STEAMCITY MOCK-UP

STEAMCITY BRICK BY BRICK

Represent a territory in a realistic way using bricks

Co-funded by the European Union

INTRODUCTION

This activity is part of the Erasmus + SteamCity project, which aims to transform their cities into learning spaces for learners where science, technology, engineering, arts, and mathematics combine to address contemporary challenges. Building a sensory model allows learners to concretely experience the complexity of urban systems and understand how each component of the city influences and is influenced by the others.

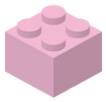
THE FOUR PILLARS OF THE CITY TO EXPLORE

Public services: the foundation of living together. The city must guarantee equitable access to essential services (education, health, culture, administration). Learners will discover how the location of these services determines residents' quality of life and raises questions of territorial equity. Where should a school be located so that it is accessible to all? How can the creation of "medical deserts" be avoided in certain neighborhoods?
Networks: the invisible that structures. Transportation, energy, water, telecommunications, waste management... These invisible but essential networks structure the city. This activity will reveal how these technical infrastructures create constraints but also development opportunities. Students will understand that each new building must fit into these existing networks and that their planning profoundly influences urban development.
Economic activity: the engine of development. Commerce, industry, offices, crafts... The urban economy generates jobs and wealth, but also nuisances and traffic. Learners will experience the tensions between economic development and residential quality of life. How can necessary economic activity be reconciled with the well-being of residents? Where should activity zones be located to minimize nuisances and risks while ensuring their accessibility so as not to increase commuting times (nor traffic jams and associated car pollution)?
Quality of life: the ultimate goal. Green spaces, sports and cultural facilities, social spaces, air quality, noise levels... Quality of life results from the subtle balance between all urban elements. Students will discover that a city is not just a collection of buildings but a complex ecosystem where the well-being of its inhabitants depends on multiple interconnected factors.

Beyond construction, this activity develops a systemic understanding where each decision has multiple repercussions. Learners discover that the city is a complex system where each element influences the others (interdependence), perfect solutions do not exist (need for compromise), history constrains the present (weight of urban legacies), participation and dialogue are essential (importance of consultation), and improvement is a continuous process (city in constant evolution). This practical experience lays the foundations for an informed citizenship where future citizens understand urban issues and can participate constructively in debates on the future of their city.

This activity is inspired by LEGO®4Scrum (https://www.lego4scrum.com/), an animation format, invented by Alexey Krivitsky, which allows you to discover agile project management and the SCRUM method. If you need to work with your learners on project management, some elements of LEGO®4Scrum can be used to enrich the construction of the SteamCity model.

LINK WITH THE SUSTAINABLE DEVELOPMENT GOALS (SDGS)



SDG 11 - Sustainable cities and communities

The model's central activity directly illustrates this objective by showing how to create inclusive, safe, resilient, and sustainable cities. Students experience the challenges of sustainable urbanization: controlled densification, functional diversity, universal accessibility, and the preservation of green spaces.

SDG 3 - Good health and well-being

By positioning health facilities, managing sources of pollution (factory, traffic), and creating green spaces, learners understand how urban planning directly impacts public health.

SDG 4 - Quality Education

School placement raises issues of accessibility and a conducive learning environment. Students discover that education is not confined to school walls but is embedded in an urban environment that can either promote or hinder learning.

SDG 7 - Affordable and Clean Energy

The question of energy networks and the installation of infrastructure (such as antennas) makes it possible to address the challenges of urban energy transition.

SDG 9 - Industry, innovation and infrastructure

The integration of industrial zones raises the question of innovation to reduce nuisances and create positive synergies between economic activities and residential life.

SDG 10 - Reduced inequalities

The activity reveals how planning choices can create or reduce spatial inequalities. The distribution of services, the quality of public spaces, and transport accessibility are all factors of territorial equity.

SDG 13 - Combating climate change

Greening, management of transport flows, and thoughtful densification are all elements that make it possible to address adaptation and mitigation of climate change in urban areas.

TO GET OFF TO A GOOD START

EDUCATIONAL OBJECTIVES

Main objectives	Skills developed
• Understanding the complexity of interactions between different urban elements • Developing a systemic vision of territorial planning • Becoming aware of the impact of urban planning decisions on quality of life • Experiment with continuous improvement through successive iterations	• Collaborative work and team communication • Solving complex problems • Critical thinking and anticipation of consequences • Creativity and adaptation to constraints

Necessary material

BRICK AS A CENTRAL BUILDING ELEMENT

The choice of construction material profoundly influences the dynamics of the activity. LEGO®®-type bricks offer considerable educational advantages: modularity, error reversibility, construction stability, and reassuring familiarity for students. However, their effective use requires rigorous organization.

Chromatic and symbolic organization of the bricks

Depending on the teacher's desire to work on creativity or not, it may be interesting to constrain the symbolism of colors to structure the rendering. Particularly when this activity is done with a geography teacher, the chromatic organization works on symbolism and spatial representation, which are important skills for better synthesizing data on a map.

Transform the apparent colorful anarchy of bricks into a coherent urban system by assigning meaning to each color.

This codification, announced from the start and visibly displayed, structures the urban thinking of the students:

- **Red: Residential buildings (collective and individual housing)**
- **Blue: Public services (school, town hall, health center, cultural facilities)**
- **Yellow: Commercial activities (shops, shopping center, market)**
- **Green: Green spaces and natural areas (parks, gardens, urban agriculture)**
- **White: Offices and tertiary services**
- **Black/Grey: Industries and technical infrastructures (factory, treatment plant, transformer)**
- **Orange: Sports and leisure equipment**
- **Brown: Transport networks (to mark roads and parking lots with signs)**

This codification instantly transforms the reading of the city: a glance is enough to identify monofunctional zones (too much concentrated red = dormitory district) or successful diversity (harmonious alternation of colors = lively district).

Preparation and distribution of materials

Instead of presenting the bricks in bulk, organize them according to a logic that facilitates collaborative work and avoids resource conflicts:

By team island	In common central reserve
• A compartmentalized bin with bricks sorted by color (facilitates compliance with the code) • A balanced basic quota: 30 red bricks, 20 blue, 15 yellow, etc. • Special elements counted: 2 brown plates for roads, 4 transparent bricks to represent water or glass	• Special parts (roofs, doors, windows) that give character to buildings • Extra bricks for unforeseen needs • Additional base plates for extensions • Decorative elements (LEGO® mini-trees, characters, vehicles)

Management of planned shortages

Deliberately, don't provide enough building blocks for each team to achieve their ideal vision. This organized scarcity generates rich learning:

- Negotiation between teams ("We'll trade you 5 reds for 3 blues")
- Prioritization of essential constructions
- Creativity in using available resources
- Understanding the real budgetary constraints of urban planning

Complementary material to bricks

Instead of presenting the bricks in bulk, organize them according to a logic that facilitates collaborative work and avoids resource conflicts:

Construction base	Contextual elements and networks	Documentation material	Measurement tools for operation
Rigid panels (foam board, thin plywood) of at least 1m x 1m covered with a coating on which it is possible to draw to create a continuous buildable surface	• Colored ribbons for networks (blue for water, yellow for gas, red for electricity, green for cycle paths) • Thin wire for overhead power lines • Aluminum foil to represent water surfaces • Cotton or green moss for non-LEGO® vegetation • Fine sand or gravel for non-buildable areas	• Colored post-its to identify buildings ("School", "Factory", "Apartment buildings") • Labels with pictograms for equipment (♿ for accessibility, 🌳 for green spaces) • Erasable markers for drawing directly on the construction surface (roads, areas) • Rulers and set squares adapted to LEGO® scale	• Tape measure • Stopwatch • Sound level meter (or smartphone app) • Infrared thermometer • Directional lamp to simulate sunlight

Adaptation according to available resources

If you have few LEGO®	If you have a lot of LEGO®	Alternative sans LEGO®
• Combine with other materials. LEGO® is used for the main buildings (easily modifiable), cardboard for secondary structures, and paper for green spaces. • This mix is educationally interesting: it shows that the city combines different types of construction.	• Introduce height constraints (maximum 3 floors unless otherwise justified). • Impose architectural standards (all public buildings must have an identifiable entrance). • Create neighborhoods with different styles (historic neighborhood with classic bricks, modern neighborhood with special pieces).	• Colored wooden blocks (Kapla type): more abstract but allow for great creativity • Recycled materials (boxes, rolls, bottles): integrated environmental awareness • 3D printing of typical buildings: if you have access to a 3D printer • Pre-cut cardboard models: faster but less flexible

ORGANIZATION OF THE SESSION - TOTAL DURATION: 2.5 TO 3 HOURS

Phase 1 : Introduction (15 minutes)	Phase 2: Build Cycles (4 iterations of 30 minutes each)
• Presentation of the context: "The mayor mandates you to create the city of tomorrow" • Team formation (3-5 students per team) • Distribution of basic materials • Explanation of the principle of iterations and validation	Structure of an iteration: • Mayor's Briefing (5 min): New Construction Requests • Team construction (20 min): creation of the requested elements • Validation and feedback (5 min): the mayor examines and identifies the problems
Phase 3: Inauguration ceremony (15 minutes)	**Phase 4: Debriefing and reflection (15 minutes)**
• Final presentation of the city • Collective celebration of work accomplished • Naming of the city, its streets, its main buildings and photos of the model	• Group discussion around the achievements and choices made • Educational perspective

PREPARATION OF THE ACTIVITY

WORKSPACE CONFIGURATION

The success of this activity depends largely on careful preparation of the work environment. The teacher must transform his or her room into a true collaborative urban planning workshop where each team can both work independently and contribute to the common work that is the city model.

Room layout in islands	Installation of the central construction space
Organize the room into work islands, one per team (ideally 4 to 6 islands for teams of 3 to 5 students). Each island should have enough work space to handle the building blocks and allow for discussion among team members. The tables should be positioned so that each team has a direct view of the central space where the city will be laid out. This star or open U-shape layout encourages teamwork, circulation, and collective dynamics.	In the center of the room, set up one or more tables forming a surface area of at least 1m x 1m to accommodate the city model. This central position embodies the fact that the city is a shared project where each team contributes equally. Ideally, use a mobile table (on casters or easily movable) that will allow the model to be stored and moved after the session. If possible, raise this central table slightly to improve visibility from the work islands. Make sure to leave enough clearance around the central table (at least 80 cm) so that several students can work there simultaneously without getting in each other's way. This area will become the place for negotiation and adjustment, where teams will have to coordinate their constructions.

Preparation of the basic ground

CREATION OF THE SUPPORT

Cover the central table with a large sheet of kraft paper or several A1 sheets of paper joined together to serve as a base. This paper support allows you to draw the contextual elements and can be kept with the model as a record of your work. Secure the edges with tape to prevent the paper from moving and tearing during handling.

MANDATORY CONTEXT ELEMENTS

Draw a visible wind rose in a corner of the plot, clearly indicating north and specifying the direction of the prevailing winds in your region (important information for the siting of the plant in iteration 2). This indication must be large enough to be seen from all the islands. Next to the wind rose, note: "Prevailing winds: West → East" (or the actual direction of your region).

Lightly outline the building plot with a thin line, leaving a 5-10 cm margin around the edges to represent connections to the outside world (access roads, utilities). This delineation helps students understand that they are working on a finite space that needs to be optimized.

OPTIONAL LANDSCAPE ELEMENTS (DEPENDING ON THE STUDENTS' LEVEL)

For more expert students or to make the exercise more complex, you can add topographical and landscape constraints:

- A waterway: Draw a river crossing the land, creating a constraint for bridges and flood risk, but also an opportunity for quality of life. The river naturally divides the land and forces us to think about connections.
- A hill or slope: Materialize a high area (with hatching or a color) attractive for housing (view, clean air) but complex for networks and accessibility.
- A protected wooded area: Delineate an existing green space that cannot be built on, forcing students to deal with this environmental constraint.
- An existing railway or motorway: Trace a pre-existing heavy infrastructure along the edge of the land, a source of nuisances but also of connection opportunities.
- A historic monument: Place a heritage element (castle, church, archaeological site) that cannot be moved and around which the city must be structured.

Organization of the material

Preparation by island	Common equipment area	Reference documentation
On each island, place the basic equipment in separate, labeled containers: • Main construction materials (LEGO®® type building bricks, pre-cut cardboard, recycled materials, etc.) • Secondary materials (colored paper, toothpicks, thread, modeling clay) • Tools (scissors, glue, rulers, markers) • A3 sheets for sketches and preparatory plans • Post-its to identify the buildings constructed	Create a common equipment area accessible to all with: • Additional materials for unforeseen needs • Decorative elements (miniature vegetation, small cars, characters) • Equipment for networks (colored wires for electricity, blue tape for water, etc.) • Blank labels to name neighborhoods and buildings	Display on the wall or distribute on each island: • A reminder of basic urban symbols (if you use color codes or shapes) • A table of acceptable distances (e.g.: school at a maximum of 500m from homes) • The list of Sustainable Development Goals concerned • A visual schedule of the 4 iterations with times

Educational preparation

Scripting the role of mayor	Anticipation of difficulties
Prepare your interventions by writing down on cards: • The precise requests for each iteration • The problems you will raise depending on the possible configurations • Typical phrases to maintain the role ("As mayor, I cannot accept that...") • Acceptable compromises to avoid blockages	Identify the points of vigilance: • Provide a "rough" area if a team wants to test before placing it permanently • Have a clear rule for modifications (who can touch what) • Prepare a solution if two teams want to build in the same location • Anticipate the case where the land becomes too small (allow height, densification)

Checklist before students arrive

- [ ] Tables arranged in islands with a view of the center
- [ ] Central table installed and stabilized
- [ ] Fixed base terrain with drawn compass rose
- [ ] Landscape constraints added (if relevant)
- [ ] Equipment distributed on each island
- [ ] Organized common equipment area
- [ ] Documentation displayed/distributed
- [ ] Mayor's files prepared
- [ ] Camera ready to document the evolution
- [ ] Visible stopwatch or timer to manage time
- [ ] Space cleared for the final inauguration ceremony

PROGRESS OF ITERATIONS

The activity is structured around four main iterations that reproduce, in an accelerated and educational manner, the organic development of a city. This approach is not just a simple temporal division: it embodies the reality of urban evolution where each era brings its needs, constraints, and solutions, while having to deal with the legacies of the past. Students will thus experience in a few hours what cities experience over decades, even centuries.

Each iteration follows a structured cycle: the mayor (the teacher) presents new requests corresponding to the evolving needs of the population, the teams build while trying to meet these needs, then comes the moment of validation where the interactions between the different urban elements are revealed. It is in this validation phase that the "sensitive" dimension of the model takes on its full meaning: the students discover that their city is not an assembly of juxtaposed elements but a system where each decision impacts on the whole.

The progression between iterations is designed to correspond to the major development phases of a new community. We begin with basic needs (housing, education, healthcare), then add the economic dimension with its opportunities and nuisances, then come the invisible but structuring networks, and finally the search for quality of life for all and collective harmony. This progression reflects both the historical evolution of many cities and the hierarchy of urban needs. It also allows for a gradual increase in complexity, with each new layer revealing new conflicts of use and requiring more delicate arbitrations.

The teacher, in his role as mayor, must adapt his level of requirement over the course of the iterations. Highly critical during the initial validations to bring out the problems, he gradually becomes more conciliatory and constructive, seeking creative solutions with the teams to the identified conflicts. This evolution is essential: it is not a question of discouraging the students with incessant criticism, but of leading them to understand that urban planning is the art of the possible, where perfection does not exist but where collective intelligence can always improve situations.

To make the activity even more gamified, you can consider each building installed in the city worth a certain number of points depending on its complexity. During the final celebration, you can highlight the winning team by paying tribute to them in your opening speech.

ITERATION 1: THE FOUNDATIONS

My dear fellow citizens, I thank you for your confidence in this new term at the town hall. Our new town is expanding and needs its first essential amenities. Families are arriving to enrich our beautiful community, and they urgently need facilities to live, learn, and care for themselves. I am counting on the town hall's specialized teams to effectively implement the vision for which you elected me.

The Mayor

MAYOR'S REQUESTS TO THE TEAM FOR THIS ITERATION

Build essential infrastructure for our city:

An elementary school.

A health center.

Accommodation for families.

A town hall for administrative services

Tips for the teacher

The first iteration lays the foundations for urban planning. Students will naturally tend to arrange buildings without thinking, often grouping housing on one side and services on the other. This is the time to introduce the first concepts of urban planning without explicitly naming them. It will also be necessary to quickly agree on a construction scale, as some teams may embark on large, 3D buildings that would not be constructible with short iterations. Often, the validation of the first housing unit will be an opportunity to set the construction scale and agree with the students on how to create the model.

When validating, start by highlighting the construction effort before gradually introducing the issues. Observe the distance between the different elements. If the school is located far from the housing, ask the students to mentally map out the children's route: "Look, the families who live here, their children will have to travel this distance every morning. In winter, in the rain, do you think that's reasonable?"

This practical approach allows learners to grasp the importance of concepts such as the "15-minute city" without necessarily explaining it first.

Building orientation is often overlooked by students, but it's an excellent starting point for discussing sustainable development and thermal comfort. If the housing is poorly oriented, explain how the sun moves throughout the day and ask: "These apartments will never see the sun; they will be dark and cold. The residents will have to heat more, which is expensive and pollutes." Similarly, if the school is located in a noisy or busy area, have them imagine children trying to concentrate with constant noise.

It is not uncommon for the students to have nothing validated by the mayor at the end of the iteration and/or for their construction to remain on their block. If this happens to you, after reporting it to the teams, you can restart the iteration for a few minutes. It is important that learners can make mistakes and use the error to learn; do not anticipate their mistakes; let them make mistakes so you can use them for discussion.

ITERATION 1: THE FOUNDATIONS

If at the end of the iteration no building is validated, you can also do an iteration 1bis to ensure that you are not slowed down in the progress of the following stages. If, on the contrary, you want to add pressure, you can carry over to the next iteration what could not be built and validated in the following iteration. This activity must be dynamic, so you must be as rigorous as possible over time to maintain the rhythm and encourage effective exchanges and the search for solutions rather than discussions that go around in circles.

At the end of the first iteration, you should feel that all the teams have understood the principle of the activity and, above all, that they are beginning to perceive that the instructions are still incomplete so that they are in a proactive position and that they question you to be sure that there is no gap between the real need and what you were able to express in your requests. For example, by never giving the size of the requested buildings, it gives you the opportunity to tell the teams who have not questioned you that the size does not suit you and to force them to anticipate the next time. Be careful not to fall into your own trap with the interactions of the different elements. If you have requested housing for 10 families, you will have to justify why you are requesting a school for 100 children afterwards.

POINTS OF VIGILANCE FOR VALIDATION

Accessibility and equity	Environment and orientation	Urban coherence
• Are services within reasonable distance of all homes? (the concept of a "15-minute city") • Are there any disadvantaged neighborhoods in terms of access to services? • Can people with reduced mobility easily access the facilities?	• Does the school have a quiet environment conducive to learning? • Are the accommodations well oriented (sunshine, prevailing winds)? • Is there enough space around the school for a playground?	• Is the density appropriate (neither too dense nor too spread out)? • Are the different types of housing mixed (social mix)? • Is the town hall in a central and symbolic position?

Questions to ask the teams:

How do children in the North End get to school? Isn't it too far?

Where are the play areas for children in shared accommodation?

In the event of a medical emergency at night, can all residents quickly reach the health center? Have you considered where the fire truck will park?

ITERATION 2: ECONOMIC DEVELOPMENT

My dear fellow citizens, our young city is coming to life! The first residents are settling in, children are discovering their new school, families are finding their feet. But then a delegation of citizens comes to see me with a major concern: 'Mr. Mayor, it's all well and good to have housing and a school, but where are we going to work? How are we going to support our families?' They're right. A city without an economy is a bedroom community doomed to decline. We need to create jobs, attract businesses, and develop commerce. Investors are at our doorstep: a manufacturer wants to set up his factory and promises us 200 jobs, a distribution chain wants to open a shopping center, entrepreneurs are looking for offices and other coworking spaces for their innovative start-ups. It's a fantastic opportunity! But... and this is where the expertise of the city hall team will be crucial... I also received a petition this morning from worried parents. They've heard about these projects and fear for their children's peace and quiet. Residents of residential areas are already organizing themselves into neighborhood committees and starting to talk about ZADs. Some are even threatening to leave the city if we transform their haven of peace into a noisy and polluted industrial zone. Our mission is therefore delicate: to create a dynamic economy while preserving the soul of our city. Each business that establishes itself will be a source of wealth and jobs, but also potentially a source of nuisance. Each business will enrich daily life but will generate traffic. We will have to be strategic and creative so that economic development rhymes with quality of life. Because a city that works must also be a city where life is good!

The Mayor

MAYOR'S REQUESTS TO THE TEAM FOR THIS ITERATION

Develop the local economy:

An industrial zone with a production plant (specify the type: food industry, textiles, technology, etc.)

A shopping center

An office district for service companies

A covered market for local producers

Some local shops in residential areas

Tips for the teacher

This second iteration is usually when conflicts of use become evident. Students, constrained by the space already occupied and their initial choices, will have to make compromises that will reveal the complexity of urban planning. This is the key moment when they understand that every past decision influences future possibilities.

The plant's location is particularly revealing. Teams will often place it in an available corner without thinking about the consequences.

ITERATION 2: ECONOMIC DEVELOPMENT

This is an opportunity to introduce the concept of prevailing winds: take a concrete example from your region. "In our area, the winds come mainly from the west. If the factory produces odors or fumes, even light ones, where will they go?" Let the students mentally trace the path of the emissions and work out the problem for themselves. If they have placed the factory to the west of the school, the reaction will be immediate.

The shopping center raises other questions. Beyond its location, it's the entire flow system that needs to be considered. Have them visualize a typical day: "It's 8 a.m., parents are dropping their children off at school. At the same time, delivery trucks arrive at the shopping center. Look at your model: where will these flows intersect?" This narrative approach helps students understand that the city isn't static but alive, traversed by movements that can come into conflict.

An often overlooked but educationally rich aspect is economic competition. If students have set up small businesses near homes, question their viability: "Won't this shopping center with its big brands and free parking empty the small businesses of their customers? What will become of the neighborhood bakery?" This is an excellent opportunity to talk about the local economy and sustainable development.

POINTS OF VIGILANCE FOR VALIDATION

Industrial nuisances	Flux et circulation	Economic and social impacts
• Does the factory generate nuisances (noise, odors, fumes) for residential areas? • Do prevailing winds carry emissions towards homes or the school? • Is there an industrial risk (Seveso type) too close to the population? • Are the factory hours (3 x 8 hours?) compatible with the neighborhood?	• Do delivery trucks pass by the school during entry/exit times? • Does the shopping center generate traffic in residential areas? • Are there any expected traffic jams during rush hour? • Are the delivery areas thought out?	• Won't the shopping center kill local businesses? • Is there functional diversity or spatial segregation of activities? • Do the jobs created match the qualifications of the residents? • How do car-free workers access employment areas?

ITERATION 3: NETWORKS AND CONNECTIONS

My dear agents,

We are faced with a modern paradox that threatens the future of our radiant city! This morning, three simultaneous crises erupted in my office.

First crisis: the companies we attracted are threatening to leave. The factory manager is categorical: He told me that without a reliable 5G connection, it will be impossible to manage their connected production lines. Obviously, competitors already have this technology and they can't get it because of us! The startups in the business district are even more virulent. This morning, the director of the committee of benevolent startuppers told me that they were losing millions of customers every second because of faulty connections. He even added, "It's the digital Middle Ages here!"

Second crisis: the prefect summoned me. Environmental standards require us to have a wastewater treatment plant operational within three months, otherwise new construction is prohibited. Furthermore, without a waste sorting center, we will be financially penalized. These infrastructures are not options; they are legal obligations!

Third crisis: the residents are exhausted. Morning traffic jams sometimes last an hour to cross our small town. Parents carry their children on their backs to cross dangerous roads. A cycling collective is calling for safe cycle paths and a ban on cars on motorways. Elderly people can no longer get around due to a lack of adequate public transport.

But here's the catch... As soon as I mentioned the installation of a 5G antenna in the city council, a terrible uproar arose! 'Not near our children!', 'We are not guinea pigs!', 'If this antenna is installed, we will organize a referendum!' Likewise, no one wants the sewage treatment plant in their neighborhood: 'The smells!', 'The property devaluation!', 'Why in our area and not in others?'

So you have to do the impossible: modernize our city with all the infrastructure of the 21st century – communication networks, waste and water management, sustainable mobility – while dealing with what sociologists call the NIMBY syndrome: 'Not In My BackYard'! Everyone wants the services but refuses the nuisances of the infrastructure that makes them possible.

This is the challenge of our time: how to install the invisible that structures everything? How to make the indispensable that is disturbing acceptable? You will have to demonstrate extraordinary ingenuity, because failure is not an option. Without these networks, our city will die economically. With these poorly placed networks, it will die socially.
Find the balance, or our new city will become a ghost town!

The Mayor

ITERATION 3: NETWORKS AND CONNECTIONS

MAYOR'S REQUESTS TO THE TEAM FOR THIS ITERATION

Make our city lively by installing the necessary technical infrastructure:

A 5G relay antenna for mobile coverage

A transport network: main roads, 3 bus lines, stops, a park and ride

A wastewater treatment plant

A waste sorting center with a voluntary drop-off point

A high voltage electrical transformer

Cycle paths connecting the main points

Tips for the teacher

This third iteration is the most challenging for the students because it confronts them with dilemmas without solutions. This is precisely what makes it so educational: they discover that city development is the art of possible compromise, not the ideal solution.

The relay antenna is an excellent indicator of the tensions between technical necessity and social acceptability. Technically, the antenna should be placed high up, in the center of the area to be covered. Socially, no one wants it near their home. Play up this paradox to the fullest: "This antenna is essential, all the residents want 5G for their phones. But look, you put it right next to the school! Parents will protest, some will even threaten to withdraw their children from our school. Where should we move it, knowing that wherever you put it, there will be protests?" Let the teams debate and find a compromise together: perhaps on the roof of an industrial building, perhaps camouflaged in a fake tree, perhaps accepted with compensation.

The transportation network often reveals that students have created an archipelago-city, with neighborhoods isolated from one another. Ask them to trace daily routes with their fingers: "Mary lives here and works there. Show me her route." If they draw a straight line through the buildings, it's time to materialize the roads. And here, the dilemma appears: the efficient route cuts the residential neighborhood in two. "This road will have 5,000 vehicles per day. How will the children from the south get to the school in the north? Do we need a pedestrian crossing? A traffic light? A bridge? A tunnel?" Each solution has its benefits and costs, both monetary and social.

The wastewater treatment plant is particularly interesting because it combines technical constraints (it must be at a low point to collect water by gravity) and social constraints (no one wants it near their home). If the low point of your model is occupied by the shopping center or luxury housing, the conflict is immediate and realistic. This is an opportunity to talk about environmental inequalities: "Often, these necessary but undesirable facilities end up in the least advantaged neighborhoods. Is that fair?"

ITERATION 3: NETWORKS AND CONNECTIONS

POINTS OF VIGILANCE FOR VALIDATION		
Social acceptability	**Urban cuts**	**Network efficiency**
• 5G antenna visible from school will spark a backlash from parents • The electrical transformer worries local residents (electromagnetic waves) • Does the treatment plant generate odors depending on the wind? • Does the sorting center attract pests (rats, seagulls)?	• Do main roads create divides between neighborhoods? • Can children cross safely to go to school? • Are there crosswalks and traffic lights in the right places? • Are the cycle paths continuous or fragmented?	• Do bus lines serve all neighborhoods equally? • Is the park and ride well connected to public transport? • Are the voluntary drop-off points accessible without a car? • Does the treatment plant have the capacity for future growth?

ITERATION 4: QUALITY OF LIFE AND URBAN HARMONY

My dear urban planners,

This weekend, our city experienced its first major social movement. A thousand people in the streets! Their banners? 'A city to live in, not to survive in!', 'Where are our green spaces?', 'Our children are suffocating!' The procession marched from the factory to the town hall, passing through all the black spots in our city. The leader of the movement, the former director of the benevolent startuppers' committee, now a young father, publicly challenged me: 'Mr. Mayor, we have jobs, yes. We have housing, certainly. We even have 5G, bravo! But where can our children play without breathing in exhaust fumes? Where can our elders walk without walking alongside concrete walls? Where can teenagers play sports without traveling 20 kilometers? We are not production and consumption machines. We are human beings who need beauty, nature, and social connections!'

And he's right. The figures I received this morning are alarming. The doctor at our health center is reporting an increase in respiratory problems among children. Teachers are reporting difficulty concentrating due to ambient noise. The municipal police are noting an increase in incivility, a classic symptom of urban malaise. Even more worrying: three executive families we had attracted have already left, citing a 'degraded quality of life'. But this morning, a miracle! A patron, touched by our situation, is offering to finance quality-of-life facilities. The regional council is releasing funds for urban greening. The state is granting us a subsidy for a major cultural facility. This is our chance to redeem our mistakes, to heal the urban wounds we have created! However—because there is always a 'however'—space is sorely lacking. Every square meter counts. This park everyone dreams of, where can we put it without destroying what works? How can we integrate this essential sports complex without creating new nuisances? How can we create this convivial square without sacrificing the parking lots that businesses depend on? You have one session, just one, to transform our machine city into a garden city, our city of work into a city of well-being. It's time to repair, reconcile, and harmonize. Some of the problems you've created can become opportunities: this noisy factory could be masked by a curtain of vegetation that would become a linear park. This road that cuts through the city could become a planted boulevard with cycle paths.

History will judge this latest iteration. Either we will be remembered as the city that reinvented itself, finding the balance between progress and humanity. Or we will become the symbol of those soulless cities where no one really wants to live. Citizens wait. Investors watch. Families hope.
Show me that you can turn urban lead into gold! Prove that sustainable development is not just a slogan but a reality that you can build! Because after this session, we will inaugurate our work. And I want to be able to proudly say: 'Here is a city where the economy thrives, where technology serves, but above all, where humanity flourishes!'"

The Mayor

ITERATION 3: NETWORKS AND CONNECTIONS

MAYOR'S REQUESTS TO THE TEAM FOR THIS ITERATION

Improve quality of life:

An urban park

Shared gardens in every neighborhood

A sports complex (stadium, gymnasium, swimming pool)

A cultural center (media library, performance hall)

A central pedestrian square with café terraces

Alignments of trees along the main axes

A health course

Correct the major issues identified previously

Tips for the teacher

This latest iteration is one of reconciliation and harmony. After confronting students with seemingly insoluble conflicts, it's now time to show them that creative solutions exist. This is the time to move from a confrontational approach to one of integration. The mayor's tone must evolve: less critical, more constructive, seeking the best possible solutions with the teams within the existing constraints.

The urban park is often revealing: students no longer have any space! This is an opportunity to help them understand the importance of anticipating future needs from the start of an urban project. But rather than blocking them, guide them toward solutions: "What if this park also served as a buffer zone between the factory and the homes? It would absorb noise and filter the air. It's no longer a constraint, it's a solution!" This approach shows that green spaces are not a luxury but an essential infrastructure that fulfills multiple functions.

Fixing previous problems is an opportunity to showcase creativity. If the antenna is problematic, suggest camouflaging it or integrating it architecturally. If the road bisects a neighborhood, propose transforming it into an urban boulevard with reduced speed limits, frequent pedestrian crossings, and trees. The idea isn't to eliminate all problems—that would be unrealistic—but to show that they can be significantly mitigated with ingenuity.

The central square deserves special attention. This is often when students realize they've forgotten to create a "heart" for their city. Encourage them to see this square not as just an empty space but as the place where the community gathers, where the city comes to life. "Imagine the Saturday morning market in this square, the sidewalk cafes where people chat, the children playing while their parents shop. This is what transforms a group of buildings into a real city."

ITERATION 3: NETWORKS AND CONNECTIONS

POINTS OF VIGILANCE FOR VALIDATION

Creation of buffer zones	Requalification of spaces	Compensations and compromises
• Use vegetation as a noise barrier between the factory and homes • Create a park between the commercial area and the housing • Install green walls to hide technical infrastructure • Create transition spaces between incompatible areas	• Transform certain roads into 30 zones or meeting zones • Pedestrianize the old city center • Create green continuities (green and blue framework) • Redevelop the area around the school into a peaceful zone	• If the antenna remains near homes, create a public garden as compensation • Accepting certain nuisances in return for quality improvements • Negotiate restricted hours for noisy activities • Share certain equipment to save space

Final success criteria:

Each neighborhood has a green space within 300m
Cultural and sports facilities are accessible by soft transport
The main nuisances have been reduced (not necessarily eliminated)
The city presents a balance between density and breathing space
The different urban functions coexist harmoniously

Points of pride to highlight:

"You have succeeded in creating a real centrality with this pedestrian square."
“This green corridor that crosses the city is an excellent idea.”
“Sharing the parking between the cultural center and the offices is clever.”
“Shared gardens will create social bonds between residents”

Gradual adaptation of requirements

The role of mayor you assume isn't just a pedagogical disguise: it's the main lever for learning in this activity. Your posture, your demands, and their evolution over the course of the iterations will determine the depth of the students' learning. The challenge is to create a constructive frustration that encourages reflection without discouraging engagement.

During the first two iterations, adopt a stance of maximum demand. You are the newly elected mayor, with an ambitious vision for your city, and you cannot accept approximations. Every potential problem must be raised, every conflict of use identified, every inconsistency revealed. This apparent intransigence serves an essential educational purpose: it forces students to realize that their planning decisions are not trivial, that each choice has multiple repercussions.

When a team places the school next to the factory, don't just say, "That's not right." Play the role of worried parents: "How can I explain to families that their children will be studying in noise and pollution? You're putting me in an impossible position with the voters!" This dramatization makes tangible problems that would otherwise remain abstract. The students are no longer correcting a technical error; they're resolving a social conflict.

From the third iteration onward, the stance must subtly evolve. The students have now understood that perfection is impossible, that each solution creates new problems. This is the time to introduce the notion of acceptable compromise. When they suggest placing the 5G antenna on the factory roof to keep it away from homes, even if it's not optimal, start validating: "It's clever, the workers are less sensitive to this issue than the parents, and the factory is already a technical zone. I can defend this to the city council." You gradually move from the intransigent mayor to the pragmatic mayor who, with his teams, seeks the best possible solutions in a constrained context.

The fourth iteration marks the culmination of this evolution. You become the caring, almost complicit mayor who helps teams value their work despite its imperfections. Your role is no longer to point out problems but to help transform them into opportunities. If a road still cuts through a neighborhood, suggest: "What if we made it a planted urban boulevard? With a 30 km/h speed limit, raised pedestrian crossings every 100 meters, and trees on either side, it's no longer a cutoff but a living artery of the city." You thus demonstrate that urban planning is the art of transforming constraints into assets.

The directory of problems

The educational value of the activity lies in your ability to identify and reveal problems at the right time. It's not about systematically criticizing everything, but rather choosing the issues that will generate the richest learning.

NOISE POLLUTION

are particularly telling because everyone can identify with them. The school near the factory is the classic example, but also think about the subtleties: the sports complex whose evening matches will disturb the sleep of local residents, the central square whose nighttime entertainment will create tensions, the morning market whose delivery trucks will wake the neighborhood at 5 a.m. For each source of noise, play the role of the potential complainants: "The elderly people in the neighboring residence have already signed a petition against the noise pollution from the stadium. What do you say to them?"

THE ISSUE OF POLLUTION AND HEALTH

touches sensitive chords, especially when it concerns children. Beyond the obvious industrial pollution, bring up fine particles from road traffic, electromagnetic waves (real or supposed) from antennas and transformers, and odors from the wastewater treatment plant depending on the winds. Use the wind rose you drew: "Look, the prevailing winds will carry the factory's emissions directly to the school. In summer, with the windows open, how will the children breathe?" These concrete questions force us to think of the city as a dynamic system, not as a static plan.

TRAFFIC AND SAFETY ISSUES

often reveal that students have designed their city for adult drivers. Systematically ask: "Can an 8-year-old child get from home to school alone safely? Trace his route for me." If the journey involves crossing a main road without a pedestrian crossing, the problem becomes obvious. The same goes for elderly people: "Mrs. Martin, 78, lives here and has to go to the health center over there. Without a car, how does she manage?" These personifications make the issues of universal accessibility tangible.

URBAN COHERENCE AND SOCIAL BALANCES

are more subtle but essential. If all services are concentrated on one side of the city, question territorial equity: "The residents of the southern district feel abandoned, they talk about spatial segregation. How do you justify this concentration?" If social housing is relegated to the outskirts, near the factory, raise environmental justice: "You are creating environmental inequalities, the poorest suffer all the nuisances. Is this the inclusive city we wanted?"

Managing tensions and facilitating debate

Your role as mayor places you in the position of arbiter between conflicting interests, and this is precisely what makes the exercise so rewarding. Students discover that urban planning is not just a technical issue but an exercise in reconciling opposites.

When two teams want to build in the same place, turn the conflict into an urban negotiation: "We have two legitimate projects here for the same space. Team A wants to put the park we desperately need there. Team B wants to put the park-and-ride there to relieve congestion in the center. Who can propose a compromise?" Guide them toward creative solutions: an underground parking lot with a park above, a landscaped parking lot that serves as a park on weekends, a shared use of spaces...

Sometimes, students will propose unrealistic solutions ("we put the factory underground", "we build a city on several floors"). Rather than abruptly rejecting these ideas, use economic constraints: "Interesting! But digging costs 10 times more than building on the surface. With this additional cost, we could build three schools. What takes priority?" You thus introduce the notion of budgetary arbitration without destroying creativity.

When tensions rise—and they will, especially in iteration 3 with its impossible dilemmas—remind us of the framework: "We're all in the same boat. This city is our collective work. The conflicts we experience, all mayors experience them. The important thing is not to be right but to find the least bad solution together." This stance transforms frustration into learning.

The strategic use of real examples

To lend credibility to your presentations and enrich the discussion, don't hesitate to draw on current events and urban history. When you raise the issue of 5G antennas, evoke real controversies: "In many cities, anti-antenna groups have been formed. In Marseille, some schools have obtained a protection perimeter. How can we manage this demand here?" These references anchor the exercise in reality.

Likewise, when creative solutions emerge, promote them by comparing them to existing projects: "Your idea of transforming the buffer zone between the factory and the housing into a park is exactly what Nantes did with the Île de Nantes. A former industrial site that has become a green lung!" These comparisons show that their ideas are not far-fetched but are in line with real urban solutions.

Preparation for the final celebration

Throughout the activity, prepare for the final ceremony by mentally or on paper noting each team's achievements. Each group should have at least one thing to be proud of at the inauguration. The team that created a network of bike paths deserves to be congratulated for its vision of soft mobility. The one that succeeded in creating a truly socially diverse neighborhood understood the challenges of an inclusive city.

The transformation of your stance, from initial intransigence to final benevolence, must be sufficiently marked for the students to feel that they have progressed, that they have earned your respect as a demanding mayor. The inaugural speech will be all the more meaningful: it is not a complacent mayor who congratulates them, but a demanding mayor whom they have succeeded in convincing through their perseverance and creativity.

ANIMATION OF THE DEBRIEFING

Orchestrating collective reflection

Debriefing is the moment when lived experience transforms into conscious knowledge. It is the crucial moment when students move from "doing" to "understanding," from action to conceptualization. Your role is no longer that of the mayor but that of the midwife pedagogue who helps learners bring to life knowledge that they have constructed on their own without realizing it. This phase must above all not be rushed or reduced to a simple roundtable discussion: it is this phase that anchors learning and gives it meaning.

Begin with a moment of silent observation. Invite students to walk around the model, observing it from all angles, like visitors to a museum. This pause after the excitement of construction allows everyone to become aware of the collective work they have created. Then, gather the group in a circle around the city, physically creating the agora where the conversation will circulate.

Questioning the process

Open the debriefing with a question that opens up the emotional experience: "What was your most frustrating moment during this construction?" The answers will come thick and fast, probably centered on your repeated refusals during the first iterations. This is the moment to explain the pedagogy: "The frustration you felt is what urban planners, architects, and elected officials experience every day. Having a vision and coming up against the constraints of reality, opposition from residents, budgetary limits. You experienced in fast-forward what it really means to develop a city."

Continue with the temporal dimension: "If you had known from the start all the demands of the four iterations, what would you have done differently?" This question is fundamental because it reveals the difference between ideal planning and the organic development of cities. Let the students realize that with a global vision, they would have reserved space for the park, anticipated network needs, and created buffer zones. Then bring them to the historical reality: "Real cities don't have this luxury. Paris was built over 2,000 years, each era adding its layer without being able to completely undo the past. Do you now understand why the Paris ring road follows the route of the old fortifications?"

The question of adaptation is central: "How did you deal with the impossibility of starting from scratch?" Students will describe their workaround strategies, their creative tinkering to make do with what already exists. Highlight these moments: "What you call 'tinkering,' urban planners call 'urban resilience.' This ability to transform constraints into opportunities is exactly what Barcelona is doing with its superblocks, reclaiming space from cars to create islands of life."

Exploring urban interactions

Then move on to systemic analysis with a narrative approach: "Tell me about a typical day for a 10-year-old child in your city. They get up in the morning in this home. What do they experience next?" Let a student trace the journey: the journey to school (easy or dangerous?), the school environment (quiet or noisy?), the afternoon activities (where to play?), the return home (safe?). This narration naturally brings out the strengths and weaknesses of their layout.

Suggest other characters: "And now, let's follow Mr. Chen, a factory worker without a car" or "Mrs. Dubois, 82 years old, who lives alone in this apartment." Each journey reveals different aspects of the city: accessibility, social diversity, territorial equity. Students discover that their city is not experienced in the same way depending on who we are, where we live, and what our means are.

Identify unresolved usage conflicts together: "What problems were you ultimately unable to fully resolve?" This question is essential because it normalizes imperfection. When students admit that the factory remains too close to certain housing units or that not all neighborhoods have equitable access to green space, seize the opportunity: "These imperfect compromises are those of all cities. There is no such thing as a perfect city, only cities that are continually trying to improve."

Transposition to reality

The time has come to connect with their daily environment: "Now that you've built a city, look at yours differently. Take the example of our school. Do you now understand why it's located here and not elsewhere?" Students will spontaneously identify logics they had never perceived: proximity to transport, distance from industrial areas, centrality in relation to residential neighborhoods.

Continue with concrete local examples: "This peripheral commercial area that you all know, with its large brands and huge parking lots, what does it tell us about the planning choices of our city?" Let the discussion emerge on urban sprawl, car dependency, and the possible devitalization of the city center. The students naturally make the connection with their own construction where they had to decide between peripheral shopping centers and local shops.

Address the historical dimension: "Our city has a factory/power plant/military base that has structured its entire development for decades. How does this legacy still influence our development today?" This question introduces the notion of path dependency, the weight of the past on the present. Students understand that their city, like their model after several iterations, bears the indelible traces of past choices that continue to constrain possibilities.

Key learnings

Use this time to formalize the concepts you've discovered. Rather than hammering out definitions, bring them out: "If you had to explain to someone who hasn't had this experience what urban planning really is, what would you say?" The answers will likely converge around the idea of compromise, complexity, and a systemic vision. Expand: "You've discovered that urban planning is the art of managing contradictions. Every decision favors some and penalizes others. The challenge isn't to satisfy everyone—that's impossible—but to find the least unsatisfactory balance for the greatest number."

Introduce the concept of a learning city: "Your city has evolved with each iteration, it has learned from its mistakes. This is exactly what we call a 'learning city' in the SteamCity project. A city that is constantly experimenting, evaluating, and adjusting." Show how their model illustrates this concept: the corrections from iteration 4, the buffer zones created to mitigate conflicts, the creative solutions found when faced with dilemmas.

Connect with the Sustainable Development Goals: "Look at your final city. Where do you see SDG 11 on sustainable cities coming to fruition? And where have you had to make compromises that take it away from this ideal?" This critical analysis shows that the SDGs are horizons to strive for, not simply boxes to check.

Projection towards citizen action

Conclude the debriefing by looking ahead: "This experience has given you some insights. The next time there's a public inquiry into a development project in your city, how will you approach it differently?" Students should express a more nuanced, less black-and-white understanding. They will no longer see urban projects as simply "good" or "bad," but as complex trade-offs between competing interests.

Propose a concrete challenge: "Identify a planning problem in your neighborhood or around the school. Now that you understand urban complexity, what solutions would you propose? Which stakeholders would need to be convinced? What opposition do you anticipate?" This projection transforms the educational exercise into an active citizenship skill.

End with an inspiring note: "You are no longer just users of the city. You now understand its mechanisms, its constraints, its possibilities. This understanding makes you enlightened citizens, capable of participating constructively in debates on the future of your territory. The city of tomorrow is something you will build, both literally and figuratively. And today, you have learned that it is an exciting challenge precisely because it is complex."

The trace and the continuation

Before dispersing the group, be sure to create a record of this experience. In addition to photos of the model, invite each student to write "The most important thing I learned about the city today" on a post-it note. Stick these post-its around the model to create a crown of knowledge that visually enriches the collective work.

Announce the rest: "This model is not an end but a beginning. It will become our laboratory for the next SteamCity sessions. We will test renewable energy solutions, simulate traffic flows, and experiment with greening. Your imperfect city will become our testing ground for imagining the solutions of tomorrow."

ANIMATION OF THE INAUGURATION CEREMONY

The inauguration ceremony marks the symbolic transformation of a teaching exercise into a moment of collective celebration. The teacher temporarily abandons his critical role to take on that of the benevolent and proud mayor of his city. The teams gather around the model, forming the assembly of citizen-builders. To prepare for the inauguration, quickly organize a collective moment to choose the name of the city and the names of the neighborhoods, public buildings, and main streets. Naming is an important moment for collective ownership of the model. Use post-it notes or markers to make the names visible.

Solemn address by the mayor

The teacher assumes a solemn posture, stands straight, and addresses the assembly with gravity and pride:

Ladies and gentlemen, architects of our new city, Dear builders of the impossible, Citizens of this city which did not exist three hours ago and which now stands before us,

Here we are gathered on this momentous day to inaugurate not just a model, but a vision, a collective dream become a tangible reality. What I contemplate before me is not a simple assemblage of cardboard and plastic, but a vibrant testament to your collective intelligence, to your capacity to overcome the most complex challenges of contemporary urban planning.

Look at this city! See how it breathes, how it already lives! Here, a school where children's laughter will soon echo. There, homes where families will build their memories. Further away, this factory that makes the economic heart of our city beat, tamed and harmonized thanks to your efforts so that it does not disturb the peace of the inhabitants.

You have faced headwinds—literally, with our compass rose! You have had to negotiate the laws of physics, the constraints of space, and the conflicting demands of your fellow citizens. When it came to installing that cell tower, a symbol of our modernity but a source of concern, you found a compromise. When roads threatened to fracture your neighborhoods, you imagined bridges, passages, and connections.

Yes, our city is not perfect—and that's its greatest beauty! For a perfect city would be a dead city, frozen in sterile perfection. Our city bears the marks of your debates, your hesitations, your courageous choices. This wastewater treatment plant that you finally managed to integrate, this park that serves as a green setting between industry and housing, this central square that didn't exist at the start and that you created by sacrificing other projects—all of this tells the story of a community that learns, that adapts, that innovates.

You have discovered what generations of urban planners have known: that a city is a living organism, a complex ecosystem where every decision resonates with multiple echoes. You have learned that governing a city means constantly navigating between the ideal and the possible, between dreams and constraints, between particular interests and the common good.

I see the Sustainable Development Goals taking shape in your buildings: an inclusive city where every neighborhood has access to essential services, a sustainable city where green spaces moderate urbanization, a resilient city that has managed to integrate its constraints to turn them into assets.

So yes, let's celebrate! Let's celebrate this imperfect but vibrant city! Let's celebrate your creative compromises, your ingenious solutions, your perseverance in the face of criticism from the demanding mayor that I once was! Above all, let's celebrate this fundamental lesson: that a city is never the work of a single person, but the fruit of collective intelligence, a shared vision, and an ongoing dialogue between all its stakeholders.

I therefore officially declare the city of [name to be chosen collectively] inaugurated! May it remain in your memories not as a simple academic exercise, but as your first experience as world builders, as tangible proof that you are capable of thinking and building complexity!

May this experience have given you the keys to understanding your own city, to participating in tomorrow's citizen debates with the keen awareness of the issues that you have acquired today. You are no longer simple residents, you have become citizen-urban planners, aware that each street, each building, each green space is the result of decisions, compromises, and visions that shape our life together.

Now, before photographing our work to immortalize it, I invite you to take a tour of your creation. Each team should present their major contribution, their greatest pride, but also the most difficult challenge they had to overcome. Because it is in overcoming difficulties that true knowledge is forged.

Congratulations to all! You have transformed chaos into cosmos, constraints into creativity, conflicts into compromise. You are the architects of tomorrow!

The Mayor

The memorial trail

Rather than simply offering general praise, tell the story of the build by highlighting key moments. You took notes during the activity; use them now: "I remember the moment Team 3 realized the school was too close to the factory. Their solution of creating a buffer park with a noise-reducing playground was brilliant." These specific anecdotes show that you truly observed and appreciated their work.

Visually walk through the city, pointing out successes: "Look at this central square that didn't exist in the first place. Team 2 sacrificed commercial spaces to create this meeting place. It's exactly this kind of long-term vision that makes great cities." Alternate between technical successes ("This optimization of the transport network is worthy of a professional design office") and human successes ("The negotiation between teams 1 and 4 for the location of the park was a model of urban diplomacy").

In Praise of Imperfection

It's time to turn "failures" into valuable lessons: "Yes, that 5G antenna is still visible from some homes. But look at how you've integrated it architecturally, how you've compensated with quality developments. That's real urban planning: not eliminating all problems, but managing them intelligently."

Show that imperfections tell a story: "This road that still cuts through the northern district bears witness to your early decisions, when you couldn't anticipate all future developments. It's the DNA of your city, its history written into its geography. Like the Paris ring road or the canals of Amsterdam, these 'flaws' are part of the urban identity."

The rite of passage and symbols

Introduce ritual elements that make a lasting impression. The symbolic handover of the "keys to the city" can be done with real keys (collected for the occasion) that you give to a representative from each team: "I give you the keys to your neighborhoods. You are no longer just their builders, you are now their guardians and ambassadors."

If you have prepared a "citizen-urban planner certificate" (even a simple one, printed on somewhat thick paper), now is the time to distribute them solemnly: "This certificate attests that you have understood urban complexity, that you have been able to negotiate, create, and adapt. It makes you enlightened citizens, capable of participating in debates on the development of your territory."

Create an official photo opportunity: "Architects of SteamCity, gather around your work for the official photo!" Take several shots: a serious "official" photo, a happy thumbs-up photo, and team photos in front of their main achievement. These photos will be invaluable for later promoting the project.

Projecting into the future

The speech should end with an opening to the future: "This city you have created will continue to live. It will be our laboratory for testing sustainable solutions, our support for understanding energy issues, our testing ground for imagining the city of tomorrow." But above all, connect the experience to their future civic life: "In a few years, some of you may be architects, urban planners, local elected officials. But all of you will be citizens. When your municipality proposes a new development project, you will no longer look at it in the same way. You will ask the right questions: What impacts on local residents? How will it interact with the existing structure? What compromises have been made? This understanding makes you enlightened citizens, and it is perhaps the most beautiful result of our work today."

Participatory fencing

End by giving the students a chance to speak, but in a structured way to avoid lengthy discussions: "Before we go our separate ways, I'd like each team to share in one sentence either their greatest pride or the most important lesson they've learned." This participatory conclusion allows everyone to express themselves and express their learning.

Conclude with a loud collective applause: "For your creativity, your perseverance, your ability to transform constraints into opportunities, for this imperfect but vibrant city that you have created together: bravo!" The collective applause creates a moment of shared euphoria that etches the experience into memories.

After the applause, invite students to move freely around the model to observe the collective achievements up close. This informal moment allows for spontaneous exchanges, mutual congratulations, and often, students discover details they hadn't noticed during construction. This is also the ideal time for individual or small group photos.

Don't forget to announce the concrete follow-up: "The model will be on display in the hall for two weeks. You can show it to your parents and friends. And next week, we will begin our first experiment on urban heat islands." This projection maintains the momentum and transforms the end into a new beginning.

The model as a miniature laboratory

Building the model is just the first act of an educational play that can be played out throughout the year. This miniature city, with its acknowledged imperfections and visible compromises, is a testing ground for exploring all dimensions of the SteamCity project. Rather than a simple souvenir tucked away in a corner of the classroom, it becomes a miniature laboratory where each discipline finds its place within the urban complexity.

The value of this approach lies in the fact that students have a familiarity with every corner of this city: they know why the factory is there, why this road cuts through this neighborhood, why the park has this strange shape. This familiarity transforms each new experiment into a personal inquiry: "How could we improve OUR city?" becomes the driving question that runs through all disciplines.

The integration of sciences

The scientific dimension finds in the model a relevant support for investigation. Students can literally see and measure the phenomena they study in class.

To study flows and circulation, the model allows students to visualize the movement of air, water, and people. Using incense smoke or light smoke bombs, students visualize how air circulates between buildings, how wind corridors form, and why some squares become unpleasant wind vortices. They discover that the layout they have created can accelerate winds (Venturi effect between two tall buildings) or create areas of stagnation of polluted air.

The study of sound propagation takes on a concrete dimension when a miniature sound source (buzzer) is placed at the factory site and noise levels in different neighborhoods are measured with a sound level meter. Students directly experience the screening effect of a tall building, the effectiveness of a plant curtain, and the reflection of sounds on facades. They can test their hypotheses: "If we put a noise barrier here, will it really protect the school?" The objective field measurement will validate or invalidate their intuitions built using the model.

The phenomenon of urban heat islands becomes palpable when heat lamps are placed above the model and temperatures are measured with infrared thermometers. Dense, mineral-rich areas heat up more than green spaces, street orientation creates thermal differences, and the materials used (dark cardboard vs. light paper) influence heat absorption. This simple but visual experiment introduces the challenges of adapting to climate change: "If our city experiences a heatwave, which neighborhoods will suffer the most? Where will residents be able to find coolness?"

The technological challenge

The model becomes a test bed for urban technological innovations. Students don't just imagine solutions; they prototype and test them on a smaller scale.
The creation of noise barriers becomes an engineering project where students test different materials (foam, honeycomb cardboard, textiles), different shapes (straight wall, inclined wall, with baffles), and different heights. They measure the attenuation achieved, calculate the cost-effectiveness ratio, and evaluate the visual impact. The best prototype is then integrated into the model, concretely transforming the problem identified during construction.

Underground or overhead passages to reconnect neighborhoods separated by roads become construction challenges. How can a passage be created that is robust, accessible to people with reduced mobility, and aesthetically integrated? Students learn about slope constraints for access ramps, the need for lighting to avoid feelings of insecurity, and the importance of width for the flow of people.

Network optimization (transport, energy, water) transforms the model into an applied math problem. Using colored wires representing the different networks, students search for optimal routes: the shortest? the cheapest? the most resilient? They discover that these objectives are often contradictory and must be arbitrated. Adding LEDs to represent public lighting raises the question of energy consumption: how many streetlights are needed? Where should they be placed to maximize safety while minimizing light pollution?

The engineering approach

Urban engineering takes on its full meaning when students must optimize the systems they have created. The model becomes a complex system that requires continuous improvement.

Designing an efficient multimodal transportation system starts with an analysis of current traffic flows. Students place markers representing residents and simulate their daily commutes between home, work, school, and shopping. Where do traffic jams occur? Which routes could be made by bike if safe lanes existed? Where should bus stops be located to maximize service while maintaining an attractive commercial speed? The final solution often combines several modes: park-and-ride on the outskirts, electric shuttles in the city center, and self-service bicycles at transport hubs.

Energy optimization transforms the city into an equation to be solved. Where should solar panels be installed to maximize production? (Calculating sunlight based on orientation and shadows). How can a district heating network be created that recovers waste heat from the factory to heat public buildings? Students discover smart grids, intelligent networks that balance production and consumption in real time.

The artistic dimension

Art is not an addition to the soul, but an essential component of a livable city. The model becomes a medium for expression and identity creation.

The creation of a visual identity for each neighborhood is based on the observation that uniform cities are stressful. Students imagine color codes, specific street furniture, and signage elements that give each area a personality while maintaining overall coherence. The historic neighborhood around the town hall could have "retro" streetlights, the innovation zone near the offices a futuristic design, and the family residential neighborhood playful elements.

Public spaces become blank canvases for artistic expression. Is this central square too mineral? The students design a sculpted fountain that becomes a meeting point and thermal regulator. This blind factory wall visible from the apartments? It becomes the backdrop for a monumental fresco recounting the city's industrial history. These blind gables? Artistic green walls blending nature and geometric patterns.

Participatory art takes shape in shared gardens where each plot tells a story, in pedestrian crossings transformed into urban art galleries, in bus stops transformed into micro-libraries decorated by residents. Students understand that public art is not decorative but unifying, creating social connections and civic ownership.

The mathematical approach

Mathematics finds in the model a field of application which gives meaning to abstract concepts.

Calculating distances and densities becomes concrete. What is the average distance from a home to essential services? (barycenter and Euclidean distances). What is the population density per neighborhood? (inhabitants/hectare). What is the land use coefficient? These calculations reveal territorial inequalities invisible to the naked eye.

Route optimization uses graph theory. The transportation network forms a graph whose nodes are stops and whose edges are lines. What is the shortest path between two points? (Dijkstra's algorithm). What is the maximum number of connections? The centrality of each node? Students discover that the mathematical optimum (minimizing the total length of the network) does not necessarily correspond to the social optimum (minimizing the average travel time).

Statistical modeling allows us to predict the city's evolution. If the population grows by 2% per year, when will a second school be needed? If 30% of trips are made by car and we want to reduce this to 15%, how many kilometers of cycle paths should be created? Mathematics becomes a tool for urban forecasting.

Investigation protocols

The model is an entry point to the real scientific investigation protocols made available by the SteamCity project.

The impact of vegetation on the microclimate becomes a controlled experiment. Hypothesis: increasing vegetation by 20% reduces the temperature by 2°C. Protocol: measure the temperature before/after adding vegetation (moss, micro-plants), controlling sunlight and ventilation. Variables: type of vegetation, density, layout (roofs, walls, soil). The results are statistically analyzed and compared with the scientific literature.

The effectiveness of different traffic plans is tested through simulation. Students create different scenarios (all cars, public transport priority, 30-km city, Barcelona-style superblocks) and simulate traffic flows using colored marbles or a simple numerical simulation. They measure journey times, congestion points, and theoretical emissions. The best scenario is the one that optimizes a basket of indicators, introducing the concept of multi-criteria analysis.

The study of universal accessibility transforms students into accessibility auditors. With a miniature character in a wheelchair, they test each route: width of passages, slopes, bumps, rest areas. The exercise cruelly reveals the barriers invisible to able-bodied people. The proposed solutions (ramps, elevators, tactile guidance) are costed and prioritized according to the cost/social impact ratio.

THE DIGITAL TRANSITION: FROM PHYSICAL TO VIRTUAL WITH CITY-BUILDERS

The physical model finds an extension in its digital recreation via urban simulation games like Cities: Skylines, SimCity, or even simplified educational versions. This transition from the tangible to the virtual opens up educational perspectives that enrich the initial experience.

Recreate to better understand	The first step is to reproduce the physically constructed city in the city-builder. This transposition is not a simple copy but a modeling exercise that requires students to formalize their choices. In Cities: Skylines, they must precisely define the zones (residential, commercial, industrial), trace the networks (roads, electricity, water, sewers), and configure the services (school radius, health center capacity). This formalization often reveals inaccuracies in the physical model: "We hadn't thought of the sewers!", "How does electricity reach this isolated neighborhood?" Digital reconstruction also allows for quantification of what remained qualitative. The game automatically calculates travel times, pollution levels, resident satisfaction, and the municipal budget. Students are sometimes stunned to discover that their beautiful city is financially bankrupt or that the crime rate is exploding in certain poorly served neighborhoods. These objective indicators enrich the reflection: the city is not only a spatial question but also an economic and social one.
Observe the temporal evolution	The great advantage of digital technology is its accelerated time simulation. In just a few minutes of play, students observe their city evolve over decades. They see neighborhoods become denser, businesses flourish or decline, and traffic jams gradually form. This temporal dimension was impossible to explore with a static model. Urban dynamics become visible: gentrification (poor neighborhoods near the center gradually become rich), urban sprawl (the city nibbles away at peripheral natural spaces), and devitalization (the shopping center kills small businesses). The students understand that their city is not static but alive, subject to economic and social forces that continually transform it. Crises can be simulated: what happens if the factory closes? (unemployment, exodus, drop in tax revenues). What if a highway is built nearby? (new flows but also nuisances). What if a natural disaster occurs? (network resilience, reconstruction capacity). These scenarios, impossible to physically test, become rich learning experiences.
Experiment with alternatives	Digital technology makes it easy to test alternative scenarios. "What if we had put the factory somewhere else?" Students save their base city and then explore different variants. They can create an "all-car" version and a "soft mobility" version to compare the impacts. A dense version and a sprawling version. A version with lots of public services (high taxes) and a liberal version (low taxes but few services). This exploration of possibilities develops counterfactual thinking and comparative analysis skills. Students discover that there is no single optimal solution, but rather different trade-offs with varying consequences. The ecological version is more pleasant but more expensive. The dense version is more efficient but perhaps less livable. These comparisons fuel rich debates on desirable city models.

Introduce systemic complexity	Modern city builders integrate complex systems that physical models cannot simulate. In Cities: Skylines, the spread of disease, economic cycles, tourist flows, and weather add layers of complexity. Students discover feedback loops: more pollution → more disease → more healthcare spending → less environmental spending → more pollution. Public policies can be tested: urban tolls, public transport subsidies, carbon taxes, housing subsidies. Students observe the direct effects as well as the unexpected consequences. Urban tolls reduce traffic congestion in the city center but increase pollution in the outskirts where cars bypass. Subsidies for social housing improve diversity but can create tensions if unevenly distributed.
Creating a dialogue between physical and digital	The pedagogical ideal is to maintain a constant dialogue between the physical model and its digital version. Problems identified in the game can be solved on the model: "The game shows traffic jams here, how could we physically modify this intersection?" Solutions tested physically can be validated digitally: "Our underpass works on the model, but is it economically viable in the game?" This complementarity considerably enriches learning. The physical brings the tangible, the collaborative, the creative. The digital brings temporal dynamics, quantification, and the simulation of complexity. Together, they offer a deep and nuanced understanding of urban reality. Students can even organize "citizen consultations" where they present different evolution scenarios from the game and ask other classes to vote for their preferred future. This participatory dimension transforms the technical exercise into a democratic experience.

THE CIVIC DIMENSION

This ongoing use of the model transcends academic practice to become a school of active citizenship. Students are no longer passive learners but actors in urban transformation.

A few months after the activity, organize mock city council meetings where students debate improvements to their city. Each proposal must be supported by a rationale (identified problem, proposed solution, estimated cost, expected benefits) and put to a vote. These simulations develop skills in democratic deliberation, argumentation, and consensus building.

Invite real-life urban planning professionals (local elected officials, urban planners, architects, neighborhood associations) to come and view the model. Students present their city, the problems encountered, and the solutions found. These professionals contribute their expertise, validate certain intuitions, and suggest avenues. These meetings transform the academic exercise into a real-life civic dialogue.

Encourage students to translate their discoveries into their real-life environments. That dangerous crosswalk in front of the high school? They can now propose a well-reasoned design. That vacant lot in the neighborhood? They can imagine a transformation that meets the identified needs. Some student projects have actually been adopted by municipalities, transforming the educational exercise into concrete civic action.

The model thus becomes much more than a simple educational tool: it is the crucible where a generation of citizens is forged, aware of urban complexity, capable of systemic analysis, and engaged in the collective construction of more sustainable, fairer, more livable cities. This is ultimately the spirit of the SteamCity project: transforming the learning of science and technology into active civic skills to meet the urban challenges of the 21st century.

Anticipate to improvise better

The success of this complex activity rests on a seeming paradox: the more prepared you are, the more you can afford to improvise and adapt to the unforeseen dynamics that are sure to emerge. This preparation concerns not only equipment and space, but above all your mental posture and your pedagogical scenario.

Start by immersing yourself in your role as mayor several days before the activity. Imagine yourself facing the teams, visualize the issues you will raise, and mentally rehearse certain key phrases. This mental preparation will allow you to naturally embody the character on the day, without having to think about it. Prepare cards with potential issues for each possible configuration: what if the school is in the north, south, or center? If the factory is isolated or integrated? These discreet reminders will allow you to remain fluid in your interventions while maintaining pedagogical coherence.

Anticipating logistical problems is crucial. What if one team monopolizes the central space? Establish a clear rule from the start: "Each team is allowed a maximum of 5 minutes in the central space per iteration; the others observe and can advise." If two teams want to build in the same location? "The first to arrive has priority, but must negotiate with the second to find a mutually beneficial arrangement." These rules, announced from the start, prevent conflicts and transform tensions into opportunities to learn about urban negotiation.

Transforming failure into learning

Frustration will be present; it's inherent to the exercise and precisely what makes it educationally rich. Your role is to keep this frustration within the zone of proximal development: strong enough to generate learning, but not too strong to avoid discouragement.

Pay close attention to signs of discouragement: a team that stops building, students who disengage, tensions that rise. This is the time to subtly adjust your level of expectation. Without abandoning your critical role, drop in clues: "This factory is indeed a problem here... Have you thought about looking at the compass rose?" or "This residential area will suffer from noise... Unless there's something between it and the source of the nuisance?" These clues provide direction without providing a solution, maintaining cognitive effort while avoiding blockage.

Collective frustration ("It's impossible to fit everything in!") is a great educational opportunity. Seize it: "Welcome to the real world of urban planning! Tokyo, Paris, New York facing densification is exactly this challenge. How did they do it?" Transform frustration into curiosity, perceived impossibility into a creative challenge. Remind them that real cities took centuries to find their balances and that they have three hours: imperfection is not a failure but a basic given.

PRACTICAL ADVICE

Adaptation to the level of learners	This activity can be carried out from middle school to higher education, but requires subtle adaptations depending on the level and maturity of the learners. The art is to adapt without simplifying, to differentiate without distorting the essence of the exercise. With middle school students, simplify the requests (3 building types instead of 5 per iteration) but maintain the complexity of the interactions. The problems raised can be more concrete and immediate: "Children can't sleep because of the noise" rather than "Noise pollution impacts public health according to WHO recommendations." The vocabulary adapts, but the concepts remain. Allow more imagination in the solutions: a tunnel under the river, a factory on stilts, hanging gardens. The important thing is that they understand the conflicts of use, not that they respect all the technical constraints. With high school students, introduce the economic and social dimensions. The questions become: "How can this park be financed? Through taxes? By selling building land elsewhere?" or "Doesn't this concentration of social housing risk creating a ghetto?" Ethical dilemmas enrich the reflection: should we prioritize the general interest or respect acquired rights? Economic efficiency or social equity? With higher education students, add real regulatory constraints (PLU, SRU law, environmental standards), governance issues (who decides? How? With what legitimacy?), prospective dimensions (how to anticipate climate change? Population aging? Economic changes?). Solutions must be quantified, trade-offs documented, and decision-making processes explained.
Create the memory of the experience	Documenting the activity is not just a simple archiving exercise, but an integral part of the educational process. It allows for reflexivity, the valorization and transmission of experience. From the beginning, designate an "official photographer" per team, responsible for documenting the evolution of their section at each iteration. These photos, sequenced, create an urban time-lapse that visually reveals the gradual transformation of the space. The effect is striking during the debriefing: "Look how dense your city has become!" The students become aware of the process they have experienced. Beyond photos, create a "mayor's logbook" where you note in real time the problems raised, the solutions proposed, the moments of tension or euphoria. This log, read during the debriefing, allows you to relive the experience with hindsight: "At 10:23 a.m., Team 3 had the brilliant idea of sharing the parking lot of the shopping center and the sports complex. At 10:47 a.m., a major conflict between Teams 2 and 4 over the location of the park, resolved by the creation of two smaller parks connected by a green belt." Encourage each team to create an "identity card" for their main neighborhood: name, number of residents, main activities, strengths, identified problems, and proposed solutions. These cards, displayed around the model, transform the cardboard assembly into a lively city with its unique neighborhoods and their stories.

	Valuing the work accomplished is essential to transform the experience into a positive memory and a conscious skill. It is not limited to the inauguration ceremony but permeates all activity and continues beyond. During the activity, practice "real-time valuation." When a team finds a creative solution, announce it to everyone: "Brilliant! Team 2 has just transformed the antenna problem into an opportunity by camouflaging it in a fake bell tower that becomes the architectural symbol of the neighborhood!" These micro-celebrations keep the energy up and spread good ideas.
Celebrating collective intelligence	The inauguration ceremony must be dramatized to make an impression. Beyond the grandiloquent speech, create rituals: symbolic presentation of the "keys to the city" to each team, unveiling of a commemorative plaque ("Here was built in 3 hours the city of [name], testimony to the collective intelligence of the [grade] class"), a minute of contemplative silence before the applause. These rituals, even artificial, create emotion and anchor the experience in memory. After the activity, extend the promotion. Display the model in a busy area with explanatory panels written by the students. Invite other classes to come and see the city with student guides who explain the challenges encountered and the solutions found. Create an article for the school's website, and organize a presentation for parents during the open house. This external promotion reinforces the feeling of pride and accomplishment.

CONCLUSION

Possible variants

The activity is rich but can be adapted to suit your specific educational objectives and practical constraints. These variations are not simplifications but rather different focuses that shed light on other aspects of urban complexity.

The "historic city" variant starts from a pre-existing old center (materialized by a few fixed buildings representing the historical heritage) around which the modern city must develop. This additional constraint brings to life the challenges of cities like Rome or Paris: how to modernize without destroying? How to densify while preserving the heritage? Students discover that history is not just memory but an active constraint on the present.

The "sustainable city" variant adds an environmental points system. Each building has a carbon cost, each green space earns points, soft transport is a bonus, and roads are a penalty. The goal is to achieve carbon neutrality while meeting needs. This quantified constraint requires explicit trade-offs: is it better to densify (less sprawl) or aerate (more green spaces)? Students discover that sustainable development is not a slogan but a complex equation.

The "smart city" variant introduces the digital dimension. Students must integrate sensors (for air quality, traffic, energy consumption), communication networks (fiber, 5G), and connected services (smart lighting, connected trash cans, citizen applications). They discover that the smart city is not just about technology but also raises questions about privacy, the digital divide, and cybersecurity.

The "resilience" variant introduces crises to be managed: a 100-year flood (the river overflows), an extreme heatwave (where to take refuge?), an industrial accident (the factory is evacuated), a pandemic (neighborhoods are locked down). The city must be able to function in degraded mode. This variant makes it clear that urban planning is not just about optimizing everyday life, but also about anticipating the exceptional.

Conclusion

This activity is not isolated but rather part of the overall dynamic of the SteamCity project. It often constitutes the ideal entry point because it creates a common reference, a shared language, a concrete support for all subsequent explorations. Systematically link the activity to the other components of the project. When you approach renewable energies in physics, return to the model: "Where could we install solar panels in our city?" When you study statistics in mathematics, use your city's data: "Let's calculate the average commute time in our model." This constant reference transforms the model into the year's guiding principle.

Use the model to prepare for field trips. Before visiting a real eco-neighborhood, analyze how you could transform a neighborhood in your model using the same principles. After the visit, apply the solutions you observed. This model-reality dialectic mutually enriches both experiences.

Finally, consider the model as scalable. With each new SteamCity module, it can be enriched: adding real sensors (temperature, sound, light) that transform the model into a measuring station; creating a 3D digital version that allows for simulations; developing an augmented reality application that superimposes information and flows onto the physical model. The city built in three hours thus becomes the basis for an entire year of exploring urban complexity.

USING SENSITIVE MAPPING DURING STEAMCITY