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## **Educational 360-degree virtual tours: engaging students in a multidisciplinary workshop with a team-based approach to teaching and learning<sup>1</sup>**

### **Tour virtuali 360 in didattica: un laboratorio multidisciplinare basato su approcci collaborativi nell'insegnamento e nell'apprendimento**

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#### **Abstract:**

The study is framed in a case-study qualitative approach with the aim to describe and analyse the multidisciplinary team-teaching impact on university students of Education Science degree course involved in a hands-on workshop conducted in the academic year 2023-2024 by three professors (Intercultural Pedagogy, Instructional Technology, Interaction Design). Students were actively involved in a group-based three-week activity where they were guided in the design and creation of a 360-degree virtual tour, a three-dimensional digital artefact that addressed, with a chosen

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storytelling direction, a pedagogical core concept. The impact of the collaborative teaching and learning experience was discussed and analysed through different data sources (notes of class observations, written and oral students' feedback, virtual tours) by taking into account the following categories: learning climate and adaptive teaching; disciplinary approach and activating learning.

**Keywords:** 360-degree virtual tour, hands-on workshop, educators' training, team-teaching, collaborative learning.

**Abstract:**

Lo studio di caso qualitativo descrive e analizza l'impatto di un progetto laboratoriale multidisciplinare realizzato nell'A.A. 2023-2024 nell'ambito del corso di studi in Scienze dell'Educazione condotto in team-teaching da tre docenti (Pedagogia Interculturale, Tecnologie Educative, Interaction Design). Gli studenti, in piccolo gruppo, sono stati coinvolti e guidati nella progettazione e produzione di un tour virtuale 360, un artefatto digitale tridimensionale costruito intorno alla narrazione di un concetto pedagogico. L'impatto dell'esperienza di insegnamento e apprendimento di tipo collaborativo è stato esaminato attraverso i dati raccolti grazie a diversi strumenti (osservazioni in classe, feedback degli studenti) e l'analisi dei tour virtuali tenendo in considerazione le seguenti categorie interpretative: ambiente di apprendimento e processi adattivi nell'insegnamento; approccio disciplinare e coinvolgimento nel processo di apprendimento.

**Parole chiave:** tour virtuali 360, attività laboratoriale, formazione degli educatori, team teaching, apprendimento collaborativo.

## 1. Introduction

University of Macerata, through its delegate for educational affair and its institutional Strategical Plan, has been encouraging innovative practices and, starting from 2021, the co-teaching optional approach has been formally recognized as instructional practice. Each course syllabus of any degree, in fact, reports information about the teaching/learning opportunity offered by faculties who, in agreement and on voluntary basis, choose to create a joint didactical time-space dedicated to their students. In the academic year 2023-2024, following the previous co-teaching experience, developed within the Education Science degree course (curriculum: Social Educator) in the preceding three academic years (Deluigi, Fedeli, 2021; Deluigi, Fedeli, 2023; Fedeli, Deluigi, 2023a; Fedeli, Deluigi, 2023b), the two involved professors decided to widen the experience offering a multiple perspective towards the interested disciplines (Intercultural Pedagogy and Instructional Technology) by integrating a third colleagues (Interaction Design) teaching in the specializing degree course in Pedagogical Science. The design of the multidisciplinary workshop, in fact, was characterized by setting (1) educational disciplinary goals ranging from the acquisition of core concepts in Intercultural Pedagogy to the experimentation of different instructional technologies (known and unknown for the cohort of students) as reflection inputs in terms of the impact different digital artefacts can have on communication and understanding, (2) transversal goals focussed on the transformative impact of collaborative activities where students are able to co-construct knowledge thorough an enhanced opportunity to share, negotiate and communicate with peers and professors (Stramaglia et al., 2020). The objective of the study was to reflect on the impact of the collaborative teaching and learning experience by analysing observational data, students' reflections and digital artefacts (virtual tours)

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that students produced as final outcomes.

Differently and additionally to previous years a focus on immersive digital environments/tools and 3D artefacts (360-degree virtual tours, 3D photos, etc.) was offered thanks to the participation of the “external” professor whose inclusion in the workshop represented both a challenge, since students in their undergraduate curriculum don’t address Interaction Design as a topic, and an opportunity, since involved students, at their third and final year, can have the chance to meet a new professor/discipline located in a graduate degree course strictly connected to the one they are currently following. The involvement of that professor can have, in fact, an orientation connotation in the transition from an undergraduate to a graduate degree course.

## 2. Background

Scientific literature in the educational field has been widely assessing the affordances of virtual reality (VR) for the teaching/learning process (Marougkas et al., 2023) and teacher/educators training (Lege, Bonner, 2020; Theelen et al., 2019). Among the variety of VR systems we can distinguish immersive, semi-immersive and non-immersive technologies according to the devices used (TV, laptop, mobile phone, VR boxes, HMD devices, etc.). Even if the level of interaction and embodiment in the VR settings can be quite different, according to the technology used, those affordances allow student active engagement, intellectually and emotionally, by requiring creativity, autonomy and problem-solving strategies.

360-degree virtual tours can be considered an emerging technology that has been, in the last years, largely experimented in education at all levels of instruction (Shadiev et al., 2020). It is a flexible format that can be designed and created to be viewed also without the support of high-cost wearable devices.

The design and implementation of learning activities that involve the use of VR systems may require a set of skills and competences that goes beyond the specific subject-matter, thus, collaboration of more teaching profiles in a multidisciplinary approach can represent a successful strategy. The instructional model of team-teaching may be developed with different approaches in the collaboration of two or more teachers according to the interdisciplinary relationship (Rainforth & England, 1997) and the roles teachers may have (Dugan & Letterman, 2008); studies on the impact of team-teaching highlight advantage in classroom management and adaptive teaching (Mariën et al., 2023). Besides, team-based approaches applied to learners, when dealing with VR systems, can offer Pedagogy the opportunity to exploit and challenge technology (Laurillard, 2009), in fact, being collaboratively engaged in a VR project design and implementation is a chance for students to focus on different aspects of their learning process (technical, relational and disciplinary) and to rely on reciprocal skills in a synergic way.

### 2.1 A focus on virtual tours

Virtual tours (VTs) have evolved significantly with advancements in digital technologies, offering diverse approaches to recreate real or fictitious environments. These environments can be exact replicas of reality, fictitious spaces, or a blend of both (Meier et al., 2024). Their creation involves various programs and applications, ranging from advanced technologies requiring specialized knowledge to simple and free tools accessible to anyone. Based on their development strategies, they can be primarily categorized into two types: model based or image-based VTs.

Model-based VTs involve reconstructing real-world environments using 3D digital models. It represents an advanced method for creating VTs, enabling to recreate entirely virtual environments where users can move and interact freely using digital devices. This approach is particularly beneficial for applications requiring direct interaction with virtual objects. However, this requires detailed modeling, texturing, lighting, and animation of scenes, using software like 3DS Max or Blender. This process is time-consuming and requires significant expertise (Janovský et al., 2022). For exact replicas of real environments, technologies such as photogrammetry and 3D scanning are employed. Photogrammetry reconstructs 3D models from multiple photographic images taken at different angles, while 3D scanners generate point clouds (x, y, z) of the space. Combining these techniques optimizes workflow and enhances model appearance. Converting these models into virtual tours often involves using video game engines like Unity or Unreal Engine, which incorporate first-person controllers (FPC) to navigate the environment and add interactivity (Meier et al., 2021). Alternatively, Image-based VTs offer a simpler and quicker method for capturing realistic environments. They are created using a series of 360-degree images or videos that users can navigate through features like arrows or hot points on a floor plan (Bastanlar, 2007). Using 360 cameras, which range from high-resolution professional models to affordable consumer versions, these tours are created by linking spherical photographs with specific software like Matterport or 3DVista and Lapentor (Rahaman et al., 2023). Although these tours limit user movement to teleportation between scenes, they are often considered digital twins due to their fidelity to reality. These tours are enhanced with additional data such as QR codes, tags, pop-ups, and interactive elements to improve visual presentation and spatial understanding (Martínez-Grana, 2013). This type of VT is cost-effective and accessible via low-cost devices like smartphones and Google Glasses, making it popular in the tourism industry due to the ease of data collection and minimal technical expertise required for post-processing (Mah et al., 2019). Moreover, 360-degree panoramic tours are highlighted as an inexpensive and efficient solution for creating engaging virtual experiences with a sense of presence, without needing specialized technical skills (Brivio et al., 2021).

To make the virtual tours, we chose to use the open source service Lapentor<sup>2</sup>, as provides a distinctive and comprehensive set of features. In particular, it offers unlimited free use, allowing users to create as many virtual tours as they need without incurring additional costs. Additionally, it provides the freedom to share or publish tours easily, which is essential for reaching a wider audience. The inclusion of advanced features such as hotspots, plugins, and extensive customization options further enhances its appeal, making it the most cost-effective, versatile and user-friendly option available. These capabilities enable users to create engaging, interactive, and tailored virtual tours that meet their specific needs and preferences. The main drawback of the Lapentor system is its lack of a collaborative authoring space. To address this, we recommended that each student group create a shared Lapentor account to facilitate collaborative work among group members.

### **3. A multidisciplinary workshop as a case study**

The workshop was organized within the course “Instructional Technology” by using the final three class weeks from the whole eight-week duration (6 hours a week). That class time was dedicated to a group-based activity (9 groups) where students (a total of 31) were actively involved in a project

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<sup>2</sup> <https://lapentor.com/>

with the guidance of a team of professors. The objective of the project was to design and create a 360-degree virtual tour, a three-dimensional digital artefact that addressed, with a chosen storytelling direction, a pedagogical core concept related to the course “Intercultural Pedagogy” that students were simultaneously following.

The three professors designed the workshop and participated all in person just at the beginning of the course and at the end of the workshop, while during the group activities two of them supported students asynchronously and interacted each other out of the class time (the Instructional Technology course professor was the one who followed students’ activities in class for all the workshop).

The initial joint explanation, by the team of the professors, aimed at presenting the project rationale and its organizational aspects in order to give students comprehensive information about all the dimensions involved: educational, pedagogical, and technical. Those dimensions include different strictly intertwined objectives: at the end of the learning experience students will, in fact, be able to (1) activate creative processes, develop communication and collaboration strategies as a group; (2) identify a storytelling format to narrate their knowledge in Intercultural Pedagogy through a 360-degree virtual tour; (3) take full advantage of digital shared environments/tools (both synchronously during the classes and asynchronously) to share, negotiate, archive and give/receive formative feedback (from peers and professors).

The required outputs, as completion of the workshop, somehow reify the fulfilment of the above mentioned objectives, that is, a storyboard of the virtual tour (paper-based or digital) that should facilitate the structure of the final artefact and check the efficacy and smooth connection of the single parts (e.g. content, interactivity) and a final reflection, an individual paper with guided open questions and a conclusive discussion during the presentation of all the group artefacts.

The assessment modality was negotiated among the team of professors and shared with students; the criteria embrace the different dimensions addressed through the objectives: (a) level of participation in the group; (b) quality of the virtual tour design and artefact (consistence, efficacy in terms of communication and appropriateness of graphical/functional choices); participation in the collective final discussion during the presentation of the artefacts.

The whole experience represented a qualitative case-study (Yin, 2013) that helped analyzing the efficacy of the team-based approach (teaching and learning) through different data gathering techniques. Participant observation, run in class during the process, allowed the collection of notes (anecdotal records) and photos, while asynchronous shared spaces (students’ questions, notes and archived in progress artefacts) aggregated “trace” data that allowed the monitoring of the development of the project and the induction of reflections on the different involved dimensions; a third collection tool was a final reflection paper with written feedback in which students reported their perceptions, viewpoints, and suggestions. The team teaching experience based on a collaborative learning set of activities was analyzed with the objective to observe its impact on students and the modalities they chose to apply to reach their project fulfilment.

### **3.1 Team-based approach**

Class observations highlighted how groups organized their work in terms of technological approach and collaborative strategies. Even if classroom spaces were not fully appropriate to facilitate group activities students were able to adapt the available environment by efficiently using additional online opportunities to interact, compare and discuss viewpoints. In the figure below (Fig. 1) we can see that



different devices (pc, smartphone, paper) accompanied the design and production steps according to the feasibility of the context and the required task. Different devices and tools, besides the ones suggested by the professors, were analyzed by students assessing their efficacy in the specific space-time of the learning step.



Fig. 1. Environments, devices and tools

Group members showed a level of autonomy in the adopted strategies to face technical challenges, they often organized by attributing themselves agreed roles and responsibilities also according to skills they thought that could be useful to the project (“we valorized our skills”), like in the case of the student that applied 3D modeling to the project taking advantage of his knowledge of the Blender software (Fig. 2).

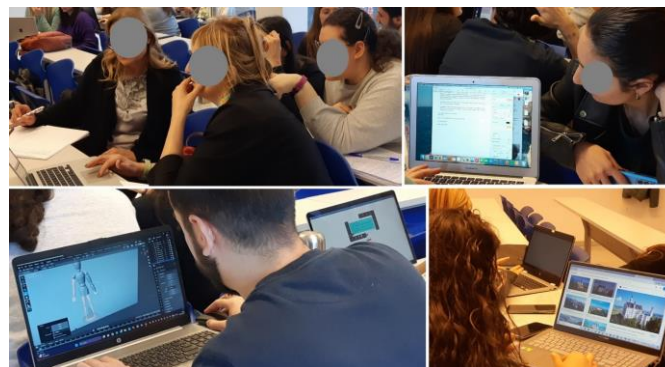


Fig. 2. Group activity

Students’ reflections underline the impact of the proposed workshop on their attitude when using technologies: some of them stated that, even if they consider themselves quite familiar with technologies (devices, software and different online environments) the educational dimension in which they had to use them offered the opportunity to reflect on the relevance of tools “adaptability” and “integration”, two aspects that appear to be a priority when dealing with education, accessibility and inclusion.

The variable “time” also was mentioned as a key aspect of personal development in terms of time

management in group work, but also in terms of strategies to be applied connected to the short available time to solve problems/barriers. The restricted time and the need to identify solutions had an impact also on transversal communication among groups, students could, in fact, rely not just on their group peers but also on the other groups' members, those relational dynamics contributed in highlighting the group empowerment value for the students, future social educators.

It is surprising that students, enrolled at the third and final year, reported that the workshop was an opportunity to know each other and learn team work skills, previous experience in the same degree course with hands-on disciplinary workshop weren't perceived so impactful in terms of collaboration; students felt that the interdisciplinary trajectory and the team-teaching approach were relevant to strengthen the social relationships and activate creative processes that feed off each other.

The professors' supervision, also at a distance through online tools (Fig. 3), was an additional opportunity for student to observe collaboration on the teaching side and take advantage of an enriched feedback flow.

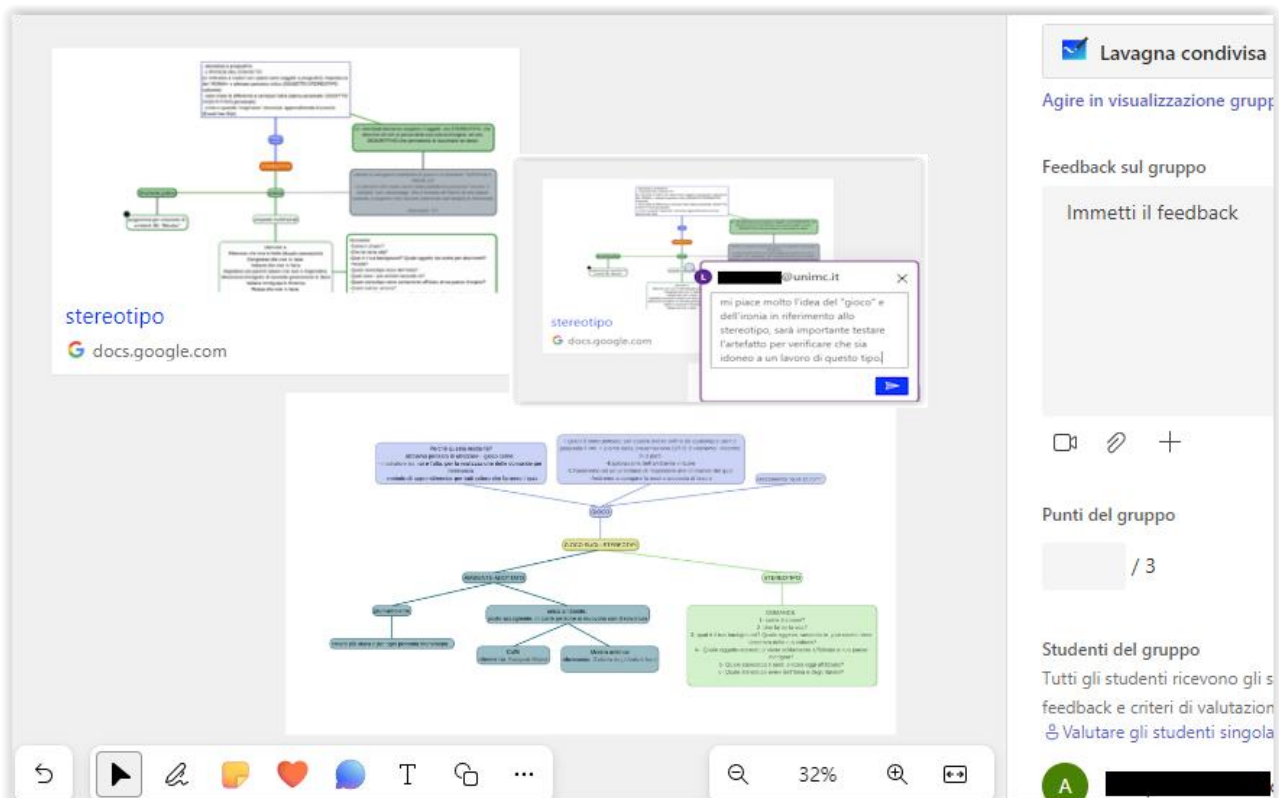


Fig. 3. The institutional TEAMS group environment for archiving and exchange feedback

The added value of the team-teaching, as highlighted by some of the respondents in the final reflection, lays in “the promotion of collaboration and personalized learning for the direct benefit of the students” and it is meant as a teaching modality that encourages “a more inclusive learning environment, oriented to the success of students” and a “more dynamic and challenging learning opportunity”.

### 3.2 Dynamic learning backgrounds

The small working groups, established independently by the participants, worked on several topics

related to intercultural pedagogy. Each group freely chose a concept from the one's discussed in the first part of the course, as a conceptual background with which to initiate critical-experiential thinking practices (Burgio, 2022; Nanni & Fucecchi, 2024; Portera, Minerva & Fiorucci, 2017; Zoletto, 2023). It is relevant to emphasise that the topics were explored in depth by the students, through interactive lectures, meetings with testimonials and stakeholder in the educational field, targeted in-depth studies and additional training proposals. The attention and time dedicated to establishing a democratic environment of dialogue with a strong contemporary dimension in a professionalising key, urged the student community to engage actively in the production of a dynamic and collective thought, which did not dwell on a notionistic knowledge "for exam preparation", but which went beyond the sense of formal assessment, giving meaning to the training course (Biesta, 2011; 2019).

The composition of the group of students also represented a peculiarity, as several of them were already professionals in the field of education - between school and hosting communities for unaccompanied foreign minors - in close contact with heterogeneous contexts, and in the process of realising or choosing an internship in socio-educational services in multicultural contexts. In addition, seven students involved in the co-teaching groups also participated in the Erasmus BIP (Blended Intensive Programme) entitled "Intercultural and interdisciplinary collaboration for more inclusion", which was implemented in the same semester in partnership with NTNU/The Norwegian University of Science and Technology and TUB/Technische Universität Berlin.

There was, therefore, a strong motivation to continue working jointly and cooperatively among students and with professors, creating stimulating and active learning environments. The participative process required an investment of time and quality of reflection from everyone, as well as mediation to achieve a cooperative climate, capable of interweaving the different interests and awareness that emerged in a critical and generative way. Furthermore, in small groups, the students had the opportunity to experience some of the intercultural logics and dynamics described by the core concepts considered. For this reason, participants were invited to focus on the relational and formative posture, making it explicit that they would undergo meta-reflection and transformative learning during the experience and the fine-tuning of the final products (Cranton, 2023; Gavrielatos, Loads, & Kostara, 2022).

The contents of intercultural pedagogy took on a "three dimensional form", solid and consistent, not crystallised, opening up to augmented reality, going through a multifaceted and complex process of collective construction of knowledge. In this sense, the ability to interconnect layers of work, to "give life" to concepts and to listen to the reciprocity experienced, was essential to generate an output oriented to value visions and perspectives deriving from the listening and dialogue between personal, educational and professional biographies played out in experience.

In order to thematize and deepen the chosen concept of intercultural pedagogy, at the beginning of the co-teaching course, some warnings and indications of method were provided, in order to promote community exploration, raising questions, doubts, relevant and not yet explored issues: (a) take note of unclear elements, compare them, ask for support and activate a dialogue among yourselves and with the lecturers; (b) focus attention on the "grey" points of the topic you are addressing; (c) work on customising ideas, creating content with references and developing original ideas; (d) generate "unresolved" questions in the production of the materials, not everything has to be fixed for certain. The proposal was also to critically use plural languages, projecting oneself into a new situation, in terms of method, content and expected outcomes. This, too, was an essential part of an intercultural



approach dialogued and expressed by the various outputs realised. Other methodological suggestions focused precisely on the collectivity of the training and cultural operation in action: (a) note among yourselves the added value of the creative cooperation and do not enter into “high-rational executive” mode; (b) it is your collective work, it is a moment of reflection in which you can produce ideas that are shared and to be shared; (c) it is a time of coexistence of ideas, and not only...; (d) it is an opportunity to thematize the contents, choosing perspectives and interpretations on which to dwell; (e) by reasoning about a key concept, connections with other topics addressed in the course may emerge. Point out the connections and make them communicable.

The encouragement on the intercultural and work organisation side was clearly to try to diverge, to trespass, to be porous boundaries, so as to create plural opportunities for reflection, in small groups and beyond.

### 3.3 Intercultural Explorations

The intercultural issues from which to start refer to pedagogical cornerstones that have been discussed by the scientific community over time and have taken on different meanings and interpretations. Each issue was discussed with different sources and prompts, not offering a definitive perspective and inviting students to further explore its significance and meanings in the situation. This opened up numerous possibilities, providing a space for effective wandering to engage in uncertain dialogues, use provisional lexicons, dwell on terminologies, and deconstruct standardised visions and readings of complexity.

One theme analysed by several groups is the way in which *stereotypes and prejudices* are constructed, recognised and deconstructed (Nelson & Olson, 2024; Tileagă, Durrheim, & Augoustinos; 2021). This is an inescapable process for understanding how to initiate dialogue in complex contexts, and which was re-proposed in the form of a “game” (Fig. 4a), thanks to the presentation of the different facets of super-heroes, of whom all too often only “side A” is shown, while also highlighting their shadows, their more fragile and vulnerable aspects, thus offering an integrated vision of identities too often identified with a single, unreviewable portrait. We find the same theme in a representation of encounters “on the surface” in which the lives of different subjects brush against each other in a public space, and think they can understand and describe each other at first glance, using only the externally decoded elements (Fig. 4b).

We also find the theme declined within a multi-context experience, in a tour-game at the “Palma Club”, where the anonymity of the characters contributes to making them describe themselves with stereotypical traits, looking for different ways to undertake a critical perspective and modify the scenario (Fig. 4c). In the same way, it is possible to understand how the mind can represent and “catalogue” different circumstances, precisely by means of a journey that explores the memories and experiences of different subjects who, by letting us into their several rooms and archives, guide us on a path of decoding thought (Fig 4d).

Finally, the theme is also addressed through a tour of the city, among squares, streets and transit places where uncomfortable and controversial topics are discussed and contrasting ideas, sources of reference on which information and opinions are built are discovered (Fig. 4e), until we arrive at the open market, a place of meeting, a heterogeneous and multicultural context, where the voices interviewed immerse us in the “Savannah of Interculture” (Fig. 4f).

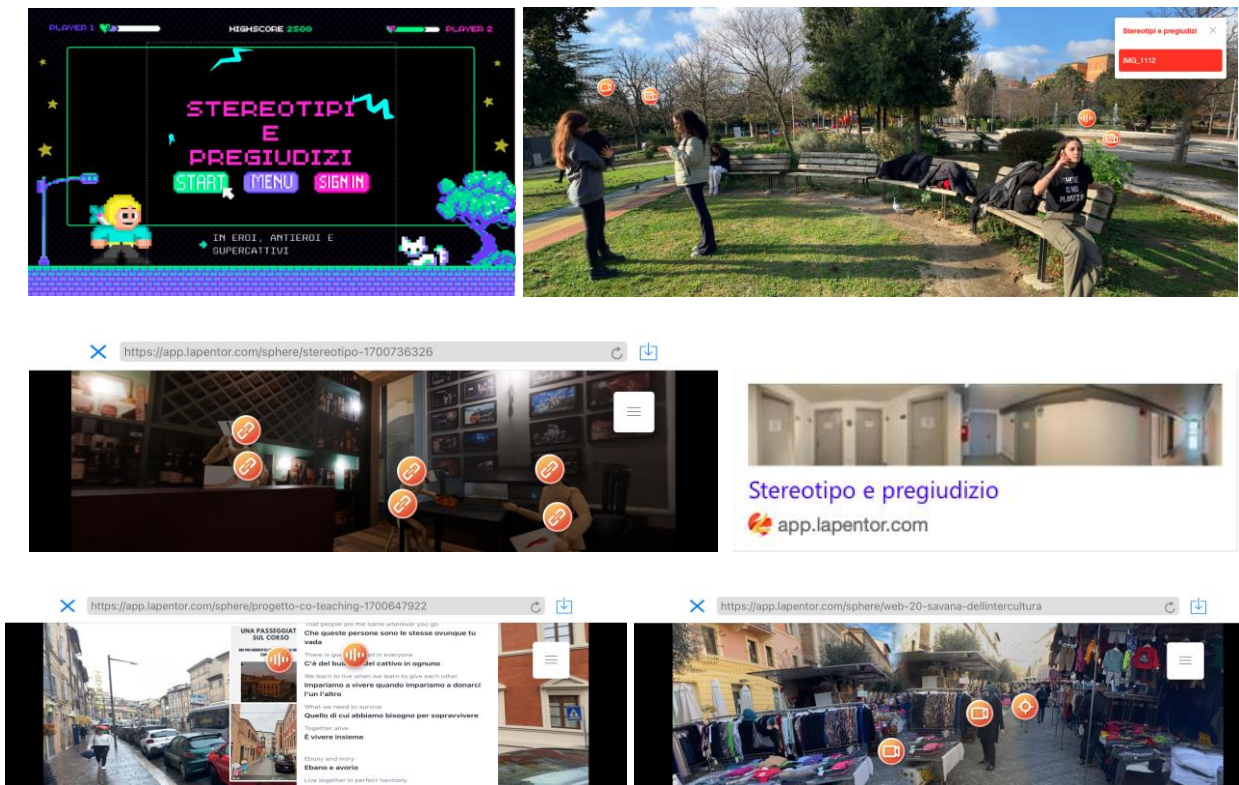


Fig. 4 (a.b.c.d. e. f.). Prejudices and Stereotypes

A second theme explored, is the *decentralised narratives*, which by opening up to the countless versions of history, amplifying the value of plurality, manages to overturn points of view, to divergently orientate the interpretation of facts, events and phenomena that, if observed with multiple gazes, offer several perceptions and representations of what is happening, also thanks to the use of languages and media that help all subjects to acquire power of expression (Gottschall, 2014; Zizioli, 2017). This is the case represented through the re-narration of the fairy tale with the princess, the knight and the ogre as protagonists, by the “antagonist”, who has the opportunity to make his point of view explicit (Fig. 5a); as well as the exploration in the library and the revision of the fairy tale of “Jack and the Beanstalk”, which immerses us in the point of view of the characters who are generally placed within pre-constructed categories, and who are therefore not given the opportunity to express their individuality with the traits that characterise it (Fig. 5b).





Fig. 5 (a.b.). Decentralized Narratives

A third theme explored is the *border*, understood as a threshold or a limit, depending on one’s outlook and crossing possibilities (Gandolfi, 2018; Triulzi, Cangi, & Di Luca, 2020). In this case, crossing defined fences became a challenging theme on which to build new scenarios and viable horizons. Starting with an interplanetary journey, devised by a group that also experienced it in a primary school class, in which encounters with different characters and imaginaries (with reference to the plot of *The Little Prince*) lead the travellers to become aware of the countless possibilities of crossing the threshold of the limit and of taking on further perspectives (Fig. 6).

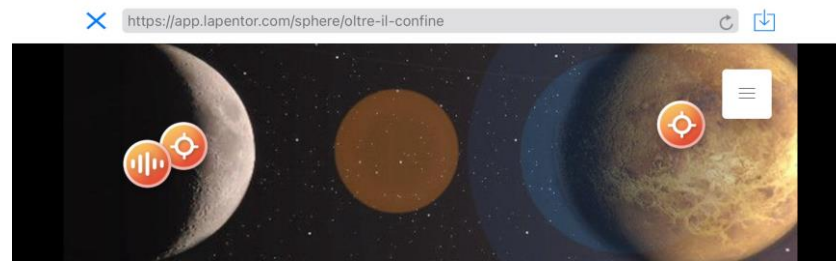


Fig. 6. The border

#### 4. Conclusions

The impact of the collaborative teaching and learning experience was analysed by crossing learning objectives and observations as data sources along with students’ reflections. In terms of coding we could isolate two main categories, that is, “learning climate and adaptive teaching” and “disciplinary approach and activating learning”, where the first aims at collecting and discussing inputs about the setting of the workshop as an enhanced teaching time-space that allowed students to “go beyond the study-class routine” and professors to offer a better guidance with a more extended and interactive instruction, and the second one which is connected to data that highlight the effect of the workshop on the disciplinary approach students adopted during the experience by choosing their own pace, trajectory, modality of expression and collaborative strategies. The content analysis (Bardin, 2000) was mainly applied on written final guided reflections where students reported their viewpoints in the lens of (1) the processes (planning, selection, production, communication, collaboration, negotiation, etc.) they were required to activate and manage; (2) the artefacts they produced along the process as work tools (maps/diagrams, photographs/images, etc.) and target outputs (360-degree virtual tours) as well.

Learning climate was mentioned by students when referred to their vision on what being in class at university means for them, and what being engaged in a hands-on workshop imply: combining

different professors' perspectives and knowledge/expertise help creating a balanced atmosphere where "visible" collaboration in a shared classroom and varied learning objectives contribute to promote students' engagement. Moreover, the task-oriented design process encouraged students to act in the framework of a real context/situation rather than asking them to "imagine a context/situation to analyse", a common format adopted in university workshops which, as reported by one of the students, don't allow the same deep engagement in active learning. Adaptive teaching, through different support actions also thanks to the use of a variety of communication/interaction tools used, was clearly identified by students in the feedback they received during the whole workshop, synchronously and asynchronously, by the three professors, each on different dimensions (educational, pedagogical/instructional, and technical). The team-teaching format was highly appreciated and reflections papers confirm collaborative teaching as an high impact practice (Dugan, Letterman, 2008). At the same time, the team-based approach to learning was recognized as a strength mostly in the following directions: inclusion, creativity, development of transversal skills and plural languages/codes; working in small groups, actually, as reported by one of the student "valorised the capabilities of each member" where roles were freely attributed within the group with a shared responsibility. The final presentation of the different virtual tours was seen as a critical step where "disciplinary core concepts, when they were not previously deeply understood, took shape" in a reciprocal open dialogue with the mediation of the involved professors. Finally, the heterogeneity within the groups, in terms of professional background and attitudes, opened up a collective reflection on the effectiveness of applying team-teaching and learning interconnections among different degree courses (undergraduate, graduate) aimed at training educational professional profiles (school teachers, educators, social workers) with transversal seminars/workshops.

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