



Science, Technology, Engineering and Mathematics (STEM)

Scenario: Air Taxi

Many cities are looking to solve some of their traffic problems by starting an air taxi public transit program. While it will be expensive at the beginning, they expect to have fares down to \$30 per ride in the next 5-10 years. Your firm wants to win the project. To do so, you must engineer the following and address the impacts:

- the craft and how the system operates (including where you take off and land, pilot, passenger number, fuel)
- how much traffic will be alleviated by the air taxi system
- how many rides can be operating at any given time
- environmental impacts
- the pros and the cons of implementation.
- synthesis: describe how new technologies might impact the implementation of your system (e.g., machine learning, artificial intelligence, the Internet of Things, robotics).

Resources

Flying cars are coming to LA, but this futuristic vision may not solve today's traffic congestion (podcast): <https://www.kcrw.com/news/shows/greater-la/flying-cars-la-street-couches/urban-air-mobility>

CNBC: The flying taxi market may be ready for takeoff, changing the travel experience forever: <https://www.cnbc.com/2020/03/06/the-flying-taxi-market-is-ready-to-change-worldwide-travel.html>

American Planning Association: Flying Taxis Are Coming and Communities Need to Prepare: <https://www.planning.org/planning/2021/winter/flying-taxis-are-on-the-horizon/>

Bloomberg: How Do the Leading Flying Taxi Companies Compare?: <https://www.bloomberg.com/news/features/2022-01-11/here-s-how-the-top-flying-car-companies-compare>

With these lesson ideas, teachers have the kernel information to complete short activities. Given that teachers will need to use state-approved course outlines, we encourage teaching in context of your program. However, if teachers wanted to expand this into formal project-based learning, allow the scenario to help you get started. We strongly encourage teacher feedback on these activities, if implemented, as well as success stories and examples of your completed work. Reviews may be sent to Darren Morris, Instructional Designer, CTECS, dmorris@ctecs.org.

1. Creativity and Innovation—We define creativity and innovation as:

- Discussing the importance of creativity and innovation in the workplace
- Brainstorming and contributing ideas, strategies, and solutions
- Developing and/or improving products, services, or processes

- Identifying and allocating available resources.
 - Provide your ideas for concepts of vehicle design, flight, and operation
 - How did you come up with your idea? What was your creative process?
 - Is this a new idea (as far as you know) or does it come from something put into practice during the pandemic?
 - What are your resources for communicating (pitching) your idea?
 - How are you innovating from an original idea that already exists?
 - What is improved: a product, a service, or a process?
 - What resources are needed to help bring your idea to life: time, people, technology, funding?

2. Critical Thinking and Problem Solving—We define critical thinking and problem solving as:

- Recognizing and analyzing problems
- Evaluating potential solutions and resources
- Using a logical approach to make decisions and solve problems
- Implementing effective courses of action.
 - What problem are you trying to solve? Define it clearly.
 - Where would you locate ports and drop-off locations? Are you providing adequate access to the public?
 - What are your flying regulations? How high, how low? How do you prevent accidents with other flying objects/taxis? Is this autonomous or would there be pilots?
 - What else is affected by your solution? What are the personal and social impacts?
 - How many solutions did you consider? What was your process for choosing a solution?
 - Is your solution feasible? How much time will it take to implement?
 - What are the potential weaknesses or risks in your solution?
 - What is the market for your solution?
 - Which aspects of your program of study were helpful to finding an appropriate solution?

3. Initiative and Self-Direction—We define initiative and self-direction as:

- recognizing the importance of proactive, independent, decision-making
- identifying workplace needs
- completing tasks with minimal direct supervision
- applying solutions.
 - If you were working for a city planner and you were the first one to come up with the idea of creating an air taxi system, what would be the steps you might follow to propose the solution?
 - To whom would you propose it? How would you propose it?
 - Would you need to work with a team? What role would you want to play in proposing this idea? What responsibilities would you want?
 - What are the benefits of proposing your solution or innovation to your superiors?

- If you are working on this proposal as part of a team, how will you step up to lead/delegate and how will you work responsibly together (establishing team norms and rules)?
- What is your motivation to succeed in this proposal (autonomy, mastery, purpose)?

4. Integrity—We define integrity as:

- recognizing the importance of having integrity in the workplace
 - complying with local, state, and federal laws
 - adhering to workplace policies and procedures
 - exhibiting honesty, fairness, and respect toward self, others, and property.
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- What regulations might govern your idea?
 - What is your interest in keeping costs down?
 - How do you strive for equity and access and the greater good, public safety, environmental ethics? Is it worth it?
 - How do you perform quality assurance? How will you know if the vehicle design is safe and efficient?
 - How do you set a realistic budget?
 - What is the motivation behind vehicle safety? How safe is safe?
 - What makes this the best idea for public transportation?

5. Work Ethic—We define work ethic as:

- demonstrating diligence (e.g., working with persistence to accomplish a task)
 - maintaining dependability (e.g., being reliable)
 - accounting for one's decisions and actions
 - accepting the consequences of decisions and actions.
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- How do you maintain morale and encourage a strong work ethic for longer project implementations, such as this?
 - If you have an initial setback after your policy proposal, how might you remain diligent and overcome barriers and closed doors to have your solution considered for implementation?
 - How does your proposal positively affect the workplace and work ethic? How many work hours are lost to employees stuck in traffic?
 - What could happen to work ethic if the policy is not implemented?
 - How would you justify your proposal?
 - What might make this solution no longer feasible?
 - How will you assess the team's progress and handle performance problems or conflict/disagreement?
 - How can you set a schedule and determine goals?
 - Reflect on your teamwork and your own contribution to this proposal. Were you dependable? Accountable?

For short activities we offer the following suggestions:

- Identify the competency or unit in your program that would be most appropriate for teaching this activity synchronously. Students learn best in context.
- Divide the class into competitive teams (at least two).
- Have the teams brainstorm ideas and establish rules for brainstorming: all ideas are accepted.
- Have teams arrive at consensus and choose their best idea to propose.
- Teams should establish norms, roles, and expectations for team members.
- Teams will clearly define their mission and the idea of their proposals.
- The teacher should act as the judge of the quality and feasibility of the ideas.
- Teachers should also provide enough background to get students started and monitor student behavior along the way, providing helpful feedback when necessary.
- Students should share work and reflect on how well the team worked together.

For teachers who wish to expand the activity into a larger project, the following PBL Design Principles and Teaching Practices are provided**PBL Project Design Principles**

1. **A Challenging Problem or Question:** The project is framed by a meaningful problem to be solved or a question to answer, at the appropriate level of challenge
2. **Sustained Inquiry:** Students engage in a rigorous, extended process of posing questions, finding resources, and applying information.
3. **Authenticity:** The project involves real-world context, tasks and tools, quality standards, or impact, or the project speaks to personal concerns, interests, and issues in the students' lives.
4. **Student Voice & Choice:** Students make some decisions about the project, including how they work and what they create, and express their own ideas in their own voice.
5. **Reflection:** Students and teachers reflect on the learning, the effectiveness of their inquiry and project activities, the quality of student work, and obstacles that arise and strategies for overcoming them.
6. **Critique & Revision:** Students give, receive, and apply feedback to improve their process and products.
7. **Public Product:** Students make their project work public by sharing it with and explaining or presenting it to people beyond the classroom.

PBL Teaching Practices

1. **Design & Plan:** Teachers create or adapt a project for their context and students, and plan its implementation from launch to culmination while allowing for some degree of student voice and choice.

2. **Align to Standards:** Teachers use standards to plan the project and make sure it addresses key knowledge and understanding from subject areas to be included.
3. **Build the Culture:** Teachers explicitly and implicitly promote student independence and growth, open-ended inquiry, team spirit, and attention to quality.
4. **Manage Activities:** Teachers work with students to organize tasks and schedules, set checkpoints and deadlines, find and use resources, create products and make them public.
5. **Scaffold Student Learning:** Teachers employ a variety of lessons, tools, and instructional strategies to support all students in reaching project goals.
6. **Assess Student Learning:** Teachers use formative and summative assessments of knowledge, understanding, and success skills, and include self and peer assessment of team and individual work.
7. **Engage & Coach:** Teachers engage in learning and creating alongside students, and identify when they need skill-building, redirection, encouragement, and celebration.