



## A THEMATIC STEAM JOURNEY TO UNDERSTAND, EXPLORE AND IMAGINE THE CITY

Five themes to transform urban issues into  
learning situations



### THE FOUNDATIONS OF OUR THEMATIC APPROACH

Learning gains depth when it is organized around authentic questions rather than compartmentalized disciplines. This thematic approach follows a simple logic: rather than studying mathematics, science, geography, or technology separately, we start with the major questions posed by the contemporary city to mobilize all the knowledge necessary to understand them.

This approach explores two complementary dimensions of open-ended learning. Interdisciplinarity builds bridges between disciplines: when students study urban mobility, they use mathematics to analyze flows, geography to understand territories, and science to study environmental impacts. Each discipline retains its specificity while enriching the others. Transdisciplinarity goes further by creating new knowledge that emerges from the encounter between disciplines: urban ecology, for example, is born from the intersection of biology, geography, sociology, and urban planning to understand phenomena that each discipline alone could not grasp.

This approach naturally reconciles scientific and humanities subjects, often artificially opposed in the collective imagination. The study of air quality simultaneously mobilizes physics and chemistry to understand pollutants, mathematics to process data, geography to analyze their spatial distribution, and social sciences to understand inequalities in exposure.

**This convergence reveals to students that contemporary challenges require an understanding that is both technical and social, quantitative and qualitative. This approach is based on research in cognitive psychology that demonstrates the effectiveness of contextualized learning. This multidisciplinary convergence generates a comprehensive and nuanced understanding of urban issues, preparing students for the complexity of a world where disciplinary boundaries are blurring.**

Our course follows a thoughtful thematic structuring logic. Beginning by exploring protocols related to governance and citizenship allows students to understand the framework within which all the urban issues they will explore fit. Before measuring air quality or analyzing mobility flows, they understand who decides on environmental policies and urban planning. This understanding of democratic mechanisms gives meaning to their technical observations and prevents their discoveries from remaining disconnected from political and social realities.

The core explorations—environment, mobility, energy—can be addressed in the order that best suits your context and educational plans. The important thing is that each theme enriches the overall understanding of the city as a complex system, regardless of the order chosen.

Concluding with protocols around artificial intelligence and new technologies engages students in algorithmic construction, developing a degree of conceptual mastery different from previous explorations. They develop structured logical thinking that allows them to put all of their learning into perspective. This approach leads them to break down urban problems and formalize their reasoning.



## FOUNDATION - CIVIC ENGAGEMENT, GOVERNANCE AND DATA

### Understanding city management, institutions, citizen participation

This first theme lays the essential foundations for any understanding of the city: who decides? how? with what means? This approach goes beyond the simple presentation of institutions to reveal the complexity of local democratic processes. Exploring urban governance transforms students' relationship with citizenship. Rather than learning the municipal organizational chart by heart, they discover concretely how a development decision crosses departments, mobilizes different actors, and gives rise to debates and negotiations. This understanding of democratic mechanisms develops their critical thinking and argumentation skills.

Investigating forms of citizen participation reveals the diversity of engagement methods: neighborhood councils, participatory budgets, public consultations, local associations. Students discover that democracy is not limited to voting but is practiced daily through multiple channels. This discovery can transform their relationship to engagement and reveal civic vocations.

The analytical tools developed in this theme—mapping, analysis of influence games through simulations, understanding constraints—will serve as a foundation for all other learning. They will allow students to contextualize their observations and anchor their scientific learning in reality.



## EXPLORATIONS - ENVIRONMENT, WELL-BEING AND PUBLIC HEALTH

### Observe air quality, green spaces, measure urban comfort

This second theme invites students to consider the urban environment not only as a physical framework, but as a direct condition for health and well-being. Students become observers of the invisible effects that shape daily life, developing a sensory and scientific approach that reveals the mechanisms by which urban planning directly influences their bodies and minds.

The study of air quality reveals its influence on breathing, concentration, and fatigue. By measuring both outdoor particles and indoor CO<sub>2</sub>, they discover discrepancies that reflect inequalities in exposure and understand how these variations affect their cognitive performance and physical well-being. This investigation transforms an abstract concern into a tangible reality, expanding their understanding of physical and chemical phenomena while revealing the direct links between the environment and health.

*Analyzing soundscapes highlights their role in learning, sleep, and mood. By identifying areas of nuisance and spaces of silence, students understand that noise is a social as well as a physical factor. By becoming pollinator detectives and explorers of the relationship between plants and the urban environment, they also discover how vegetation influences not only biodiversity but also stress, physical activity, and social connections, thus introducing them to the concepts of urban ecology and environmental health.*

This approach links physical sciences, ecology, and humanities to show that the urban environment affects the body, mind, and behavior. It reveals that contemporary environmental challenges are inseparable from issues of public health and social equality.





## EXPLORATIONS - ENERGY EFFICIENCY

### Identify energy sources, measure consumption, suggest savings

This theme addresses one of the major challenges of the 21st century: the energy transition. This practical, local approach allows students to understand global issues based on their immediate environment.

Identifying urban energy sources reveals the complexity of the technical networks that power the city. Students discover the diversity of sources—fossil, renewable, local, imported—and understand the challenges of the energy mix. By experimenting with different energy scenarios, this investigation develops their understanding of contemporary physical phenomena and technological challenges.

Measuring energy consumption requires technical and mathematical skills and helps improve students' familiarity with units of measurement and orders of magnitude. Students develop their technical creativity by devising solutions for insulation, optimization, and energy recovery.

By investigating urban heat loss and analyzing the impact of insulation on energy consumption, this project dimension mobilizes their design skills and teaches them to translate their observations into concrete proposals for improvement.



## EXPLORATIONS - SUSTAINABLE MOBILITY, TRANSPORT AND REGULATION

### Analyzing flows, understanding regulation, exploring the mobility of tomorrow

Exploring urban mobility reveals the city as a dynamic system in constant motion. This kinetic approach transforms the static perception of urban space and initiates an understanding of the flows, regulations, and technological transformations that redefine our movements.

Understanding mobility regulation reveals the complexity of the actors and rules that govern our travel. Students discover how different stakeholders—municipalities, prefectures, transport operators, and law enforcement—coordinate their actions to manage urban flows. By exploring the issues surrounding dynamic regulation and autonomous vehicles, they grasp the technical, legal, and ethical challenges posed by these innovations: Who programs the decision-making algorithms? How can safety be guaranteed? What are the impacts on employment and urban planning?

Exploring the mobility of tomorrow develops critical thinking and the ability to analyze the future. Beyond technical efficiency, students learn to evaluate the social, environmental, and economic consequences of innovations: electric, autonomous, shared vehicles, or new forms of micro-mobility.

By creating algorithms to identify polluting vehicles or designing connected objects to optimize travel, this systemic approach prepares them for the complex decisions they will have to make as citizens and professionals in the face of transformations in urban mobility.





## OPENING - ARTIFICIAL INTELLIGENCE AND NEW TECHNOLOGIES

### Understanding artificial intelligence and questioning its role in the city

This final theme culminates the course by developing an active understanding of artificial intelligence and its urban application. This technological exposure prepares students to master these tools rather than be subjected to them, while developing their critical thinking skills in the face of the digital transformations of the city.

Exploring bio-inspired AI reveals the natural mechanisms that inspired learning algorithms. Students discover how neural networks, algorithms, and collective intelligence are inspired by the brain's natural learning process, through trial and error. This biomimetic approach develops their understanding of learning and decision-making processes, whether natural or artificial.

Unplugged activities allow students to understand algorithms without a computer. Through games, hands-on experiments, and logic challenges, students grasp the fundamental principles of sorting, searching, classification, and optimization. These tactile experiences demystify algorithms by revealing their internal logic and prepare them for programming by developing computational thinking.

AI analysis for the city transforms students into critical designers. Rather than being subjected to digital transformations, they evaluate how artificial intelligence can improve urban life: optimizing traffic lights, predicting energy consumption, and intelligent waste management. By designing urban assistance chatbots, creating image recognition algorithms to analyze vegetation or selective sorting, or developing decision trees to identify sources of pollution, they question the ethical and social issues of automating urban decisions while developing their technical mastery of these tools.



### ORCHESTRATE THIS JOURNEY

This approach draws on urban questions to mobilize relevant knowledge. Rather than teaching mathematics, science, or geography separately, you explore a concrete question with students—how can we improve the air quality in our neighborhood?—which naturally calls for different skills.

**Interdisciplinarity emerges from the questioning itself. When students measure pollution, they are practicing physics and chemistry. When they map their results, they mobilize geography and mathematics. When they research causes, they investigate public policies and social behaviors. This convergence occurs organically, in the service of understanding.**

The progression between themes adapts to your local context and time constraints. You can start with the one that best resonates with your students' concerns or local news. The important thing is that each investigation enriches their overall understanding of the city as a complex system.

This approach allows you to support the discovery of urban issues by forging links between concrete observations and disciplinary knowledge. Learning takes on meaning because it answers real questions that students ask themselves about their daily environment.