Ideas with IMPACT

ROBOTICS
Self Driving to Success
Lesson Plan: Introduction to Self-Driving Vehicles

Grade Level: 6-12

Objective: Students will understand the concept of self-driving vehicles, their uses, advantages, and limitations. They will also learn about the technology behind self-driving cars and gain hands-on experience by assembling and programming a self-driving robot car using the ELEGOO Smart Robot Car Kit V4.0.

Materials:
- ELEGOO Smart Robot Car Kit V4.0 (one per small group)
- Computers or laptops with internet access
- Cell phone or tablet for programming app (Elegoo Kit)
- Projector or smartboard
- Whiteboard or flip chart
- Markers
- Handouts or printed resources about self-driving vehicles (see resources section)

Duration: Approximately 3-4 hours (can be divided into multiple sessions)

Lesson Plan:

1. **Introduction to Self-Driving Vehicles (30 minutes)**
   - Begin the lesson by asking students if they have heard about self-driving vehicles and what they know about them.
   - Use a projector or smartboard to show videos or images of self-driving cars in action.
   - Facilitate a brief discussion about the potential uses and advantages of self-driving vehicles, such as improved safety, increased efficiency, and accessibility.

2. **Technology Behind Self-Driving Vehicles (45 minutes)**
   - Explain the key technologies used in self-driving vehicles, including sensors (LiDAR, cameras, radar), GPS, mapping, and artificial intelligence (AI) algorithms.
   - Discuss how these technologies work together to enable a car to navigate, sense its environment, and make decisions autonomously.
   - Use diagrams and illustrations to make complex concepts more accessible.

3. **Hands-On Activity: Assembling the ELEGOO Smart Robot Car (90 minutes)**
   - Divide the students into small groups (3-4 students per group) and provide each group with an ELEGOO Smart Robot Car Kit V4.0.
   - Give them the assembly instructions included with the kit and allow them to work collaboratively to build the self-driving robot car.
   - Assist and guide the groups as needed.

4. **Programming the Self-Driving Robot Car (1-2 class periods)**
   - Once the robot cars are assembled, introduce the programming aspect of the activity.
Students can use the Elegoo Kit App or Arduino IDE or any compatible programming platform to write code that enables the car to move.

Introduce tasks in attachment below to facilitate the activity

Provide coding examples and explanations to help students get started.

Encourage creativity and experimentation with different coding approaches.

5. **Testing and Debugging (30 minutes)**

- Allow each group to test their self-driving robot car and identify any issues or bugs in the code.
- Facilitate a discussion on problem-solving strategies, debugging techniques, and the importance of trial and error in the learning process.

6. **Real-World Applications (30 minutes)**

- Gather the students and present real-world applications of self-driving vehicles, such as transportation, delivery services, and agriculture.
- Discuss the potential impact of self-driving technology on various industries and society.

7. **Reflection and Discussion (15 minutes)**

- Engage the students in a reflective discussion about their experience with the ELEGOO Smart Robot Car Kit and what they learned about self-driving vehicles.
- Encourage them to share their insights and observations from the hands-on activity.

**Resources:**

1. **What Are Self-Driving Cars?**
   https://www.techtarget.com/searchenterpriseai/definition/driverless-car


3. **TED-Ed: How Do Self-Driving Cars See?**
   https://youtu.be/PRg5RNU_JLk

4. **The ethical dilemma of self-driving cars**
   https://youtu.be/ixIoDYVfKA0

5. **YouTube example videos:**
   - How to assemble
   - How to use
   - How to program

6. **Hands-On Worksheet “Autonomous Vehicle Tasks”**

**Assessment:**

1. **Formative assessment:** Observe students' engagement and participation during the hands-on activity and discussions. Provide feedback and support as needed.
2. **Summative assessment:** Assign a short written or oral presentation where students explain the uses, advantages, and limitations of self-driving vehicles, and discuss their experience with the ELEGOO Smart Robot Car Kit V4.0.

**Note:** Always prioritize safety during the hands-on activity and ensure appropriate adult supervision.
Lesson Plan 2: Introduction to Self-Driving Vehicles (more in-depth lessons)

Objective: Students will learn about the concept of self-driving vehicles, their uses, benefits, and challenges. They will also engage in a hands-on activity using the ELEGOO Smart Robot Car Kit V4.0 to understand the basic principles of autonomous driving.

Grade Level: 9-12

Duration: 3-4 class periods (45 minutes each)

Materials:

- ELEGOO Smart Robot Car Kit V4.0
- Computers or tablets with internet access
- Projector or smartboard (optional)
- Whiteboard and markers
- Handouts and worksheets (see resources section)
- Safety precautions (if needed)

Lesson Plan:

Day 1: Introduction to Self-Driving Vehicles

1. Warm-Up (10 minutes): Start the class by asking students about their knowledge of self-driving vehicles. Encourage a short discussion about what they think self-driving vehicles are and what they can do.

2. Presentation (20 minutes): Use a projector or smartboard to present a slide show or video explaining the concept of self-driving vehicles. (See resources)

   - Cover topics such as:
     - Definition and principles of self-driving vehicles
     - Key components and technologies involved (e.g., sensors, AI, GPS)
     - Benefits and potential applications in various industries (e.g., transportation, logistics, delivery, public services)
     - Challenges and concerns (e.g., safety, ethical considerations)

3. Class Discussion (15 minutes): Engage the students in a discussion about the presented material. Ask questions to assess their understanding and encourage critical thinking. Address any misconceptions and encourage open dialogue.

Day 2-3: Hands-on Activity - Building the Smart Robot Car

1. Introduction to the ELEGOO Smart Robot Car Kit V4.0 (15 minutes): Show the ELEGOO Smart Robot Car Kit V4.0 to the students and briefly explain its components and capabilities. Emphasize that they will be building a basic version of a self-driving vehicle using this kit.
2. **Group Work** - Assembling the Smart Robot Car (90 Minutes): Divide the class into small
groups and provide each group with a kit. Instruct them to follow the provided instructions to
build the car step by step. Circulate among the groups to assist and ensure safety.

**Day 4: Hands-on Activity - Programming the Smart Robot Car**

1. **Introduction to Programming (15 minutes):** Briefly explain the basics of programming and
   how it is used to control the behavior of self-driving vehicles. Introduce the programming
   environment that comes with the ELEGOO kit.

2. **Group Work:** Programming the Smart Robot Car (60 minutes): Instruct the students to write a
   simple program to make the robot car perform basic autonomous functions. For example,
   they can program the car to move forward, avoid obstacles, and stop at a specific distance. See
   Autonomous Vehicles Tasks below.

**Day 5: Resources and Wrap-Up**

1. **Resource Exploration (30 minutes):** Provide the students with a list of online resources
   (articles, videos, and documentaries) related to self-driving vehicles. Allow them time to
   explore these resources individually or in small groups. They can take notes on interesting
   findings and prepare to share them with the class.

2. **Presentations and Discussion (15 minutes):** Invite students to present their findings from the
   online resources they explored. Encourage discussions about the potential impact of self-
   driving vehicles on society, the environment, and various industries.

3. **Conclusion (10 minutes):** Summarize the key points covered throughout the lesson. Ask the
   students what they have learned and how they feel about self-driving vehicles. Address any
   remaining questions or concerns.

**Assessment:**

1. **Formative assessment:** Observe students’ engagement and participation during the hands-on
   activity and discussions. Provide feedback and support as needed.

2. **Summative assessment:** Assign a short written or oral presentation where students explain
   the uses, advantages, and limitations of self-driving vehicles, and discuss their experience
   with the ELEGOO Smart Robot Car Kit V4.0.

**Resources:**

1. **What Are Self-Driving Cars?**
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4. **The ethical dilemma of self-driving cars** [https://youtu.be/ixIoDYfKA0](https://youtu.be/ixIoDYfKA0)
5. **YouTube example videos:**
   - How to assemble
   - How to use
   - How to program

6. **Hands-On Worksheet “Autonomous Vehicle Tasks”**

   Note: The resources provided above were available at the time of this publication in November 2023. Please ensure they are still relevant and accessible before using them in the classroom.