



Work-in-Progress—"Our Online Classroom": Immersive Web Environment

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Abstract. This work in progress describes "Our Online Classroom", the result of a co-created space between a teacher and 3rd and 4th years in a Portuguese school. The students are aged between eight and ten. The students actively participated in the design of the online space, from its ideation to the choice of setting in the immersive web environment, Frame VR. After the teacher presented the concept, the students divided into groups and in several brainstorming sessions, created sketches of the online space on scenery paper, which were then presented to their classmates. The teacher guided the work of the different groups, but due to the limitations of the school equipment, it was she who realized the Frame VR space with the resources suggested by the students, bringing their ideas to life in the virtual environment. "Our Online Classroom" is not only a place for interaction, but also an educational space where students can learn, explore and collaborate together while enjoying the immersive experience. The application of the student survey questionnaire made it possible to evaluate the impact of this experience, as well as to gather information for future initiatives involving the integration of Immersive Web Environments (IWE) in the classroom. The teacher, enthusiastic about the results achieved, wants to continue using in the classroom.

Keywords: Immersive Web Environments, Co-creation, Personalization.

1 Introduction

The knowledge that students acquire at school must be up-to-date and grounded in research and scientific enquiry. Schools must adapt their teaching methods integrating digital technologies (DT). The integration of technology into the educational context has changed not only the way in which knowledge is transmitted, but also the learning space itself. Schlemmer (2021) criticizes the reductionist view of digital technologies as only a means, tool, resource or support in education, highlighting their importance as products of society and culture, inseparable from society. They shouldn't be seen as something external or unwanted in education, but neither should they be used merely as instruments, because when they are applied in the traditional way, they are being underutilized [1]. Instead of replicating traditional teaching methods in digital form, the author advocates an approach that explores new methodologies and pedagogical practices that harness the full potential of digital technologies to transform educational practices.

With the growing integration of digital technologies in the educational context, there is a need to rethink the school. Not just pedagogy and content, but also the space where teaching and learning take place. Virtual spaces, 3D virtual worlds, metaverses or Immersive Web Environments (IWE), offer opportunities to reimagine classrooms through student conceptualization.

"Our Online Classroom" was developed as part of a teacher training workshop on Immersive Web Environments in an educational context, which explored the reinvention of educational environments (physical and virtual), integrating technology, innovative pedagogical practices and relevant content into the teaching-learning process.

This article describes the process of co-creation, between students and their teacher, of a virtual space designed by the students. The aim is to promote innovation and the inclusion of IWE in the classroom. At the same time, it seeks to understand how IWE can be integrated and enhanced by models that emphasise the importance of considering space as an element that enhances the intersection between technology, pedagogy, content and physical or virtual spaces. This approach aims to enable education that is more flexible, inclusive and aligned with the competences students are expected to acquire, particularly those considered essential for the 21st century.

2 Educational Frameworks: TPeCS, PST and HyFlex for Flexible Learning Environments

The models: i) Technology, Pedagogy, Content & Space (TPeCS) [2] based on the model Technological, Pedagogical, Content Knowledge (TPACK) [3], where Space meets Technology, Pedagogy and Content: ii) Pedagogy, Space, Technology (PST) [4], where Pedagogy, Space and Technology influence each other; or the more recent concept of iii) Hybrid and Flexible Learning (HyFlex) [5], which allows students to choose whether to take part face-to-face or remotely, allow the creation of learning environments that make the most of the possibilities offered by digital technologies, while adapting to the individual needs of the students.

The TPeCS model proposed by Kali et al. (2019) is an extension of the TPACK model, proposed by Mishra and Koehler (2009), as it incorporates space as an important element in the teaching and learning process. The model emphasizes the interaction between the pedagogy adopted, the educational content that is enhanced by the technology used, and the space designed and adapted to allow flexibility in the co-construction of knowledge. The TPACK model, is based on the intersection between technology, pedagogy and content. For the authors, technological knowledge refers to understanding technological tools and resources; pedagogical knowledge has to do with teaching and learning strategies; and content knowledge is related to understanding the concepts and topics to be taught. The integration of these three domains is crucial for the successful design and implementation of technology-mediated educational practices.

Similarly, the PST model, proposed by Radcliffe (2008) emphasizes the interaction between pedagogy, space and technology. These three elements are interconnected and influence each other, i.e. the way a space is used conditions (facilitating or not) a certain type of pedagogy, while a specific technology can affect the way a space is used. Furthermore, pedagogy can be enriched by the integration of technology [6].

The HyFlex concept, proposed by Penrod (2022) combines elements of face-to-face and online teaching, allowing students the flexibility to choose how to participate in classes at their convenience. This flexibility promotes the inclusion of students with different backgrounds, such as those with mobility restrictions and/or other specific needs. Thus, the learning space is no longer limited to the physical classroom, but can expand to virtual, online environments.

3 “Our Online Classroom”

The aim of “Our Online Classroom” was to understand whether students would be interested in participating in the personalization of an immersive web environment and how this participation influences the appropriation of this space. To do this, the students imagined the immersive environment, starting by drawing it on scenery paper and then personalizing it with the teacher, using the options provided by the platform they used.

The data collection tools and techniques used included photographic and audiovisual recordings of the sessions made by the teacher, as well as a questionnaire survey completed by the students. This questionnaire was used to assess the students' interest in creating an online space and to check whether they enjoyed the activity and whether they intended to continue using IWE. It also includes questions about how to access the online classroom, to mention aspects they liked and disliked, as well as suggestions for improvement. All ethical procedures were followed, informed consent was obtained, and the confidentiality and anonymity of the participants was guaranteed. The participants voluntarily took part in the study, and the parents were informed and consented to their children's participation.

Although it was designed during the lesson, the personalization of the space by the students was done at home. In the classroom, the personalization was done by the teacher, due to difficulties in accessing the internet and problems with obsolete computer equipment.

The study involved the participation of twenty-one primary school students, fourteen from the fourth year and seven from the third year.

3.1 The Meeting Point for 3rd and 4th Year Students

The Moodle platform has been used by 3rd and 4th year students as a resource to support face-to-face lessons. It has been found that when students log on to the course at the beginning of each lesson, in those first few minutes, they like to use it to send private messages to each other. They arranged times (at the weekend) to meet on the Grouping's Moodle to exchange new messages. The teacher, realizing the students' interest in this online interaction, suggested creating an online space where 3rd and 4th grade students can meet and chat at any time. In this space, it would be possible to write messages in a chat, but also talk to each other using the microphone. The students accepted the teacher's suggestion, and "our online room" was born, in the immersive space of the Frame VR platform. Frame VR is a cross-platform that works in a web browser on computers or mobile devices (desktops, smartphones, tablets) and on VR headsets. There's no need to download or install anything, which facilitates communication, collaboration and creation in 3D environments, as everything is done from the web browser.

The space was designed by them to be their meeting point and working groups were set up to define the areas of interest. The space was divided into two main areas: the 3rd year rooms and the 4th year rooms. While both areas can be visited by pupils of any grade, the resources available cater to the preferences defined by the pupils themselves. These areas were then placed in the online room, created on the Frame VR platform, by the teacher, who has been building the online space during lessons, displaying it on her own laptop, due to limitations related to the school's computer equipment.

In the 3rd year section, there are the rooms "Programming Games" (Fig. 1), "Drawing Room", "Music Room", "Socializing Room", "Moodle Room", "PK XD Room", "Roblox Room" and "Minecraft Room".

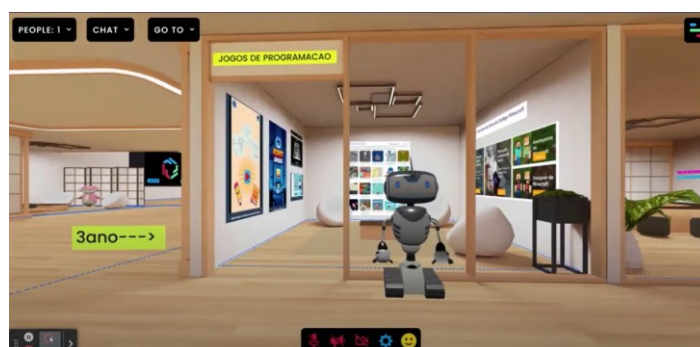


Fig. 1. "Programming Games" room.

In the 4th grade section, there is the "Typing Room" (Fig. 2), "Music Room", "Youtube Room", "Programming Games", "Social Room", "Cooking Room", "Netflix Room" (with suggestions of children's series) and "Reading and Theatre Room".

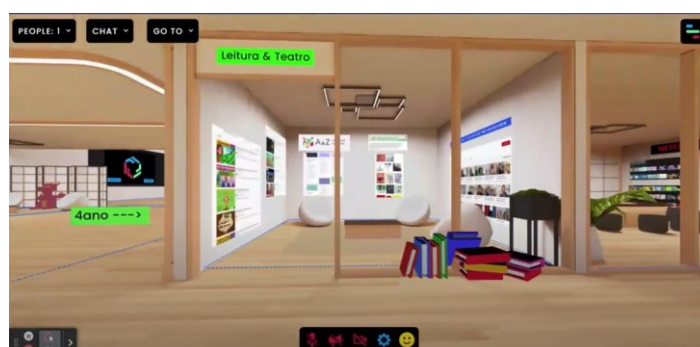


Fig. 2. Typing Room.

In addition to these specific areas, common rooms have been created that contain hyperlinks to SeguraNet's educational games (Fig. 3) and to the posters created for "Home Study". In the leisure areas, pupils have access to online radio stations (as shown in this video¹).

¹ https://drive.google.com/file/d/1iSu6NB1hFT2xThjz0NKS5li0zqWIHTCm/view?usp=drive_link

"Our Online Classroom" has become the meeting point for 3rd and 4th year students from the two schools of the Grouping. In this space they can talk, exchange impressions, access various resources, in a safe place and controlled by the teacher, since access notifications are active. Since the space was created, there have been more than 200 accesses. The platform is accessed outside of class time, autonomously by students mainly through their personal devices, as the school computers do not support Frame VR.

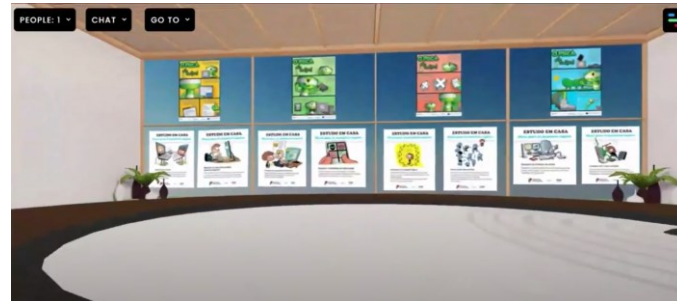


Fig. 3. SeguraNet's educational games.

3.2 Co-creation of the “Our Online Classroom”

To find out which online space and which educational activities the students imagined, the teacher challenged them to idealize the space. After choosing one of the templates, provided by Frame VR platform, the students planned the room. Organized in groups, they discussed their ideas for the design of the online room.

Initially, they created a sketch of the (online) space on scenario paper, dividing it into eight rooms on each side (eight for year 3 and eight for year 4). The groups also defined the themes for their rooms. To design the scenery according to their preferences, they did a lot of research to get inspiration and information (Fig. 4).

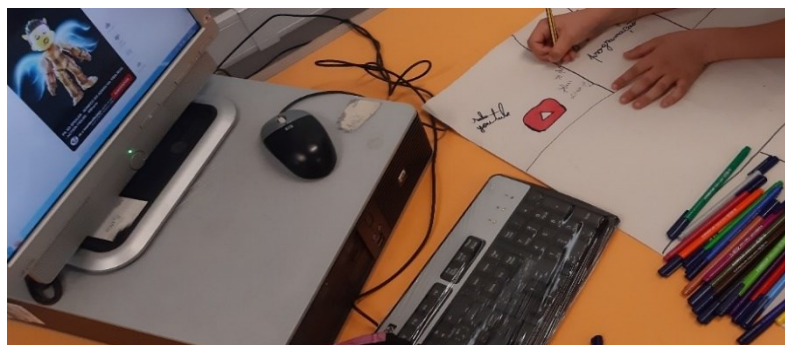


Fig. 4. Conceptualization of "Our Online Classroom".

To make the experience more interactive, a voting system has been implemented on site, so that students can express their opinion about the room (whether they like it or not). The space also has two meeting rooms, ready to be used in case it is necessary to hold online classes. The rooms are equipped with whiteboards for writing and drawing, thus facilitating the collaboration process.

The technological resources used for the construction of this virtual environment included Frame VR, which enabled the visualization and creation of the space, and several websites with educational content appropriate to the ages of the students.

After the conceptualised process was completed, each group presented and explained "their room" to their colleagues (Fig. 3).



Fig. 5. Presentation of the works.

This allowed them to discuss and choose the educational resources that best represent their interests in the virtual environment.

The teacher played an important role in guiding the project, presenting the concepts and conducting the students' brainstorming. From these discussions, the space was co-created and moulded to meet the students' interests, including the resources they suggested, making the space attractive and suitable for their educational needs.

3.3 Students' Perceptions

To evaluate the interest in creating an online classroom, the students were surveyed. For this purpose, the teacher prepared a short questionnaire survey, two questions of which were applied before IWE was created. Twenty-one students, 66,7% (14) from the 4th year and 33,3% (7) from the 3rd year, answered the two questions set by the teacher.

To the first question, "I like the idea of having a room where I can see and talk to my friends", 85.7% of the students fully agreed, while 9.5% partially agreed. To the second question, "The idea of having an online room where I can see and consult resources appeals to me", 76.2% fully agreed, 9.5% partially agreed and 9.5% totally disagree (Table 1).

Table 1. Questions answered before creating the IWE.

Question (21 students)	Totally disagree (1)	Partially disagree (2)	Don't agree or disagree (3)	Partially agree (4)	Totally agree (5)
I like the idea of having a room where I can see and talk to my friends	0 (0%)	1 (4,8%)		2 (9,5%)	18 (85,7%)
The idea of having an online room where I can see and consult resources appeals to me	2 (9,5%)	1 (4,8%)		2 (9,5%)	16 (76,2%)

After the IWE has been completed, the teacher consulted the students again and the majority answered that they enjoyed creating the virtual room on role play (Table 2).

Table 2. Questions answered before creating the IWE.

Question (21 students)	I didn't like it at all (1)	I didn't like it very much (2)	Indifferent (3)	I like it (4)	I really enjoyed it (5)
Did you enjoy building the virtual room's scenery out of tracing paper?	0 (0%)	1 (4,8%)	2 (9,5%)	6 (28,6%)	12 (57,1%)

To the question "do you think our online room is according with what you wanted to see there", 76% answered positively, however, 19% answered "More or less". These 19% are the students who were unable to enter due to technical problems (latency, slow access) or even because their parents did not lend them their mobile phones (Table 3).

Table 3. Questions answered after creating the IWE.

Question (21 students)	No	More or less	Yes
Do you think our online room is according with what you wanted to see there?	1 (4,8%)	4 (19 %)	16 (76,2%)

Regarding the way of accessing the online classroom (Table 4), the majority use a laptop or access via mobile phone or tablet. Four cannot access the classroom. Only one report using a fixed computer.

Table 4. Questions answered after creating the IWE.

Device used for accessing IWE	21 students
Desktop computer	1 (4,8%)
Laptop computer	8 (38,2%)
Tablet	4 (19%)
mobile phone	4 (19%)
I can't log in to our online room	4 (19%)

Regarding sharing with adults, 38.1% report that they have shown the online classroom to parents and/or guardians and grandparents, while 57.1% have not (Table 5).

Table 5. Questions answered after creating the IWE.

Question (21 students)	No	I couldn't log in	Yes
Have you shown IWE to any adults at home?	12 (57,1%)	1 (4,8%)	8 (38,1%)

It should be noted that four students said they were unable to log on in the classroom and only one replied that he was unable to log on at home. In order to get answers to the questionnaire, the students tried out the environment on the teacher's computer.

In addition, 28.6% have arranged with colleagues to visit the room after school and/or on weekends (Table 6).

Table 6. Questions answered after creating the IWE

Question (21 students)	No	Yes
Have you planned with a colleague to visit the IWE after school or at the weekend?	15 (71,4%)	6 (28,6%)

To the question of whether they intend to visit the online classroom during the holidays, 61.9% answered yes and 33.3% answered maybe (Table 7).

Table 7. Questions answered after creating the IWE.

Question (21 students)	No	Maybe	Yes
Are you planning to visit the room during the summer holidays?	1 (4,8%)	7 (33,3%)	13 (61,9%)

Regarding what they liked most about the online classroom, they mentioned that they liked everything (Table 8), but they emphasized the YouTube room.

Table 8. Questions answered after creating the IWE.

What you liked most about the online room	21 students
Sala Youtube	5 (23,8%)
Sala Minecraft	1 (4,8%)
Sala Roblox	2 (9,5%)
Cooking room	1 (4,8%)
I liked everything	12 (57,1%)

Regarding what they liked least, they indicated that there is nothing specific to mention. Similarly, when asked about suggestions to improve the room, the majority replied that they had no suggestions to make.

3.4 Limitations

Despite the efforts to implement the online classroom, on the Frame VR platform, together (teacher and students) and in the (physical) classroom, some limitations related to the school's equipment emerged. The school's technological equipment is quite old and the speed of internet access prevented students from being able to fully utilize the potential of the collaborative environment, making it more of a passive experience than an opportunity for active creation and interaction. Initially, the teacher intended to allow the students to organize the room, with everyone working in the space in real time and placing the resources they had chosen. The platform enables real-time collaborative work, which would be ideal for this approach and would make the environment more personalized. However, the computers in the computer rooms, the limited memory of the laptops allocated to primary school pupils and the school's internet network did not allow them to edit the virtual space, restricting their activities to the role of mere visitors, unable to contribute directly to the creation of the environment. Thus, these difficulties limiting the possibility of personalization that students could have achieved if they had full access to the immersive environment and leading to the space being accessed outside of class time through their personal devices.

Another significant problem mentioned by several students was the latency and instability of the internet connection. Entering and staying in the immersive room was hampered by these difficulties, making the experience less fluid and frustrating at times. The slowness of the internet affected the interaction and the ability to fully explore the functionalities of the IWE.

4 Final Remarks

The IWE was co-created and made available to 3rd and 4th year students as part of the subject the teacher was teaching. This private space allows students to communicate and interact with each other as avatars. It can be used when and where they want, and they can explore the educational resources they have chosen themselves in an autonomous and flexible way, at their own rhythm and according to their interests. It is a friendly, interactive and educational space where students from the cluster's schools can learn and meet safely, creating social learning spaces [7].

Analysing the process of building the online space, the number of accesses obtained through the notification of the teacher's email address and the responses obtained in the questionnaire, namely the fact that the students indicated that they plan to visit the room in the holidays, allows us to affirm that there is interest and curiosity on the part of the students in exploring IWE. This curiosity is corroborated by literature reviews, which point out that these environments tend to motivate and engage students and develop essential skills for the 21st century [8], preparing them to deal with new challenges in an increasingly digital world.

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