



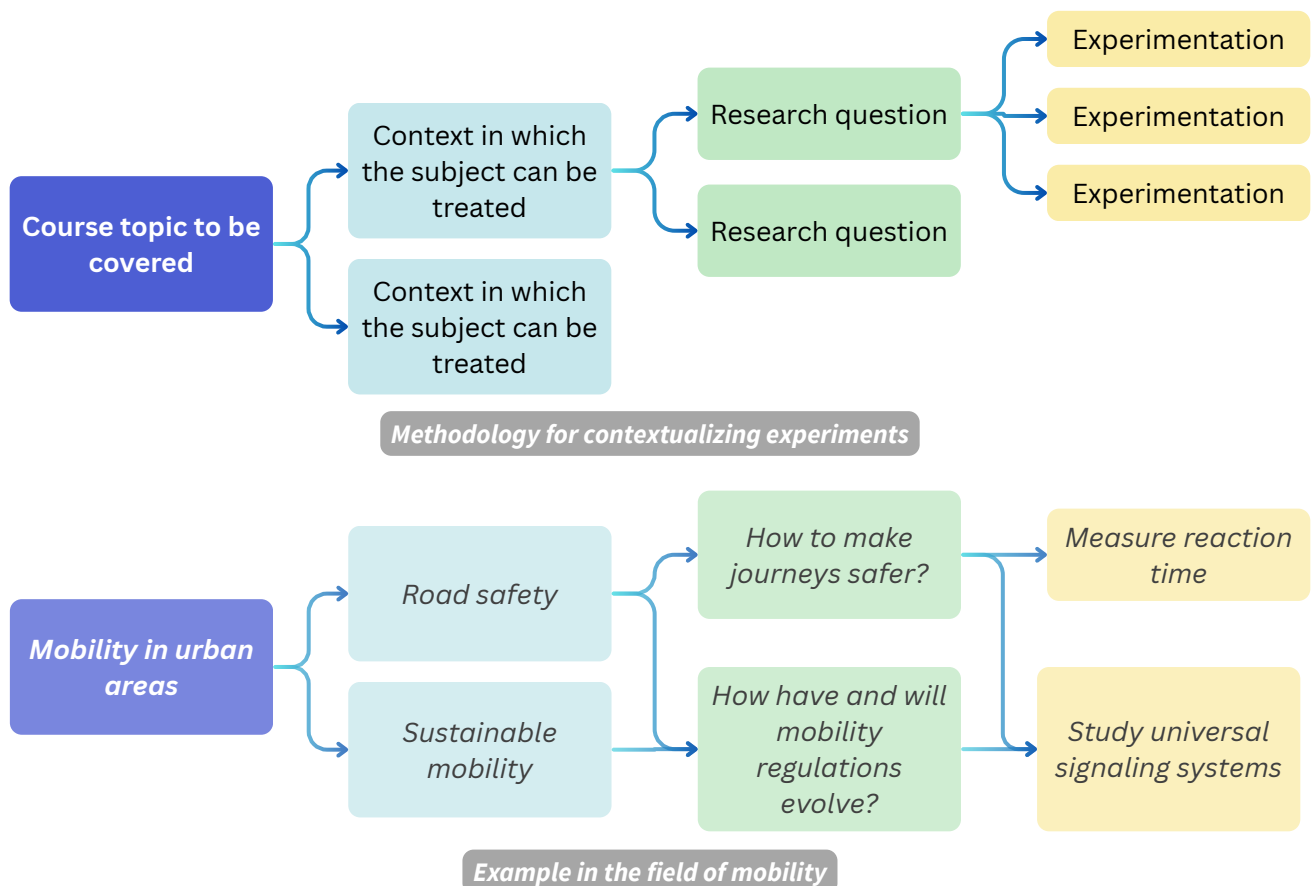
## CREATE A MULTIDIMENSIONAL APPROACH TO A RESEARCH QUESTION

**Construct learning based on a research question and link it to the curriculum**



As part of the SteamCity project, we propose a methodology for building learning experiences based on 6 steps, each of which allows knowledge to be contextualized and given meaning. The first phase is the creation of a multidimensional matrix of the course theme, based on the following input: the research question. The objective is to understand and define how to approach a theme in a transversal manner, integrating scientific rigor and impact for students.

The underlying objective is to contextualize learning in order to ensure student engagement and a better ability to retain the information transmitted. The question of the meaning of knowledge guided this methodology. How can learning situations be made closer to the students' daily life situations, without the content and theoretical approach becoming the poor relation?

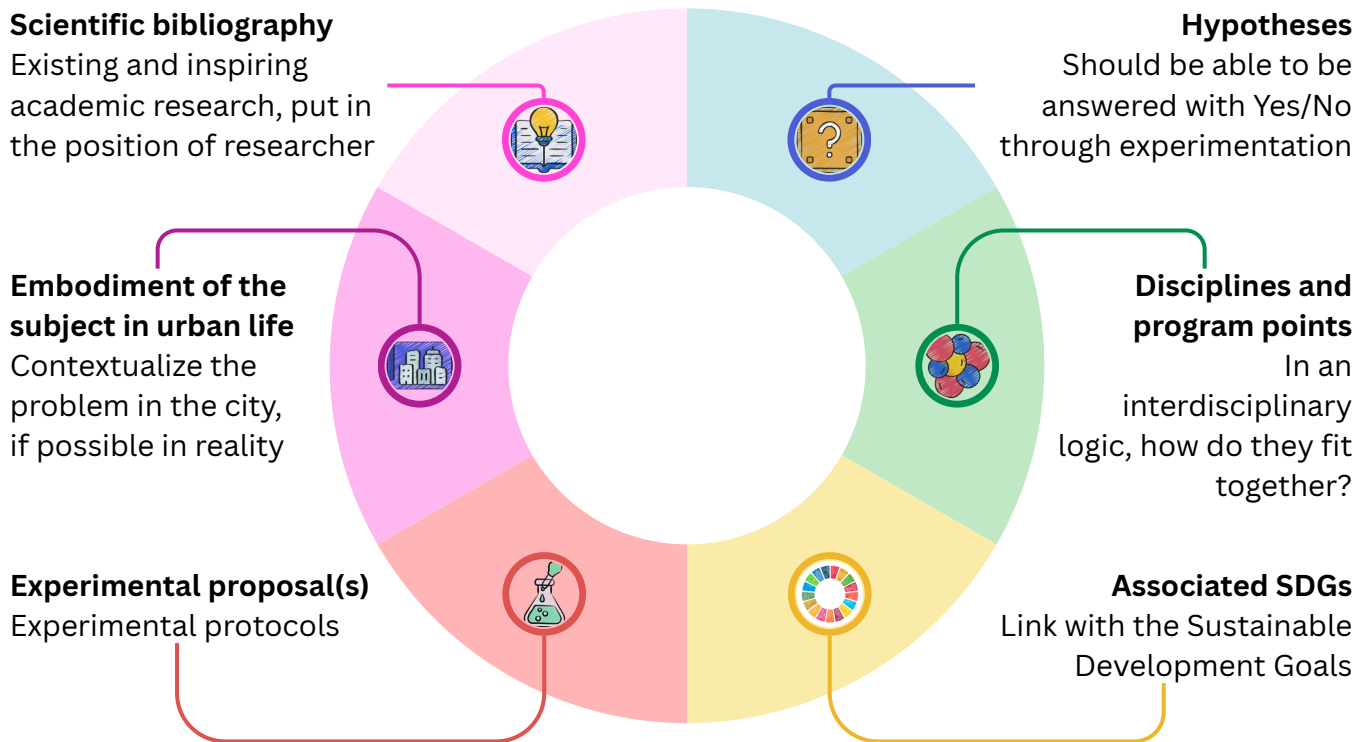


**The research question constitutes the crucial element of any investigative and experimental approach. It is a problem that reflects the researcher's initial questioning, and which precedes the formulation of one or more hypotheses.**

Basing our investigations on research questions allows us to avoid perceiving a subject through a bias, or to presuppose how to address a problem. Thus, we will not seek to prove that a hypothesis is true or false, but we will seek to define which hypotheses must be explored to address an issue in its entirety. The process of formulating this question can be based on direct observations, spontaneous questions, daily life, and gives meaning and engagement to the practice of science.

Once this first level of work has been completed, we encourage you to develop your research question in order to make the context more meaningful, more rigorous, and to engage students in a complete and strict investigative process:

**The research question and its matrix**



## Design work with students

We encourage you to use this phase directly with students. If your class schedule allows, introduce a collaborative questioning session, guided by the teacher, and linked to a specific point in the curriculum to be covered.

Students can share their pre-existing observations and questions to make the subject of study tangible in relation to their daily lives and personal experiences. The objective is to invite students to mobilize their observations and anchor their thinking in concrete situations. This paves the way for an active inquiry into the underlying scientific mechanisms, directly linked to their living environment.

**Example of an assignment on thermal comfort. Guide a discussion with students around the following questions: Have you ever noticed that some rooms feel stuffy or uncomfortable, even if the temperature seems right? What might explain this feeling? How does the indoor environment influence your mood, concentration, or energy on a daily basis? Why do some homes require a lot of heating or cooling to stay comfortable, while others seem naturally comfortable?**

Once the questions have been identified, guide their transformation into a research question that will allow their observations to be translated into a real study topic.

### **Example of work on thermal comfort.**

*How do temperature and humidity vary from room to room in a house?*

*How does ventilation influence the stability of temperature and humidity over time?*

*What factors affect the level of comfort in different rooms of the same home?*

Once the questioning phase has been completed, students will be able to participate in the development of multidimensional documentary research work:

- Have them explore the scientific dimension of the chosen question by discovering the world of research, finding and identifying real experimental protocols, documented through scientific articles and publications. You can use recognized tools and publishers: Elsevier, Springer, ResearchGate, JSTOR, Google Scholar ...
- Ask them to link the problem to societal and social issues, introduce them to the Sustainable Development Goals and how the international sphere is addressing these issues to meet the needs of citizens.
- Have them carry out documentary research on field actions to address this issue in the city, if possible in their own territory.

This work will finally make it possible to generate valid hypotheses, mobilizing measurement variables, which will all respond directly to the research question, will be inspired by the documentation analysis and will be able to generate results to serve the cross-sectional understanding of the problem.

These assumptions must:

- be formulated in the form of an affirmation or questions to which we can respond, which we can confirm or deny,
- be verifiable through the implementation of an experimental protocol,
- be precise, testable and measurable using clear variables.

### **Example of work on thermal comfort.**

For "How do temperature and humidity vary from room to room in a house?"

*Hypothesis: Rooms exposed to the sun will have a higher temperature and lower humidity than rooms located in the shade - Yes or no?*

For "How does ventilation influence the stability of temperature and humidity over time?"

*Hypothesis: Better ventilated rooms will have more stable temperature and humidity levels than those with insufficient ventilation - Yes or no?*

For "What are the factors that affect the level of comfort in different rooms of the same home?"

*Hypothesis: Rooms with high humidity will be perceived as less comfortable, even if the temperature is adequate - Yes or no?*

## Encourage critical thinking and debate

**Students should be encouraged to explore different perspectives and test their assumptions.**

*For example :*

- *Can building materials or furniture placement influence the temperature or humidity level in a room?*
- *Why do feelings of comfort vary from one person to another?*
- *Do our temperature and humidity measurements reflect all the significant variations in an indoor space?*

**Students must also connect their thinking to broader issues:**

- *How can better indoor climate control help reduce energy consumption and improve sustainability?*
- *What solutions could improve the indoor climate in poorly insulated homes?*
- *How can these observations influence the design of more energy-efficient buildings?*

**These connections allow students to understand the real scope of their work and encourage them to deepen the analysis of their hypotheses by placing them in a broader environmental and societal context.**

**Methodological point on documentary research:** As part of the creation of the multidimensional matrix, students will be required to search for sources to support their research question. This step must be carried out in accordance with documentation techniques, applying a rigorous approach to fact-checking. This is based on several crucial principles:

1. **Diversity of sources:** Reliable information must come from multiple independent sources to verify consistency and avoid bias.
2. **Consistency and clarity of presentation:** Well-structured and logical information is easier to analyze and compare, which strengthens its credibility.
3. **Objectivity and Neutrality:** A reliable and objective source presents facts impartially, based on empirical evidence.

*To go further, consult the matrix model provided and explore the “Factbusters” protocol*