
INITIATE Lesson Plan: *Demographics – Lesson 1*

Lesson plan at a glance

Name	Demographics
Course	Arithmetic
Suggested grade	9 th to 12 th
Prerequisites	Basic Arithmetic skills
Time	Preparation: 5 minutes Instruction: 20 minutes

Standards

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Lesson Overview

People with disabilities need special transportation, something that caters to their every need. This includes, but not limited to, wheelchair access, special facilities for the elderly, etc. But the current types of transportation have several issues related to ADA compliance, regular services and so on. With Autonomous Vehicles (AVs) under development and becoming a promising technology, their use in Paratransit services can be a way to address these issues. But before we can begin development of these vehicles, we must know the people who will use this technology. This lesson plan focuses on understanding the number of people who could use this Autonomous Paratransit Service and their demographics.

Driving Questions

Overarching Driving Questions for Bowsher Wide Project:

- How will autonomous vehicles affect people with disabilities in our society?

Lesson Specific Question:

- What are the demographics and needs of differently abled people in Toledo?

Materials and Equipment

- For the student:
 - *Required:*
 - Calculator

Preparation Tasks

	<ul style="list-style-type: none">• Check if the tablet is sufficiently charged• Check if calculator is working• Check if everyone has scratch papers and pencils to work	5 minutes
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The Lesson

Warm-up Activity	10 minutes
Activity 1: People with disabilities	5 minutes
Wrap-up: Conclusions and Inferences	5 minutes

Warm-up Activity: Information Gathering and Brainstorming (10 minutes)

Activity:

The lesson starts off with a video on the need for autonomous transportation for people with disabilities (<https://www.youtube.com/watch?v=OGrDUx14sEs>).

- Which population needs autonomous transportation?
- What are the problems that people with disabilities face a lot?
- What are some of the benefits of bringing in autonomous transportation?

Teaching Tip:

The teacher can use an online discussion board to host these questions where students can actively discuss the warm-up questions with the teacher and peers. The teacher can act as a moderator so that the students can stay on the discussion.

Activity 1: People with Disabilities (10 minutes)

Problem Statement: Since we are dealing with people with disabilities in the United States and Ohio, we need to know closely as to who makes this population and how many people in the US and Ohio needs paratransit services. Also, according to disabledworld.com, the percentage of people with disabilities in the US and in the state of Ohio is very close, so we want to find out if there is a significant difference between these two values.

Part 1: The Population for people with disabilities in the US (2 mins)

Problem Statement: Given the population of the US is 327.2 million in 2018 and 12.6% of this population has some form of disability, how many people have some form of disability?

Solution:

Percentage of Disabled population = 12.6%

Population of US = 327.2 million

No. of people with Disabilities in the US = $12.6/100 * 327.2 = 41.23$ million

Part 2: The Population for people with disabilities in the Ohio (10 mins)

Problem Statement: Given the disabled population of Ohio at the end of 2014 was 1.624 million, and it is increasing at a rate of 0.02% per year, what was expected disabled population of Ohio at the end of 2018 (Round off to 3 decimal places)? What percentage of the Ohio population has disability (Round off to 2 decimal places)?

Solution:

Number of People with disabilities at the end of 2014 (P) = 1.624 million

Rate of increase of this population (r) = 0.02%

Time lapse from end of 2014 to end of 2018 (t) = 4 years

Let the expected disabled population in 2018 be P'.

We know,

$$P' = P \left(1 + \frac{r}{100} \right)^t$$

Therefore,

$$P' = 1.624 \left(1 + \frac{0.02}{100}\right)^4$$

$P' = 1.625$ million

Number of people with disabilities in Ohio in 2018 was **1.625 million**.

Find the population of Ohio in 2018:

On a quick google search we find that the population of Ohio in 2018 was 11.69 million.

Percentage of people with disabilities in OH = $1.625/11.69 * 100 = 13.9\%$

Here we are trying to investigate how many people in Ohio and the US have some form of disability for finding the solution to the overarching driving question. This investigation and problem solving are components of PBL.

We have a procedure for solving problems like these, which means that we are designing an algorithm or using an algorithm to solve the problem which is a component of Computational Thinking.

Teaching Tip:

The teacher can use an online portal such as Google Classroom, Blackboard, etc. to create a questionnaire, and the students can submit their answers there.

Wrap-up: Conclusions and Inferences (5 minutes)

Activity:

- What can be seen from the trend of US and Ohio disabled population?
- Is this population large enough to be focused on?
- Can we say that the data we have for people with disabilities in the US be a representative of the data for people with disabilities in OH?

Teaching Tip:

The teacher can wrap-up the lesson by asking the questions during an active session, and just give a fine closure to the lesson.

Assessment:

Collect students' reflections. Assess for thoughtful, complete responses and experimental understanding. The students' interest in STEM.

Learning Objectives and Standards

Learning Objectives	Standards
LO1: Students will be able to analyze a problem and suggest possible solutions.	<i>Computer Science</i> CCSS.MATH.PRACTICE.MP1 : Make sense of problems and persevere in solving them.
LO2: Students will be able to see	

the relationship between two sets of data.	
LO3: Students will be able to verbalize a plan (an algorithm) for the whole process.	
LO5: Students will be able to see the mathematics behind everyday things.	

Additional Information and Resources

Project-based Learning Features

Feature	Where does this occur in the lesson?
Driving Question	The Driving Question can be seen at the very top after defining the Lesson Objective. In this lesson, we answered the question how will autonomous vehicles affect the differently abled people of our society? It is necessary to find how many people need paratransit services, and what kind of services they need.
Investigation & Problem Solving	A Problem Statement is presented in the beginning of each Activity section. These problems are solved in the Activities using an Investigatory and problem-solving approach. The activities done in this lesson requires investigating the population with disabilities and their needs related to transportation.
Technology Incorporation	We are using google classroom(Google Incorporation, 2018) to share the results.
Collaborative Opportunities	In the Activities designed, the people involved the lesson are discussing their results and sharing their ideas. They share their ideas and knowledge with each other, leading to Collaborative Learning Opportunities.
Assessment techniques	Assessment is done on whether the solutions to the problems are correct or not and the approach used is appropriate to the problem presented. The students should be able to solve problems in a better way and show sign of developing Computational Thinking skills.

Computational Thinking Concepts

Concept	Where does this occur in the lesson?
Decomposition	Activities requires the students to decompose the problems into parts and solve each of the parts independently to get the result of the presented problem.

Administrative Details

Contact info:	www.utoledo.edu/research/initiate
Sources:	Google Incorporation. (2018). <i>Google Classroom</i> . classroom.google.com
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Template adapted from:	https://edu.google.com/resources/programs/exploring-computational-thinking/