

Research-Driven Pedagogy: Advancing Transformative Skills in Spatial Justice and Urban Sustainability through Educational Innovation. Insights from the REPLACE Project

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Abstract

This paper presents a transformative educational initiative developed within the REPLACE project, which integrates university research with civic engagement. Focusing on a pilot workshop conducted in a primary school, the study analyses the design and implementation of The REPLACE Game, a board game that introduces children to spatial justice, sustainability, and cohesion policy through experiential learning. Co-created with university students, the game fosters critical thinking, ethical awareness, and teamwork in young learners while promoting public engagement and pedagogical innovation. The paper outlines the design process, pedagogical goals, and learning outcomes, and discusses further developments in higher education as well. The experience illustrates how schools can become laboratories of democracy, translating abstract policy concepts into accessible, action-based learning experiences.

Keywords: Spatial Justice, Transformative Learning, Research-Driven Pedagogy, Civic Engagement, Research extension

Introduction

In recent years, universities have increasingly embraced the so-called Third Mission or Research Extension expanding their role beyond teaching and research to include civic engagement, knowledge dissemination, and collaborative innovation. The REPLACE project¹ exemplifies this paradigm by integrating educational innovation with public-oriented research on spatial justice and sustainable development. Within its broader Dissemination and Communication strategy, REPLACE translates complex policy frameworks, such as territorial cohesion and spatial equity, into accessible and engaging formats. This paper focuses on one of its most compelling pilot initiatives: a pedagogical workshop co-developed with the International European School "Altiero Spinelli" in Turin at primary level, centered around a custom-designed board game titled The REPLACE Game.

The article is organized into six chapters. Chapter 1 situates the REPLACE project within the framework of the Third Mission and transformative pedagogy. Chapter 2 introduces the conceptual foundations and rule system of the game. Chapter 3 outlines the implementation strategy of the workshop. Chapter 4 analyzes the educational objectives and observed learning outcomes, while Chapter 5 reflects on the experiential and transformative dimensions of the initiative. Finally, Chapter 6 presents the future developments of the project, particularly its forthcoming expansion into secondary education through the VIBES initiative. By exploring this case study, the article proposes a replicable model of research-driven pedagogy that empowers young learners through experiential, civic-oriented education. It argues that such initiatives are not peripheral but central to the university's evolving public mission and to the cultivation of active, critical, and socially engaged citizenship.

1. From Research to Civic Impact: Educational Innovation in the REPLACE Project

In recent years, universities have increasingly embraced an expanded vision of their societal role, one that transcends the traditional binary of teaching and research. This broader mandate, often described as the Third Mission of the University, encompasses a set of activities that connect academic institutions to wider society through civic engagement, public dissemination of knowledge, and collaborative innovation (Zomer & Benneworth, 2011; Perkmann et al., 2013). Within this framework, new spaces of interaction between academia and civil society have emerged, particularly in domains where research has direct implications for pressing societal challenges such as inequality, urban development, and sustainability. One area where this convergence is espe-

¹ The project has been developed within the Department of Architecture and Urban Studies (DASTU) of the Politecnico di Milano and funded by NextGenerationEU and the Italian Ministry of University and Research. It has been coordinated by Sarah Isabella Chiodi, assistant professor at DASTU, Polimi. The activities of extension of the research have been managed by a research group made up of the coordinator, Dr. Lorenzo Liguoro and three Polimi's students: Antonio Perrone, Jana Ondrejovicova and Teresa Kucich.

cially evident is in the field of spatial and territorial justice, where universities are uniquely positioned to act as mediators between scientific knowledge and public understanding.

The REPLACE project embodies this approach, overcoming the traditional missions of research. While its core research objective is to promote integrated territorial development by bridging regional planning and EU structural funds, the project has consistently operated under the principle that knowledge production must be matched by knowledge dissemination. In other words, the research not only aims to influence policy and planning practices but also to foster awareness and dialogue among diverse segments of the population, including youth and local communities. To this end, the project has developed a Dissemination and Communication strategy, which has been embodied into a dedicated Work Package of the REPLACE project (WP.B): it places significant emphasis on educational outreach, targeting both academic and non-academic audiences. The WP.B has become a cornerstone of the project, encompassing a wide array of initiatives which range from academic publications and international seminars to innovative outreach tools aimed at younger audiences, such as interactive workshops, visual storytelling, seminars in Brazil, and participatory games. Through these activities, the project promotes critical thinking about the socio-spatial dynamics of urban environments, helping to instill foundational knowledge of planning principles and European policy frameworks among new generations.

Among the most innovative dimensions of WP.B is its collaboration with the school, which has served as a platform for translating abstract research themes, such as cohesion policy, spatial inequality, and participatory planning, into accessible and engaging formats for students at various educational levels. This collaboration is aligned with a growing body of literature emphasizing the importance of partnerships between universities and schools as a fundamental expression of the Third Mission (Benneworth et al., 2016; Facer & Enright, 2016). Such alliances are not only vehicles for civic engagement but also catalyze transformative learning experiences that benefit both students and researchers. Schools gain access to contemporary knowledge and new pedagogical tools, while universities are challenged to render their work intelligible and meaningful to broader publics.

The partnership between REPLACE and the Scuola Internazionale Europea Statale Altiero Spinelli in Turin, the only public institution in Italy offering a complete European curriculum from elementary to high school, represents a flagship initiative in this regard. The unique nature of this public European school, which is characterized by a multicultural and international environment², provided fertile ground for engaging students with themes of socio-spatial justice and sustainable urban development. This collaboration aims to represent a pilot project in educational innovation and civic engagement, with specific emphasis on introducing concepts of spatial justice to younger generations.

The activities undertaken with the Spinelli School form the focal point of this article. It will concentrate specifically on the laboratory held in the primary school and the interactive board game created for that occasion. The forthcoming activities with the high school division, which are currently in the design phase and scheduled for implementation in 2025, will also be briefly discussed as part of the project's forward-looking trajectory.

The elementary school initiative was conceptualized as an immersive educational experience built around a workshop and an interactive game titled "the REPLACE Game", co-designed by the research team and a group of bachelor students from the Politecnico di Milano through a structured internal internship. The rationale for engaging such a young audience stemmed from the conviction that spatial justice, despite its complexity, could

2 Families are often multicultural and made by parents both from different countries and multilingual. The School "A. Spinelli" was born as an educational project aimed at Italian and foreign students, formulated in the main European languages: French, English, Spanish, German, in addition to Italian of course. The Istituzione Torinese per una Educazione Responsabile (ITER) has promoted and signed with the School "A. Spinelli", the European Nursery School and the Madr&lingua Association, the Educational Pact for the implementation of the "Language Project", to develop the multilingual competence of all students in a multilingual environment. The Project therefore aims to promote cultural integration through the daily exchange of experiences between students and teachers of different nationalities, in a relationship of dialogue and reciprocity, enhancing multicultural cognitive skills.

be meaningfully introduced through experiential learning. The workshop aimed to familiarize children aged 8 to 10 with ideas such as equity, spatial distribution, and urban form, using language, tools, and activities tailored to their developmental stage. The Game employed role-playing, strategic thinking, and creative problem-solving to simulate urban scenarios in which participants had to balance environmental constraints, social needs, and budgetary limitations: a miniature, age-appropriate metaphor for real-world planning challenges.

A key component of the initiative was the involvement of undergraduate students through an internship program activated within the Department of Architecture and Urban Studies. The **internship**, advertised through a departmental call, offered students the opportunity to contribute directly to the “Impact of Research” component of the project. Participants were tasked with co-designing and conducting educational laboratories in schools located in Italy. The activities spanned a variety of functions: from simplifying complex research findings into school-appropriate narratives, to coordinating hands-on learning experiences, and even participating in the drafting of dissemination materials and articles. Importantly, the internship was formally recognized with academic credits, contributing to the students’ graduation requirements and underscoring the pedagogical value of their involvement.

Within the context of the Spinelli elementary school, the interns played a pivotal role. Not only did they assist in classroom activities and support the facilitation of the workshop, but they were also actively involved in the co-creation of the REPLACE Game. Working side by side with the research team, the students contributed to the conceptual design, created the visual content for the game cards (e.g., user profiles, urban functions, infrastructure types), and helped define the operational rules that govern the dynamics of gameplay. This collaborative design process not only enhanced the quality and accessibility of the game but also provided the interns with a real-world application of their academic knowledge, while fostering their skills in communication, team coordination, and design thinking.

As outlined in the internship description, the objectives of the program included educating and engaging younger audiences on EU cohesion policy and spatial inequalities, promoting socio-spatial justice, and developing the interns’ own competencies in scientific communication and public engagement. The initiative served a dual purpose: it enriched the pedagogical content delivered to schoolchildren and, at the same time, empowered university students to act as agents of knowledge transfer. In doing so, it created a virtuous cycle in which research, teaching, and civic responsibility reinforce one another.

By focusing on the Spinelli collaboration, and particularly on the elementary school workshop and game, this article sheds light on a replicable model of **research-driven pedagogy**. It proposes that such models are not peripheral but essential to the university’s evolving public role. Moreover, they offer an opportunity to reimagine education as a collaborative, multi-level process in which learning flows not only from academia to society but also, in reverse, where researchers, educators, and students co-create knowledge that is responsive to the needs and realities of local communities.

In the chapters that follow, we will provide a detailed account of the Game and its pedagogical framework, including its design process, learning objectives, and classroom outcomes. We will also contextualize these activities within broader educational theories and discuss the potential for scaling such initiatives across different age groups and institutional contexts. Through this exploration, the paper aims to contribute to the discourse on the Third Mission by offering a grounded, practice-based reflection on how universities can meaningfully engage with society to advance spatial justice and sustainable urban futures.

2. Designing the REPLACE Game: Concepts, Mechanics, and Educational Aims

The REPLACE Pedagogical Game was conceived as an educational bridge between the abstract policy framework of territorial cohesion and an engaging, child-centred learning experience. The design team began by distilling three abstract pillars—spatial inequality, sustainability, and social cohesion—into a set of tangible mechanics that players could manipulate, argue over, and re-configure. Central to this translation was the decision to create

a **full-fledged board game**, complete with high-resolution A1 boards, laminated card decks and professionally printed iconography, signalling to pupils that they were engaging with an authentic game world rather than a didactic exercise. At the same time, deliberately “unfinished” elements—pasta shapes for coins and environmental tokens, blank cards awaiting pupils’ own structures—left visible the scaffolding of a work-in-progress construction site, inviting collective authorship. Its purpose was to translate complex concepts such as spatial inequality, sustainability, and social cohesion into tangible, interactive mechanics that primary school pupils could manipulate, explore, and reflect upon. The resulting board game combines rigorous design with elements of play, immersing children in urban planning scenarios that require them to navigate trade-offs, prioritise needs, and co-create inclusive, sustainable spaces.

The game was introduced through a multi-session workshop in which pupils, organised in teams, were tasked with reimagining the public space surrounding their school. Activities followed a coherent sequence—from problem identification and scenario building to spatial negotiation and collective reflection—culminating in a simulated redistributive intervention modelled on the logic of EU Cohesion Policy. The use of the school’s actual site plan as the game board embedded the activity within a familiar spatial context, reinforcing Gruenewald’s (2003) call to treat place as pedagogy and anchoring abstract ethical debates in real environments.

A key design feature was the co-creation process involving intern-researchers, who collaborated with the academic team to prototype and refine the game. Their contribution ensured both conceptual rigor and accessibility, modelling a learning pyramid in which university students, trainee educators, and primary pupils occupied successive rungs. This structure reflects the principles of **service learning**, an educational approach that integrates meaningful community service with academic instruction and reflection. Within this framework, students are not passive recipients of knowledge but active contributors to projects that address real social needs. They designed solutions, implemented activities collaboratively, and participated actively to the workshops. They provided a tailored design for the game and a logo³ as well. In the context of REPLACE, the university interns engaged not only in the technical design of the educational game but also in its delivery, co-facilitating workshops that directly served younger learners and their schools. This experience embodied the core elements of service learning: community-oriented service, application of academic knowledge in real-world settings, active student involvement in all project phases, and the cultivation of civic awareness. Through this integration of research, design, and action, the REPLACE project nurtured transversal competences such as problem solving, teamwork, and ethical reflection, while fostering a stronger connection between higher education institutions and local communities.



Figure 1. The REPLACE project logo. Two stylised human figures—composed of circles and inverted triangles—symbolise inclusion and the complementarity of differences. The minimalist, symmetrical design visually conveys the project’s core values: spatial justice, territorial cohesion, and participatory citizenship, reflecting its commitment to equity through education and dialogue.

This iterative process led to a well-calibrated rule set with clear thresholds and an integrated framework of **pedagogical constraints and ethical goals**. Each group of five to six pupils was assigned the task of **designing an inclusive, functional, and sustainable urban or green space** directly on the actual site plan of their school. To complete this mission, teams had to comply with five compulsory constraints and one ethical objective. First, each group was required to integrate at least three **functions**, in order to diversify the intended uses of the space.

3 The logo has been an original creation designed by the intern student Antonio Perrone.

Second, they had to satisfy the needs of at least three different kind of **users**, thus embedding inclusion into the core of the design process. Third, teams could place no more than fifteen **structures**, including both pre-printed and custom-designed cards, with each structure's physical form reproduced using 5 m² tiles and spatially arranged within the boundary of the map, requiring teams to manage land occupation like a spatial puzzle. Fourth, teams were assigned an asymmetric economic **budget** and were encouraged to spend their entire allocation strategically, as the funds represented earmarked resources intended for the school's improvement. Lastly, **land consumption** was constrained by the number of available tiles: when space ran out, students had to remove or reconfigure structures to make them fit, enhancing spatial reasoning under constraint. Beyond these formal rules, the game introduced an ethical challenge linked to **environmental impact**. Each structure carried an ecological cost, which symbolised emissions or biodiversity loss. While teams began with a generous allocation of tokens, they were encouraged to preserve as many as possible.

Therefore, at the core of the game are six component families. **Structure Cards** (red) include twenty pre-printed elements such as the Hopscotch Grid, Stargazing Telescope, Hammock, Pottery Shed, Pocket Theatre, and Vegetable Garden. Each card specifies its functions, compatible user categories, economic cost (1–5 coins), ecological impact (1–5 tokens), and spatial footprint (in 5 m² tiles). Blank Structure Cards allow pupils to invent their own facilities, encouraging creativity and numeracy.

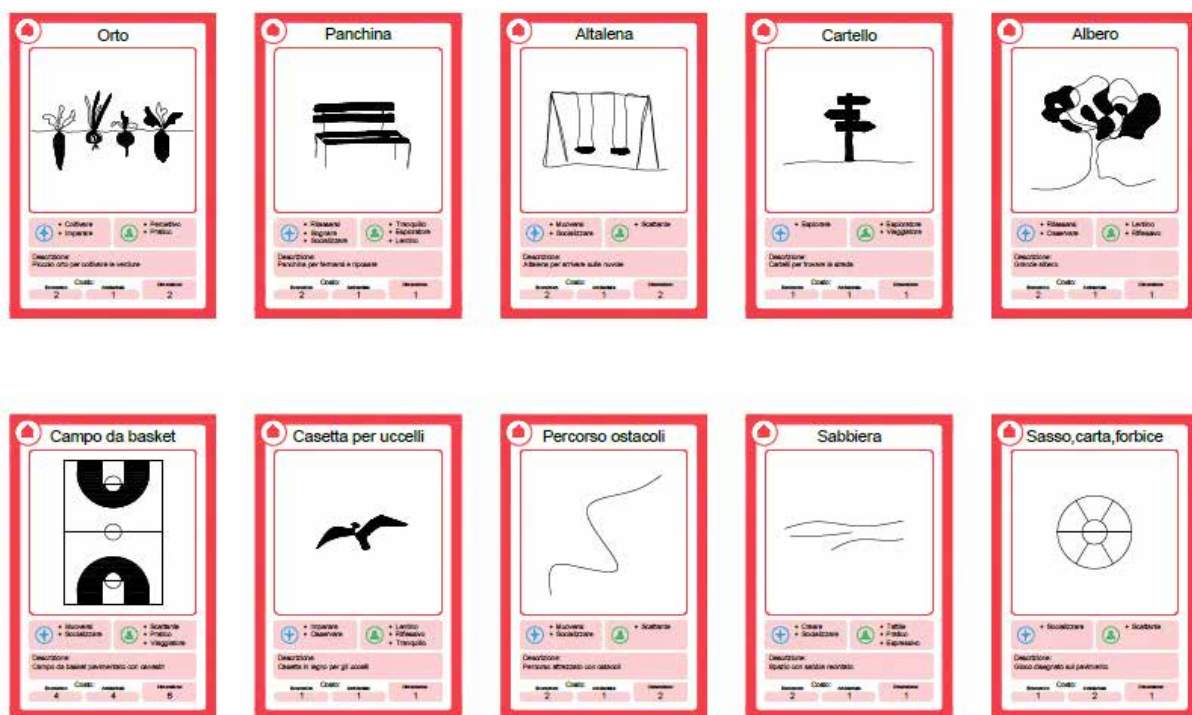


Figure 2. Examples of Structure Cards designed for use in the REPLACE board game. Each card represents a potential spatial intervention, with associated costs in surface area, budget, and environmental impact.

User Cards (green) represent ten accessibility profiles inspired by Italy's Special Educational Needs (SEN) framework: Slow Mover (requires obstacle-free routes and longer transition times), Calm Seeker (benefits from quiet, low-stimulus areas), Quick Mover (needs space for active movement and physical play), Hands-On Learner (prefers interactive and manipulable environments), Tactile Explorer (responds to textured and sensory-rich surfaces), Expressive Communicator (communicates through non-verbal or alternative languages and needs multi-modal stimuli), Reflective Thinker (requires calm observation points and time for processing), Sensory Sensitive (sensitive to noise, light, and unpredictable layouts, needs controlled sensory environments), Cultural Traveller (requires inclusive symbols and multilingual access), and Explorer (thrives in open-ended paths and spaces that

reward curiosity and movement). These personas place inclusivity at the centre of spatial design, compelling teams to accommodate different learning styles and physical needs.



Figure 3. Examples of User Profile Cards. These cards draw inspiration from inclusive education frameworks and help players consider the diverse needs of school users when planning interventions.

Function Cards (blue) define the curricular and behavioural goals of each intervention, including Explore, Create, Socialise, Learn, Relax, Move, Observe, Cultivate, Experiment, and Dream. The selection of functions is designed to prompt students to reflect on the multiple functional properties of space and to recognise that certain functions may exclude others. This focus on the functionalisation of public and shared space enabled reflection on how to mediate between individual preferences and collective choices. Together, user and function cards define the brief for each team, determining which combinations of structures best fulfil their stated goals.



Figure 4. Examples of Function Cards. These cards represent key functions of inclusive public space—such as learning, moving, and socialising—and guide teams in ensuring functional diversity within their designs.

Each team is also assigned six **Role Cards** (teal), which mirror the division of labour in real planning processes: the Master of Ceremonies (MC) selects the functions to be pursued in the space and the users to whom the project should be addressed, chairs group discussions, sets priorities, and delivers presentations; the Supreme Shape Creator (SSC) sketches new structures and quantifies costs and impacts suitable for the selected users and functions; the Dream Architect (DA) curates the structure catalogue by identifying the most suitable structures—both new and standard—to meet user needs and to support the implementation of the selected functions; the Grand Treasury Accountant (GTA) manages finances, negotiates trade-offs, and purchases the structures to be included in the project; the Space Genius (SG) positions the structures within the available space, places tiles, and ensures accessibility and circulation; and the Harmony Guardian (HG) safeguards fairness and ecology, holding veto power and maintaining a public ledger of coins, butterfly tokens, and space used, administers environmental resources, and verifies that teammates' decisions have respected the initial commitments to provide specific functions for selected user profiles. This mutual interdependence enforces constant negotiation and fosters teamwork, as no action can proceed without coordination across roles.



Figure 5. Examples of Role Cards. Each card assigns specific responsibilities—such as managing resources, designing layouts, or facilitating group harmony—encouraging cooperation, accountability, and active participation within the team,

The material components of the game further support its educational goals. The game board—a high-resolution A1 printout of the school grounds—is accompanied by coins (penne-shaped pasta), environmental tokens (butterfly-shaped pasta), and space tiles (white 5 m² cardboard squares). Pupils must tape together tiles to physically construct the shapes of proposed structures, confronting issues of adjacency, circulation, and land consumption in a kinaesthetic mode.

In sum, the REPLACE Game transforms policy discourse into a dynamic, material, and collaborative exercise. It engages children as designers, planners, and citizens, cultivating the cognitive, ethical, and practical competences needed to imagine more just and sustainable futures.

3. Implementing the REPLACE Workshop: Pedagogical Strategies and Facilitation

The implementation of the REPLACE game workshop followed a carefully designed pedagogical trajectory, combining elements of direct instruction with inquiry-based learning, and progressively guiding pupils through a structured yet flexible educational arc. The process began with a collectively framed discussion on the notions of socio-spatial justice, land scarcity, and sustainability. Rather than delivering a one-way lecture, facilitators employed a dialogic and visual approach, encouraging children to identify inequalities within their own neighbourhood and to reflect on the spatial and material deficiencies of their school environment. This opening activity reframed the map of the school grounds from a neutral diagram into a socially contested and emotionally resonant terrain, setting the stage for more complex spatial reasoning and ethical deliberation.

As pupils moved into the design phase, they began customising their own components of the game. Working in pairs, they created new Structure Cards using blank templates and were asked to estimate three key values—land footprint in tiles, economic cost in coins, and ecological impact in environmental tokens. These estimations were not arbitrary: each proposed structure had to be explicitly linked to a User Card and a Function Card, thereby rooting design imagination in the needs of specific user profiles and tangible programme goals. This creative act, guided by the role of the Supreme Shape Creator, enabled pupils to develop a sense of authorship over the game material while enhancing their numeracy and evaluative skills through peer dialogue and negotiation.

Resource allocation introduced asymmetry as a deliberate pedagogical tool. Facilitators distributed uneven starting budgets—45, 35, or 25 coins per team, along with an equal number of environmental tokens—thereby

making inequality immediately visible. The Grand Treasury Accountant recorded each team's balance on a public scoreboard, prompting early discussions on fairness, responsibility, and the relationship between resources and obligations. This staged disparity would later become the basis for a simulated redistributive intervention, allowing pupils to critically engage with concepts underpinning cohesion policy.

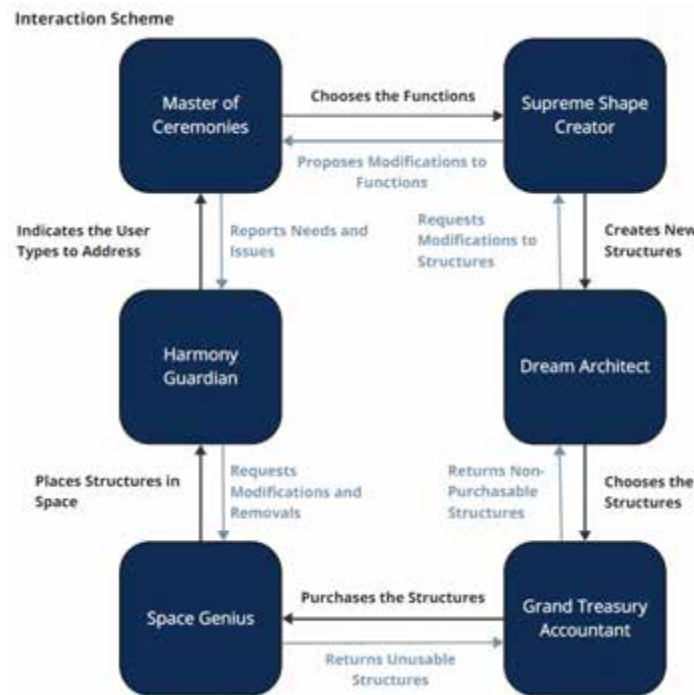


Figure 6. Group roles and interaction dynamics within the REPLACE workshop. The diagram illustrates how task-specific responsibilities (e.g., Space Genius, Dream Architect) structure collaboration and collective decision-making.

The **design phase**, occupying a substantial portion of the workshop, tasked teams with composing spatial layouts using a maximum of fifteen structures, while integrating at least three different user categories. The Space Genius orchestrated the physical placement of tiles on the map, and the Dream Architect curated the final configuration of selected structures. Throughout this process, facilitators maintained a reflective and non-directive presence, asking open-ended questions such as "Who might be excluded from this design?" rather than prescribing answers. This fostered an atmosphere of self-correction and ethical inquiry, as students revised their plans to increase inclusivity and accessibility.

Midway through the session, the workshop simulated a **redistributive shock** modelled on EU cohesion mechanisms. Additional funding was introduced: the team with the lowest initial endowment received the largest injection, followed by moderate support to the middle group and minimal increase for the most advantaged. This moment forced teams to reassess priorities under new conditions of equity, with the Master of Ceremonies in each group renegotiating goals in dialogue with teammates. In this way, abstract principles of distributive justice became embedded in the gameplay itself.

The final segment of the workshop was devoted to presentation and reflection. Teams publicly shared their spatial layouts, remaining coins and environmental tokens, and described the logic behind their decisions. The Harmony Guardian articulated how trade-offs were resolved and whether sustainability and inclusion had been achieved. A concluding plenary discussion, guided by facilitators, invited pupils to reflect on the most challenging dilemmas, the emotional impact of resource redistribution, and what they might do differently in a future

iteration. These conversations surfaced not only the design outcomes but also the values and social reasoning cultivated throughout the activity.

Throughout the workshop, facilitators adopted a deliberately Socratic posture—questioning, mirroring, and guiding rather than evaluating—to create a space of co-inquiry. The classroom thus became a rehearsal ground for collaborative planning and democratic participation, where children could practise critical citizenship through playful yet meaningful engagement with real-world challenges.

4. Learning in Action: Educational Goals and Outcomes

The game was purposefully designed to foster a comprehensive set of competencies that reflect the multidimensional profile of a future-oriented citizen-planner. Among the core learning goals were mathematical reasoning, spatial literacy, communication skills, civic awareness, empathy, and creative problem-solving. These were not addressed in isolation but emerged organically through the mechanics and social dynamics of the game-based experience.

Budget management, for instance, required pupils to engage in continuous arithmetic, calculating expenses, converting spatial units into square metres, and recalibrating available resources following a redistributive top-up. This process embedded mathematical operations such as addition, subtraction, and proportional reasoning within an authentic, time-sensitive scenario, thereby sharpening estimation skills and unit conversion abilities. Simultaneously, the manipulation of 5 m² tiles on a scaled map of the school site engaged pupils in spatial reasoning tasks. By repositioning playground equipment or designing new layouts, they developed an understanding of adjacency, circulation, and orientation, acquiring a practical grasp of spatial planning principles.

Communication and teamwork were equally central. The structured distribution of roles, each with distinct responsibilities, required participants to practise active listening, negotiate effectively, and coordinate actions with their peers. The division of powers (for instance, only the Treasury Accountant could release coins, and only the Space Genius could place tiles) reinforced interdependence and the need for clear, respectful dialogue. These dynamics offered a lived experience of relational and communicative competence under conditions of mild pressure and complexity.

The game also served as a rehearsal for democratic practice. Decisions regarding the allocation of resources, the selection of functions, or the response to new constraints were made collectively, with facilitators modelling procedural fairness and encouraging inclusive debate. The figure of the Harmony Guardian, with the authority to veto inequitable or ecologically harmful choices, ensured that deliberation was grounded in shared values of justice and sustainability. In this way, pupils were introduced to the principles of deliberative governance, simulating microcosms of participatory decision-making.

Empathy and social awareness were developed through the use of ten “User Cards”, each inspired by profiles drawn from the Italian framework for Special Educational Needs (BES). These profiles prompted participants to imagine the needs of different users—such as slow movers, sensory explorers, or multilingual learners—and to incorporate accessibility and inclusiveness into their spatial solutions. Children often expressed a sense of responsibility toward “their” users, and many reported adjusting their decisions to better accommodate these imagined perspectives. This affective engagement reflects the emergence of perspective-taking and ethical reasoning, key foundations of civic maturity.

In terms of creative capacity, the presence of blank Structure Cards empowered pupils to assume the role of novice designers. Estimating land take, costs, and ecological impacts became a process of iterative sketching, peer critique, and problem-solving that mirrored real-world design studios. The most inventive teams proposed hybrid installations—such as a combined “Reading-Garden Pergola” or a “Bike-Repair Kiosk”—capable of satisfying multiple user needs and functional goals at once. These examples demonstrated a capacity for divergent thinking and adaptive creativity under constraint.

At a deeper level, the workshop asked pupils to manage three parallel ledgers—**spatial, economic, and ecological**—each governed by different norms and logics. The spatial ledger, linked to physical tiles representing 5 m² units, introduced constraints of shape and fit: an L-shaped pergola or winding footpath might occupy the same area as a rectangle but proved more difficult to position effectively, prompting children to experiment with layout efficiency and spatial optimisation. The economic ledger, represented by penne-shaped pasta coins, captured financial trade-offs: while the objective was to spend the entire budget, groups had to evaluate utility over prestige, understanding that unspent funds held no advantage in the final assessment. The ecological ledger, expressed through farfalle-shaped environmental tokens, reflected the cost of carbon emissions, resource depletion, and habitat loss. Unlike coins, these tokens were best conserved. Though overspending was technically permitted, it carried social consequences, as seen when peers chided others with remarks like “You’re wasting butterflies!”, thus transforming planetary limits into a shared moral concern.

Balancing these ledgers required pupils to confront complex trade-offs and to understand that land, money, and ecological resources are interconnected but governed by conflicting imperatives. Through this balancing act, they encountered a form of moral arithmetic—“Can we afford it? Can we fit it? Should we do it?”—that encouraged systems thinking and early eco-ethical awareness. The result was a rich, multidimensional learning experience that went far beyond the accumulation of isolated skills, instead nurturing the kind of integrated reasoning necessary for navigating the socio-spatial dilemmas of contemporary urban life.

5. Transformative Learning in Practice: Reflections on Experience, Impact, and Educational Value

The REPLACE workshop demonstrated how play-based learning can integrate complex urban planning concepts with the cognitive, emotional, and social development of primary school pupils. Far from a mere educational diversion, the initiative yielded robust outcomes: students developed spatial awareness, demonstrated empathy toward diverse user profiles derived from inclusive education frameworks, and produced creative, context-sensitive design solutions under a range of constraints. Teachers reported enhanced attention, sustained enthusiasm, and strengthened cooperative behaviour among participants: evidence of the game’s ability to merge analytical rigour with affective engagement.

A distinctive feature of the workshop was the pedagogical role of emotion, which acted not as a peripheral effect but as a primary vector of reflection and transformation. The asymmetrical distribution of initial budgets sparked humour, frustration, and pride; the subsequent redistributive intervention triggered surprise in some groups and resentment in others. Rather than downplaying these emotions, facilitators framed them as learning opportunities, inviting pupils to examine their reactions and articulate connections between personal feelings and principles such as fairness, responsibility, and solidarity. These affective dynamics reinforced the ethical foundations of the experience and mirrored the kind of value-based negotiation found in real-world planning processes.

As pupils advanced through the design and evaluation phases, this reflective capacity deepened. When comparing remaining budgets and environmental tokens, students collectively evaluated the outcomes of their decisions not in terms of competition, but mutual improvement. Each team succeeded in meeting the pedagogical requirements addressing at least three SEN profiles, staying within budget, and reducing ecological impact. The final presentations reinforced a culture of shared learning and peer recognition. The result was a shift in classroom dynamics: from individual achievement to collaborative responsibility.

Three pedagogical strengths emerged clearly. First, high levels of sustained engagement: even typically less vocal students remained deeply involved throughout the workshop, forming strong attachments to the needs of “their” users and the success of “their” proposals. Second, the emergence of justice-oriented thinking: pupils began to spontaneously reference equity-based principles such as “fair shares of shade” or “step-free access,” revealing the internalisation of inclusive spatial reasoning. Third, inventive capacity under constraint: when challenged by tight budgets and spatial limitations, students produced innovative hybrids—like a pergola that doubled as a sensory retreat—regarded by teachers as exceeding the expected outcomes of standard de-

sign-and-technology curricula.

Alongside these achievements, the pilot also revealed areas for future refinement. A central limitation concerned the documentation of reasoning. Although the negotiation processes were often rich in dialogue and deliberation, much of this was only partially recorded through facilitator notes. Future versions could benefit from integrating tools such as video recordings or structured logbooks to capture the full depth of students' decision-making. Another challenge relates to the game's localisation: while the use of the actual school site enhanced engagement and realism, it also constrained replicability. Addressing this tension will require context-sensitive adaptations—such as replacing the site map with locally relevant public spaces, adjusting economic parameters to reflect regional conditions, and aligning user profiles with national SEN frameworks—to ensure that the pedagogical intent is preserved across diverse socio-cultural settings.

At a broader level, the Game offers a compelling model for translating academic research on cohesion policy, sustainability, and spatial justice into accessible, impactful educational experiences. By employing intergenerational co-design, role-based collaboration, and material proxies for territory, money, and ecology, the game renders abstract planning dilemmas concrete and emotionally resonant. In doing so, it fosters deliberative, imaginative, and ethical competences—skills that are foundational for civic agency and long-term democratic participation.

The decision to use a serious game format is not incidental, but central to the project's pedagogical strategy. Games situate learning in embodied, interactive, and emotionally charged environments, turning abstract concepts into negotiated realities. Within the REPLACE workshop, pupils did not passively absorb content but actively co-constructed meaning, experimenting with choices, negotiating trade-offs, and collaboratively building scenarios. The game thus functioned as a microcosm of territorial governance, where scarcity is felt, roles are distributed, and every spatial decision becomes simultaneously technical and ethical.

This design is grounded in multiple pedagogical traditions. Mezirow's theory of transformative learning is evident in how pupils confronted disorienting dilemmas that challenged their assumptions about justice and responsibility. Wals and Corcoran's vision of sustainability education as experiential, participatory, and action-oriented is embedded in the game's structure, which obliges players to balance environmental, social, and financial factors. Finally, Gruenewald's critical pedagogy of place is realised in the spatial immediacy of the game board—a real map of the school grounds—which reframes space not as a neutral backdrop but as a site of social negotiation.

Within the broader framework of the REPLACE project—which investigates governance and territorial cohesion at the European scale—the workshop stands as a concrete micro-level enactment of these themes. It enables children to “live” the concepts of spatial justice, rather than merely hear about them, and to explore how collective agency can shape public space. The result is not only a model for future replication, but a pedagogical prototype for engaging schools as active laboratories of democracy, where planning literacy becomes a tool for inclusive citizenship.

6. From Simulation to Action: Future Developments and Scaling Potential

The REPLACE project was conceived as a multi-level initiative that interweaves territorial governance, educational innovation, and civic engagement. At its core, the project aims to translate abstract policy constructs—such as spatial justice, sustainability, and territorial cohesion—into concrete, participatory experiences across diverse educational levels and socio-territorial contexts. Among its most impactful outputs, the game-based workshop for primary schools has proven particularly effective in disseminating these concepts through co-design, experiential learning, and inclusive urban literacy. This immersive approach not only fosters foundational planning competences among young learners, but also positions universities as agents of civic imagination and transformation.

In 2025, the project enters a new developmental phase through the launch of **VIBES - Visioni Innovative per un BEne comune nella Scuola**, a participatory initiative targeted at upper secondary students of the Spinelli School.

Building on the pedagogical groundwork laid in the primary-level pilot, VIBES shifts from simulated planning exercises to real-world spatial interventions. It adopts a project-based learning methodology that invites students to critically reinterpret and redesign their school courtyard, engaging directly with the social, environmental, and spatial dynamics of their everyday surroundings.

Structured in three progressive phases—Contextual Exploration and Data Collection, Collaborative Design and Scenario Building, and Project Presentation and Community Engagement—the initiative guides students from situated inquiry to actionable spatial strategies. Supported by researchers from the Politecnico di Milano, participants translate empirical data⁴ into design proposals aligned with the principles of equity, sustainability, and cohesion. These proposals are then shared with the broader school community and local stakeholders, fostering intergenerational dialogue and civic visibility.

The VIBES initiative reinforces the longitudinal ambition of REPLACE by extending its core learning objectives (systems thinking, spatial literacy, and democratic participation) across developmental stages. It exemplifies how school environments can evolve from passive spaces of instruction into active sites of civic agency and collaborative design. In this way, education becomes not only a process of knowledge transmission but a platform for public action.

Taken together, the REPLACE project and its expansion through VIBES articulate a robust model for integrating research-driven pedagogy with societal relevance. By embedding abstract concepts within participatory, place-based frameworks, these initiatives demonstrate how schools can serve as laboratories of democracy and how academic research can animate civic life. As parallel efforts across Europe⁵ are beginning to show, cultivating the capacity of younger generations to design more inclusive and sustainable spaces is not merely aspirational, it is essential for addressing the socio-environmental urgencies of our time.

Conclusions

This paper has presented the REPLACE project as an innovative model of research-driven pedagogy that bridges academic research, civic engagement, and educational transformation. Through its focus on spatial justice, territorial cohesion and sustainability, the project exemplifies how universities can extend their mission into the public sphere by developing participatory, place-based learning experiences.

The discussion began by situating the REPLACE research extension's activities within the broader framework of the University's Third Mission, underscoring its orientation toward knowledge dissemination and societal impact beyond traditional academic boundaries. It then examined the conceptual development of The REPLACE Game, a pedagogical board game designed to translate complex policy ideas into accessible, experiential learning for primary school pupils. The workshop's implementation and facilitation strategy was analysed in detail, highlighting how co-design, role-play, and structured simulation fostered civic imagination, ethical reasoning, and spatial literacy.

⁴ Empirical data refers to a digital questionnaire which has been submitted to school mates, school workers and inhabitants in order to investigate the issue of the school courtyard's renewal

⁵ See, for example: La Città dei Bambini by Francesco Tonucci, an international initiative active in over 200 cities worldwide, which establishes Children's Councils to involve young citizens in urban planning and governance, promoting child-friendly city designs; the Youth Engagement Programme in London, which collaborates with schools to engage students in real urban development projects through workshops with architects and planners, fostering early civic involvement; Helsinki's Nuortenbudjetti, an annual participatory budgeting process where youths aged 12–17 propose and vote on the allocation of approximately €150,000 for youth services, empowering them in municipal decision-making; and the Our Cities project, an Erasmus+ initiative led by the Hill School in Athens, engaging primary school students in exploring their urban environment, identifying infrastructural challenges, and collaboratively designing models of ideal cities, thereby cultivating active citizenship and spatial awareness from an early age.

Subsequent sections explored the workshop's **transformative learning** outcomes. Pupils demonstrated not only increased spatial awareness and mathematical reasoning, but also developed empathy, teamwork, and environmental consciousness. Emotional responses and ethical dilemmas were not incidental but central to the learning process, catalysing reflection and value-based decision-making.

The final part presented future developments, particularly the VIBES initiative, which expands the REPLACE methodology to the secondary school context. Through real-world design challenges and community engagement, this new phase furthers the project's commitment to building civic capacity across educational levels.

Taken together, the REPLACE game and VIBES initiatives align with the principles of critical pedagogy, as articulated by Paulo Freire (1970) and Ivan Illich (1971). Freire's emphasis on education as a practice of freedom, where learners critically engage with the world to transform it, is incorporated in the research extension's activities provided by REPLACE and its dialogic and participatory structure. Similarly, Illich's vision of deschooling society and reclaiming education as a cooperative, learner-driven act echoes in REPLACE's challenge to traditional instructional hierarchies and its relocation of learning into real, contested, spatial environments, as suggested by its transformative educational initiative.

In sum, the REPLACE project offers a replicable, scalable model for integrating research, teaching, and civic responsibility. By aligning academic knowledge with critical pedagogy, it demonstrates how schools can become laboratories of democracy and how educational institutions can cultivate the competences and critical awareness required to address today's most pressing socio-spatial and environmental challenges.

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