adding online lectures and networking spaces. Technical issues were noted by P9, who suggested optimizing the virtual room, and by P10, who found the navigation between banners confusing. While the feedback was largely positive, the suggestions highlight opportunities to improve platform usability and expand interactive functionalities in future editions.

Question 03 - Regarding the Technical Team's Support: Technical support was rated as "Very Good" by 76.7% of participants (23 out of 30) and "Good" by 16.7% (5 participants), while 6.7% (2 participants) rated it as "Acceptable." Participants praised the team's efficiency and attentiveness, with P13 noting: "They were very attentive and quick to respond," and P1 adding: "I was well-supported before and during the event." Suggestions for improvement included faster issue resolution, as noted by P25: "Support took time to notice an error with the initial link sent." Those who rated the support as "Acceptable" often cited no need for contact, such as P29: "I didn't use the support." Despite the positive ratings, the suggestions emphasize the importance of proactive communication and quicker problem resolution to ensure a smoother experience.

Question 04 - Regarding the Tutorials Prepared by the Technical Team: The tutorials received positive ratings from all participants, with "Very Good" by 83.3% of participants (25 out of 30), while 13.3% (4 participants) rated it as "Good," and 3.3% (1 participant) as "Acceptable." Feedback emphasized clarity and functionality, with P13 stating: "The tutorials were objective and well-explained," and P1 highlighting their practicality: "Clear and simple tutorials; I created my avatar in minutes." Suggestions for improvement came from participants who rated them as "Good," such as P14, who recommended more detailed instructions: "Specify more." Overall, the tutorials were essential for the event's success, enabling participants to adapt to the virtual environment. However, there is room for enhancements to make the materials even more comprehensive and accessible.

Question 05 - Regarding the Participants' Experience in the Metaverse of the 21st ENIC: The experience in the metaverse was rated as "Very Good" by 90% of participants (27 out of 30), while 6.7% (2 participants) rated it as "Good," and only 3.3% (1 participant) classified it as "Poor." The overwhelmingly positive feedback highlighted the innovation, practicality, and quality of the virtual environment. Participants appreciated the convenience, as P1 noted: "I could present from home without issues," and P10 stated: "A great experience for the academic environment; virtually, it's much more practical." P17 described the event as "a game changer," while P28 called it "a unique and innovative experience." Suggestions for improvement included enhancing the virtual environment (P12: "The environment was very good") and addressing technical issues such as connection failures (P22) and platform lags (P29).

Overall, the feedback was highly positive, yet adjustments to technical aspects and platform functionality are necessary to further enhance the experience in future editions. The survey data that was analyzed is available on Zenodo [2].

4 Discussion

The results of this study highlight the potential of immersive technologies in higher education, as evidenced by the positive evaluation of the 1st ENIC edition held in the metaverse. Research suggests that immersive learning, when combined with narratives and active methodologies, fosters significant engagement and promotes critical knowledge construction [4], aligning with participants' perceptions of the event's innovation, accessibility, and organization.

Innovation and Inclusion: The overwhelmingly positive evaluation, with 90% rating the proposal as "Very Good," demonstrates the transformative impact of the event. The integration of participants from both in-person and remote learning modalities in a three-dimensional environment underscores the metaverse's potential for inclusive educational events. Comments such as P17's description of the event as "a game changer" and P28's recognition of it as a "unique and innovative experience" further validate this perspective.

Technical Support and Tutorials: While technical support and tutorials were widely praised, some participants reported challenges, including unstable connections and platform lags, emphasizing the need to enhance technological infrastructure. Suggestions to improve tutorials included more detailed guidance to facilitate navigation and user adaptation.

Interactivity and Collaboration: The virtual environment's strengths included personalized avatars and real-time communication. Participants proposed adding private chats and networking spaces to enhance collaboration and enrich their overall experience.

The success of the 1st ENIC edition in the metaverse reinforces the feasibility of integrating immersive technologies in higher education, eliminating geographical barriers and promoting academic inclusion. As P25 noted: "*I liked the initiative of being online, making it easier for distance learners.*" The platform's accessibility enabled participation from students in diverse locations. For future editions, recommendations include platform optimization, the development of detailed tutorials, the expansion of interactive functionalities like private chats, and stress tests on the infrastructure. These measures can consolidate the metaverse as an innovative solution for academic events.

While the transition to the metaverse increased accessibility and engagement, it also introduced challenges, particularly regarding networking and future collaboration. Traditional in-person academic events foster informal interactions that often lead to research partnerships, whereas the virtual format of ENIC may have limited spontaneous discussions. Some participants noted the absence of unstructured networking moments, which could have impacted the exchange of ideas beyond scheduled presentations. As a potential solution, future editions should incorporate dedicated networking spaces, breakout rooms, chat functions, and AI-driven matchmaking tools to facilitate meaningful connections. Additionally, adopting a hybrid format—combining virtual and physical networking opportunities—could ensure accessibility while preserving the collaborative benefits of in-person events.

5 Conclusions

This study evaluated the implementation and outcomes of the first edition of ENIC in the metaverse, highlighting the use of immersive technologies as an innovative and inclusive solution for academic events. Quantitative and qualitative data demonstrated that the initiative was widely successful, with positive evaluations in key aspects such as organization, accessibility, and participants' overall experience.

Hosting the event in a three-dimensional virtual environment enabled the integration of students and faculty from diverse modalities and locations, fostering greater academic inclusion. Similar findings have been reported by [5], emphasizing the benefits of the metaverse in education, including increased interactivity and immersion, while also addressing challenges and limitations in its implementation.

The positive feedback reinforces the potential of immersive technologies in higher education, particularly in terms of accessibility, innovation, and engagement. However, participants' suggestions highlight areas for improvement, such as the need for more detailed tutorials, enhanced technical infrastructure, and additional interactive features like private chats and networking spaces.

We conclude that the use of the metaverse in academic contexts offers a significant opportunity to rethink how scientific events are organized and accessed. Future editions of ENIC and other academic events should prioritize

technical improvements and the expansion of interactive functionalities to maximize the benefits of this technology. The success of this initiative establishes a milestone in higher education, consolidating the metaverse as a viable and promising tool for the future of education.

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