SDSU | San Diego State University

Evaluating the Safe Routes to School (SRTS) Transportation Program in Socially Vulnerable Communities in San Diego County, California

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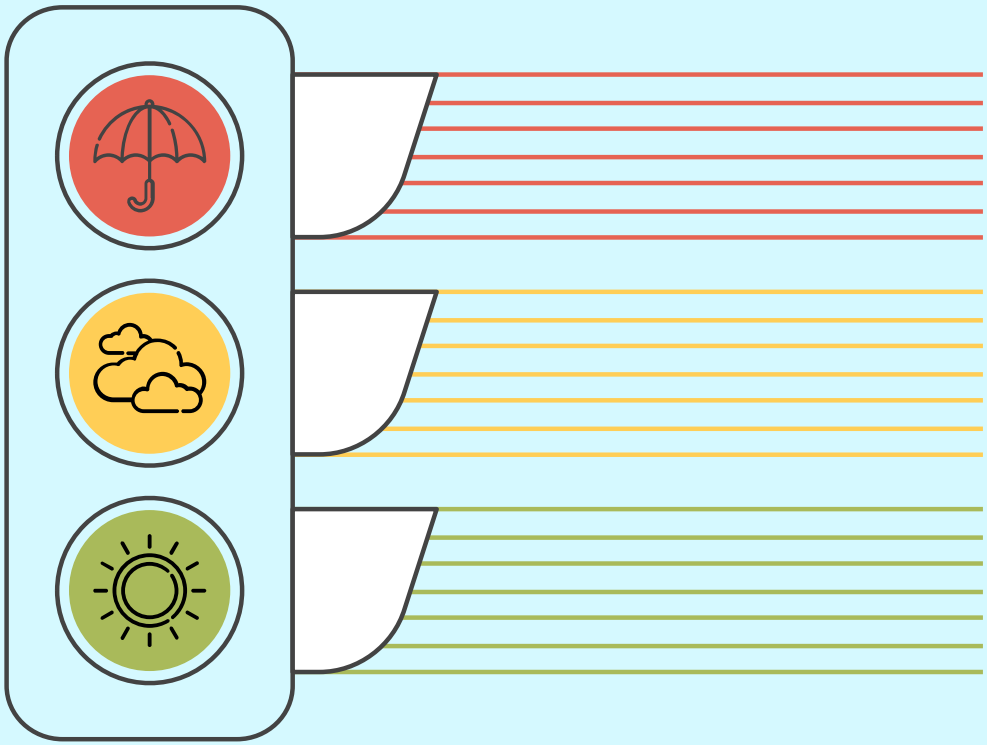
Safety Through Disruption Webinar
Project: 06-011
Wednesday, July 19, 2023

SAFE-D SAFETY THROUGH DISRUPTION

Presentation Agenda



Team Introduction

Evaluating the Effectiveness of Safe Routes to School (SRTS) Program

Kids 4 Safe Routes VR Game

Team

PI: Dr. Gabriela Fernandez
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(Department of Geography, Big Data Analytics, SDSU)

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Project Background

- Part of the Safe-D project
- Proactively promote safety through a data-driven collaboration
- Virginia Tech Transportation Institute, the Texas A&M Transportation, and San Diego State University

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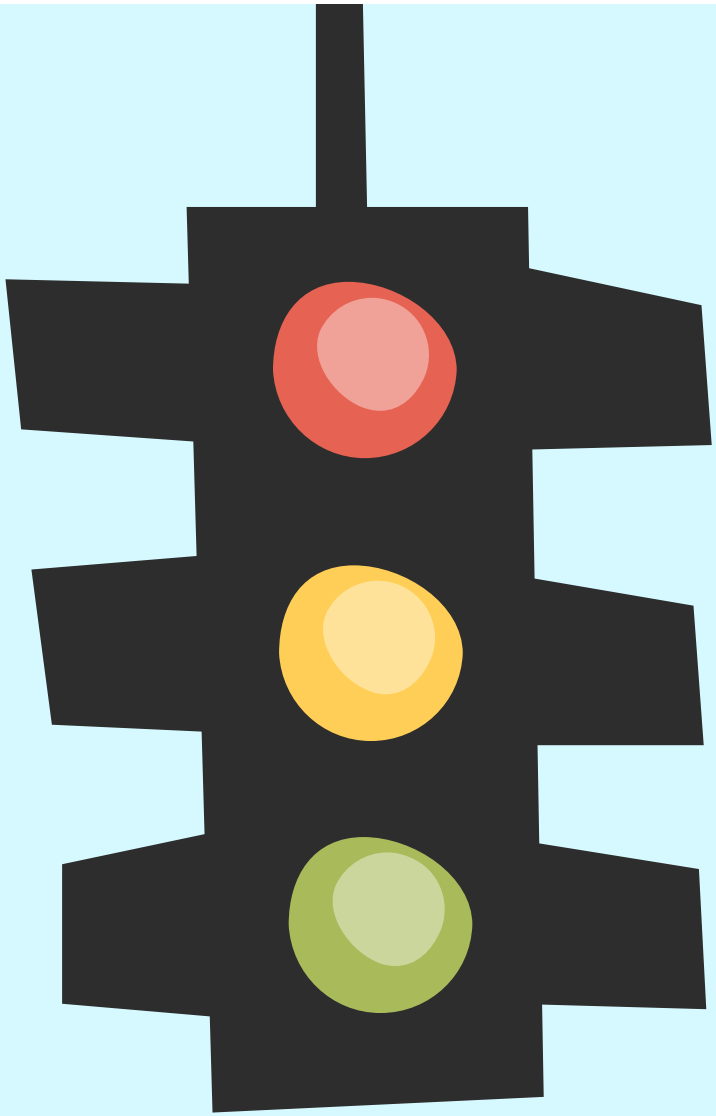
HDMA @SDSU | THE CENTER FOR HUMAN DYNAMICS IN THE MOBILE AGE

SDSU-STAR Lab

SDSU METABOLISM OF CITIES LIVING LAB
Together for the SDGs

SDSU San Diego State University

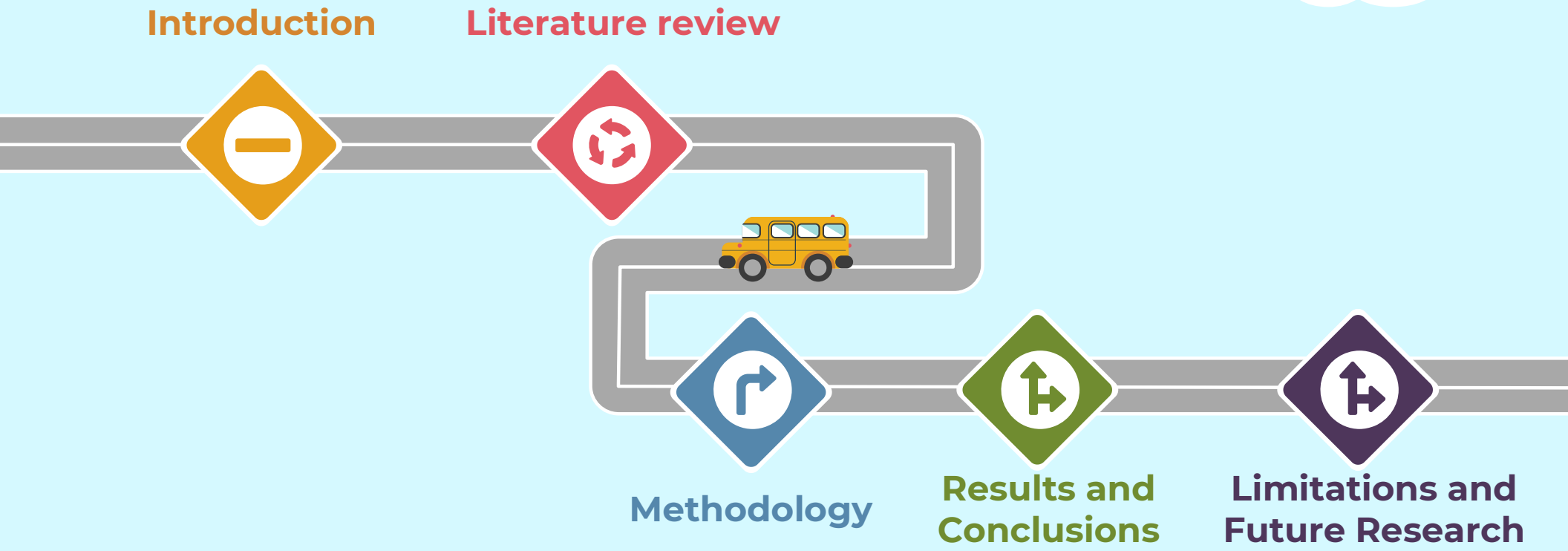


Section 1:

Evaluating the Effectiveness of Safe Routes to School (SRTS) Program

Presented by Bita Etaati

Section 1 Overview



Introduction

Safe Route to School (SRTS)

Federally funded program promotes active transportation for children K-12

Through infrastructure improvements and educational programs

Collect information through surveys (tallies and parents)

Why Chula Vista, CA?

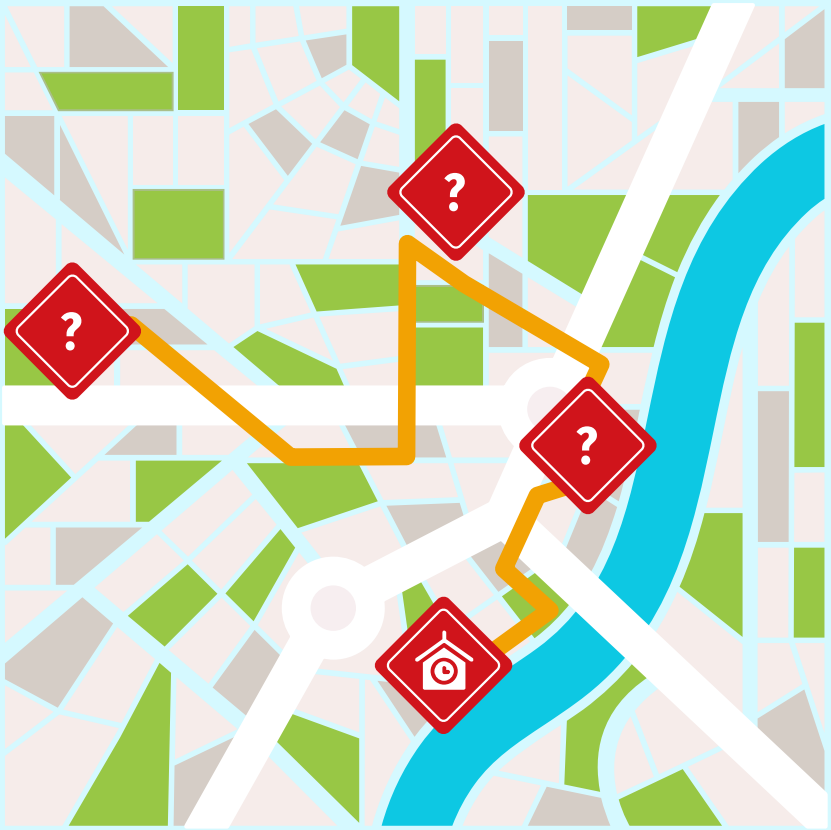
The second most populated city in San Diego County

Twenty-five percent of its population are children under eighteen years of age (fifty-two elementary schools)

Active participant of the Safe Routes to School program since 2007

A socially vulnerable community/ city in San Diego County based on the Social Vulnerability Index (SVI)

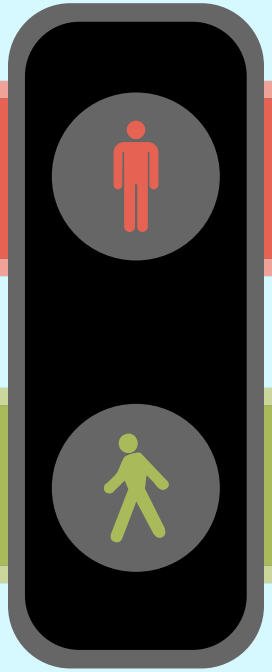
Questions to be answered



- Has the walking/cycling habit of students changed in Chula Vista with respect to the SRTS program?
- What are the main factors influencing active school travel of students in Chula Vista?
- Does traffic variables, number of accidents and area demographics have any impact on the active transportation rate?

Literature Review

Literature Review Structure



01

Previous studies on SRTS programs effectiveness

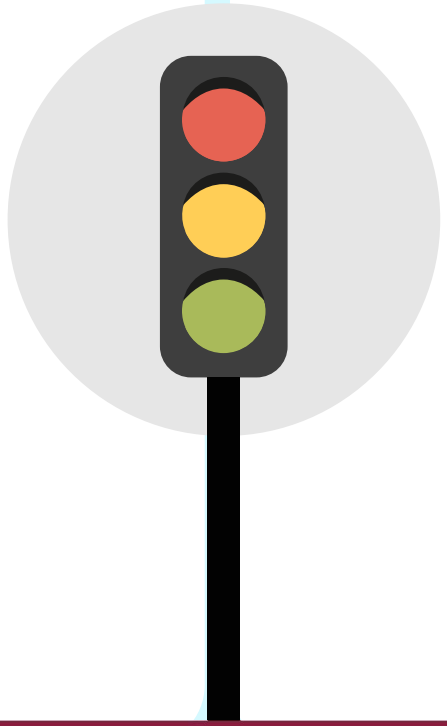
02

Exploring the barriers of active transportation for students

Previous Studies

Pre-post analysis on the infrastructure improvement

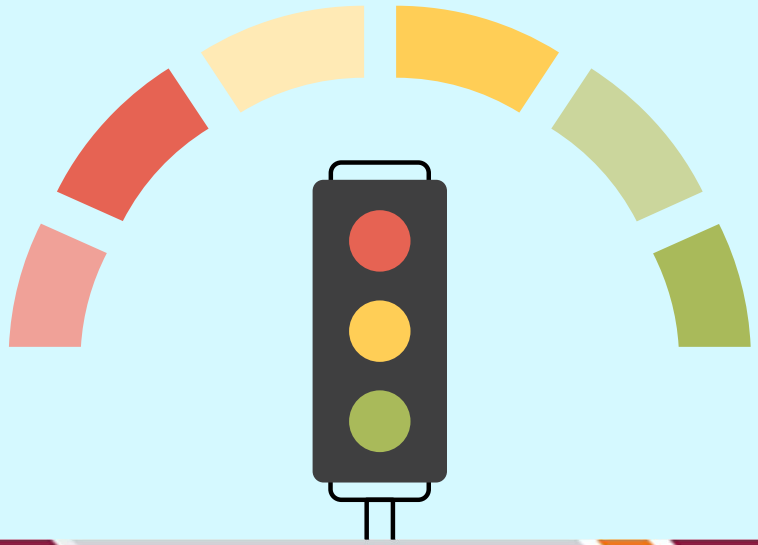
1. Boarnet et al observed an increase in walking or bicycling trends of students whose safe route differed from their usual route.
2. Traffic improvements may not be sufficient to increase cycling and walking in schools with low levels of activity.
3. SRTS encouragement programs was associated with the 25% increase in walking and bicycling, while infrastructure improvements can be related to 18% relative increase in active travel to school (McDonald et al.).
4. Education and encouragement programs were more significant on walk and bicycle trends than on infrastructure measures (Lizarazo et al.).



Importance of educational programs

1. SRTS educational program had a positive impact on the increase in the rate of students walking and bicycling to school in the long-term in California (Ragland et al).
2. Even one day encouragement events such as “International Walk Day to School” and “Fill the Rack!” program showed an increase in student participation on the day of the event and a few weeks later. (Buckley et al.).

Previous Studies

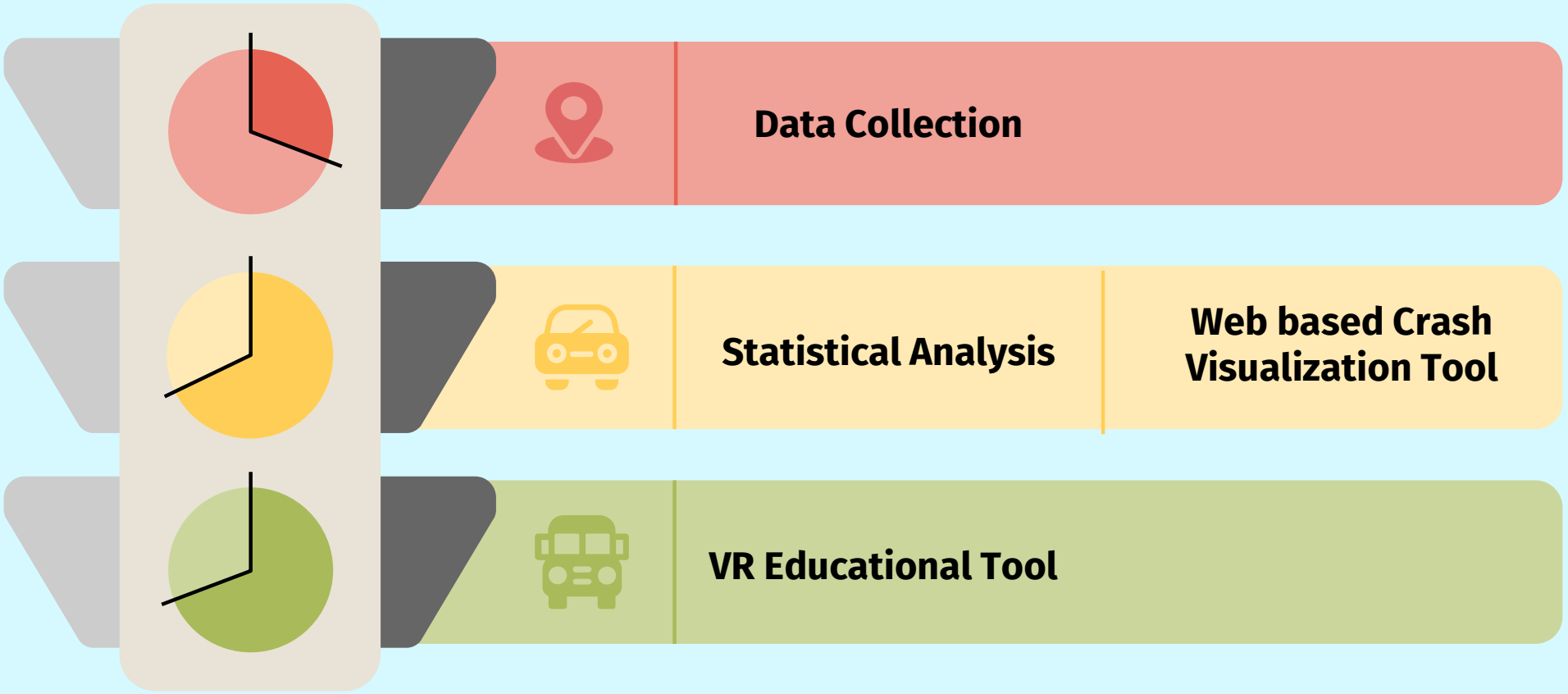


Significant Factors in using ATS

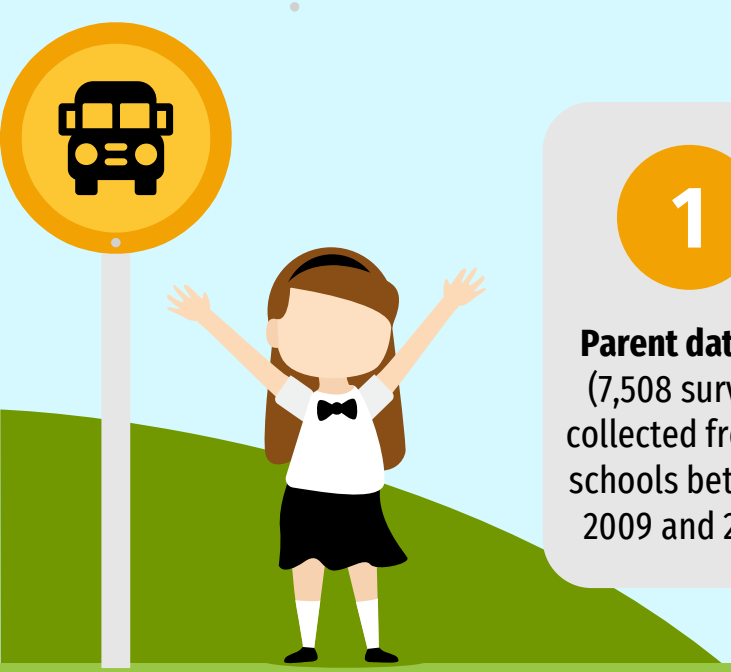
1. Only 5% of students used active transport (walking or biking) to get to and from school (Bungum et al.).
2. Street connectedness near schools was a significant predictor of using active transport (Bungum et al.).
3. Perceiving walking to school as a time-saving and safe activity was positively associated with the likelihood of walking to school (Rodriguez et al).
4. Insufficient traffic lights and pedestrian crossings in their neighborhood were less likely to increase their active commuting (Hume et al.).

Methodology

Methodology Sections



Data Collection



1. **Parent dataset** (7,508 surveys collected from 19 schools between 2009 and 2011)
2. **Tally dataset** (19,926 students from 41 schools between 2009 to 2019)
3. **Transportation Information Mapping System (TIMS) dataset** from 2010 to 2021
4. More than 12 **shapefiles** extracted from SANDAG
5. **Feaster Charter Elementary School Case Study**

Walk Percentage Linear Model

1. Trying to find the association between students' walk percentage with age group, gender, and home-to-school distance, as well as the school's role in encouraging students and parents' level of education, perceptions, and concerns about active transportation.

2. Linear regression model based on the Parent survey data (R stats library).

3. Used multiple evaluation metrics (AUC, RMSE) to verify model accuracy.

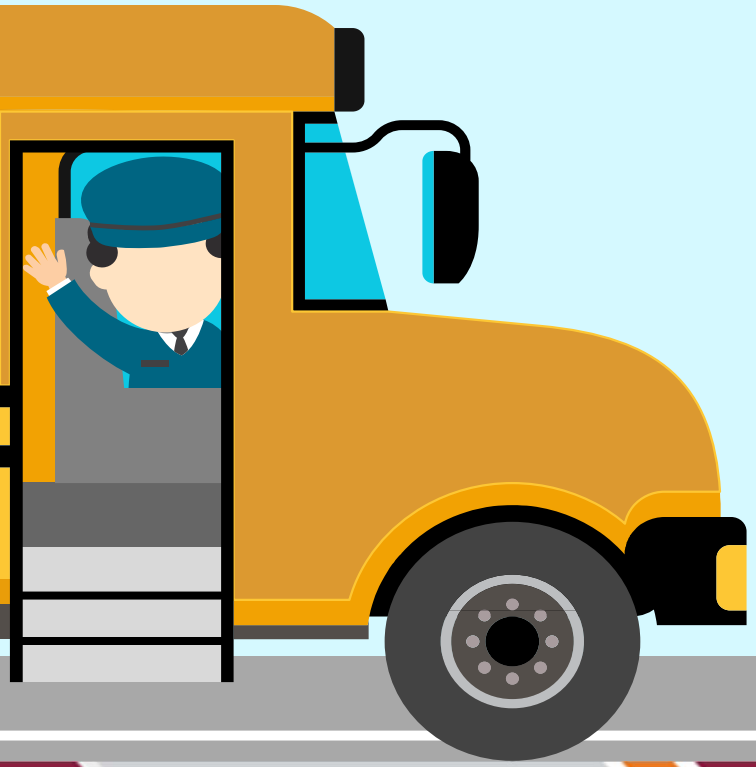
Walk Prediction Logistic Regression Model

1. Predicting whether the student walks as their usual commuting mode (walk = 1) or if they use any other transportation mode (walk = 0) based on Parents data.

2. a classification model (logistic regression) is used to find the most significant factors influencing student walking to/from school based on the Parents survey questionnaire.

3. Used multiple evaluation metrics (AUC, RMSE) to verify model accuracy.

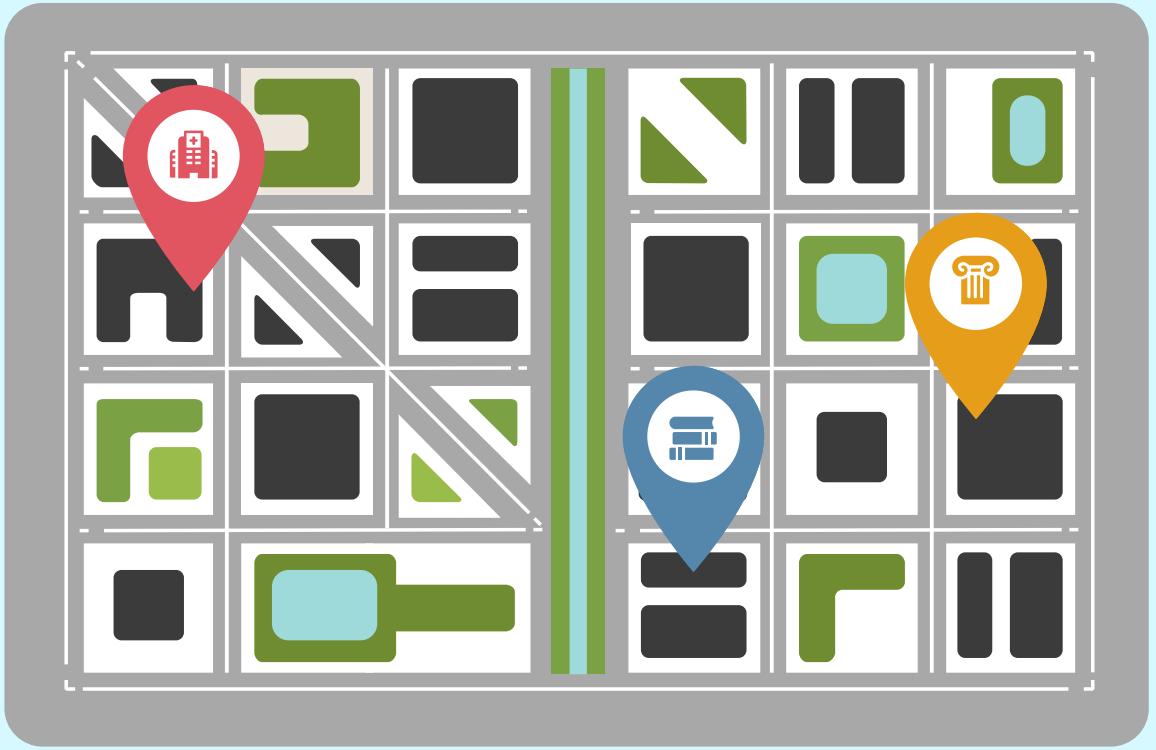
SRTS Impact on Walking Trends



1. Using Chi-square test to Analyze SRTS impact on students' walking trends.
2. Comparing percentage of students walking to/from school based on the Parent survey, before, during ,and after the program ending.
3. Run Chi-Square test both for Tallies and Parents walk percentage.

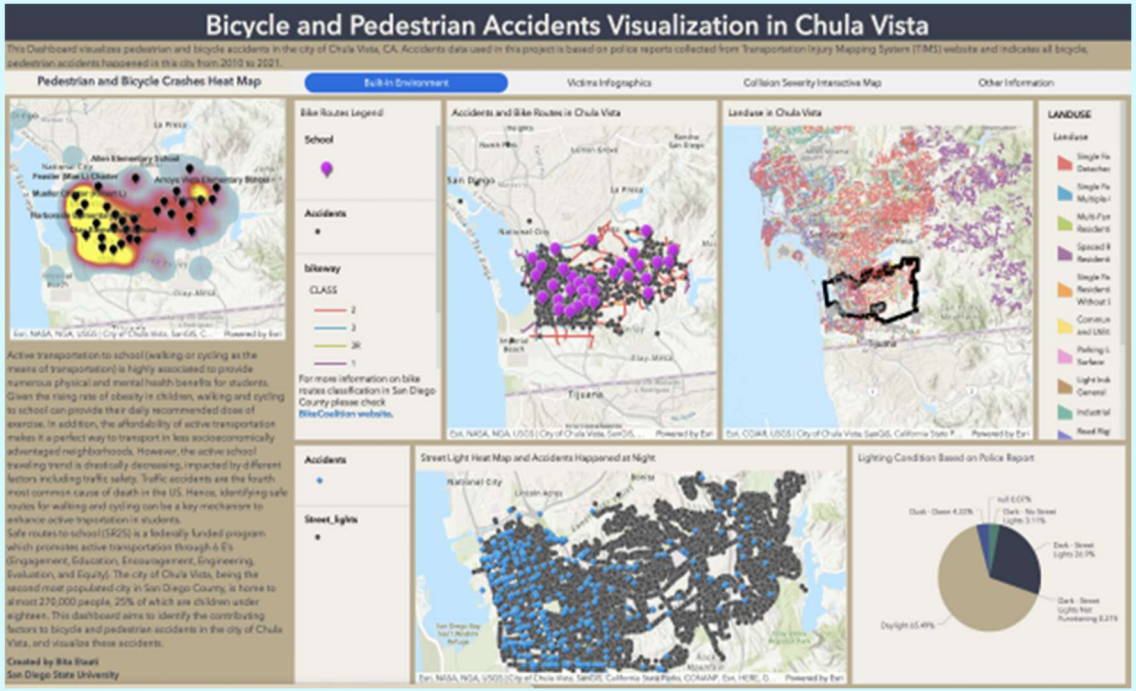
Web-Based Crash Visualization Tool

1. Created using ArcGIS Dashboards based on the TIMS dataset of pedestrian and bicycle crashes in Chula Vista from 2010 to 2021, includes over 1,400 crash reports.
2. Consists of three tabs (Built-in Environment, Collision Severity Interactive Map, and Other Information).
3. Includes information such as speed limits, streetlights, available bike routes information about victims of the crashes, including gender, race, and age.

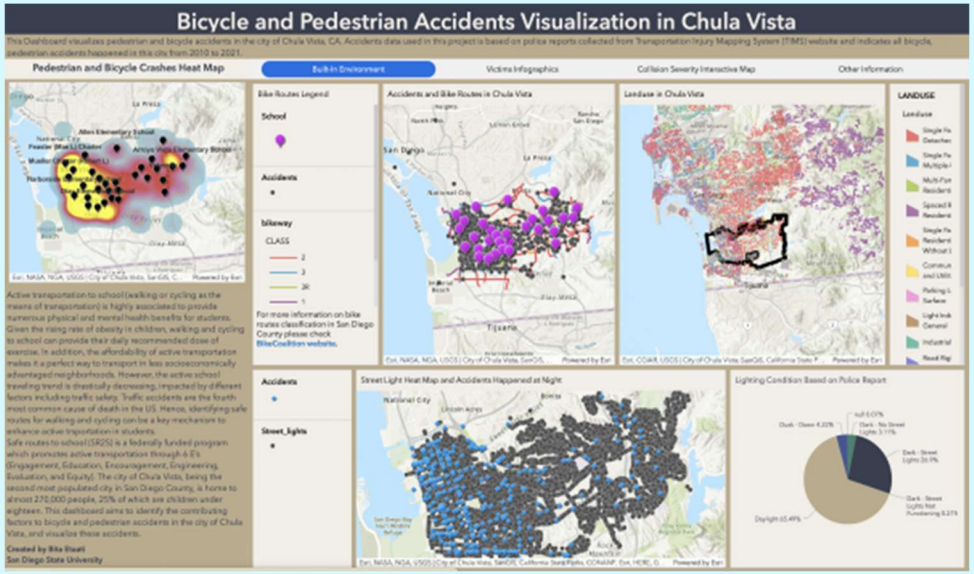


Web-Based Crash Visualization Tool

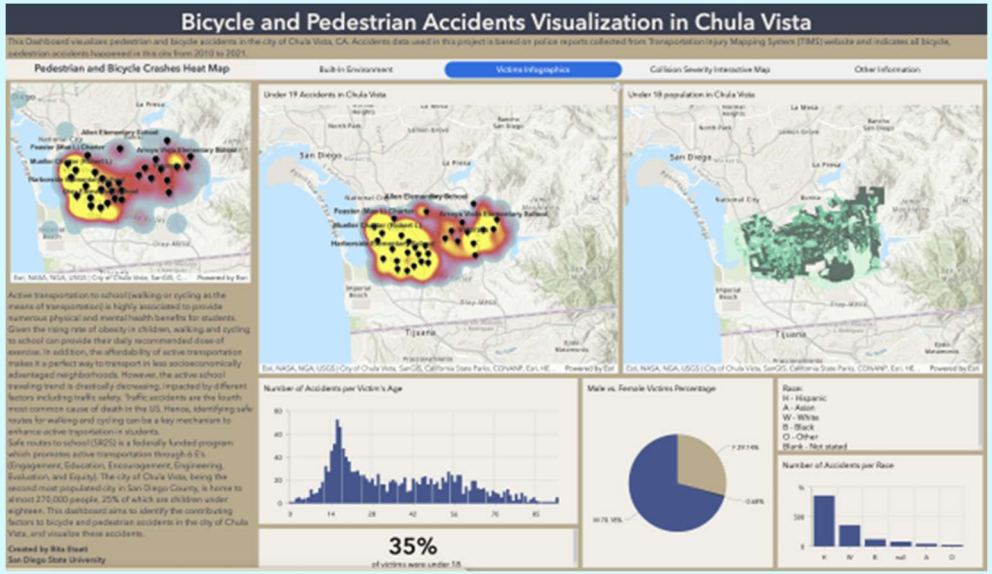
1. Most of the crashes occurred in the western areas of the city, with daytime being the most common time for crashes to occur.
2. 15% of the crashes were fatal.
3. Most of the fatal crashes occurred in the western areas of Chula Vista.
4. Males were found to be the most common victims of these crashes.



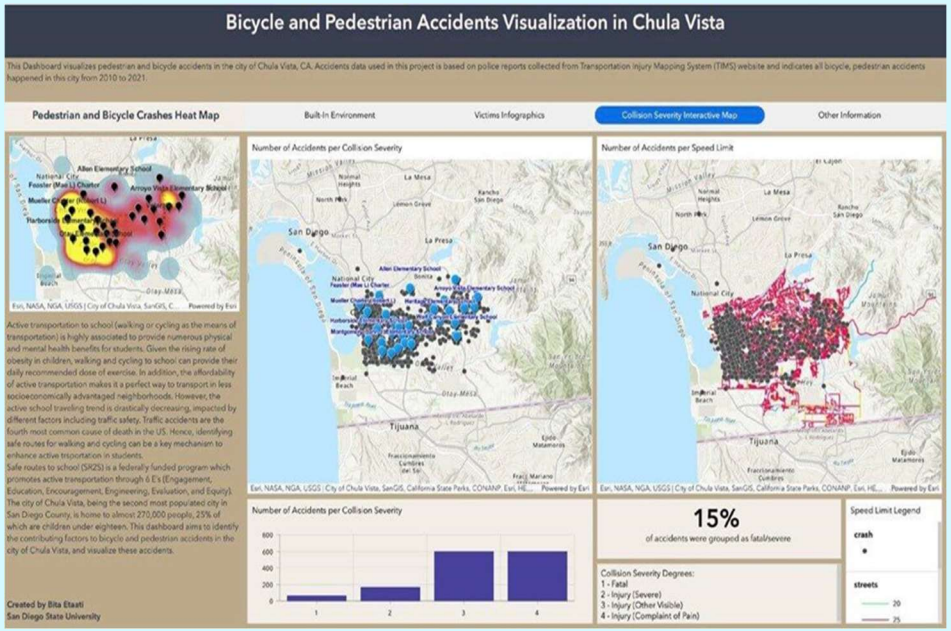
Built Environment



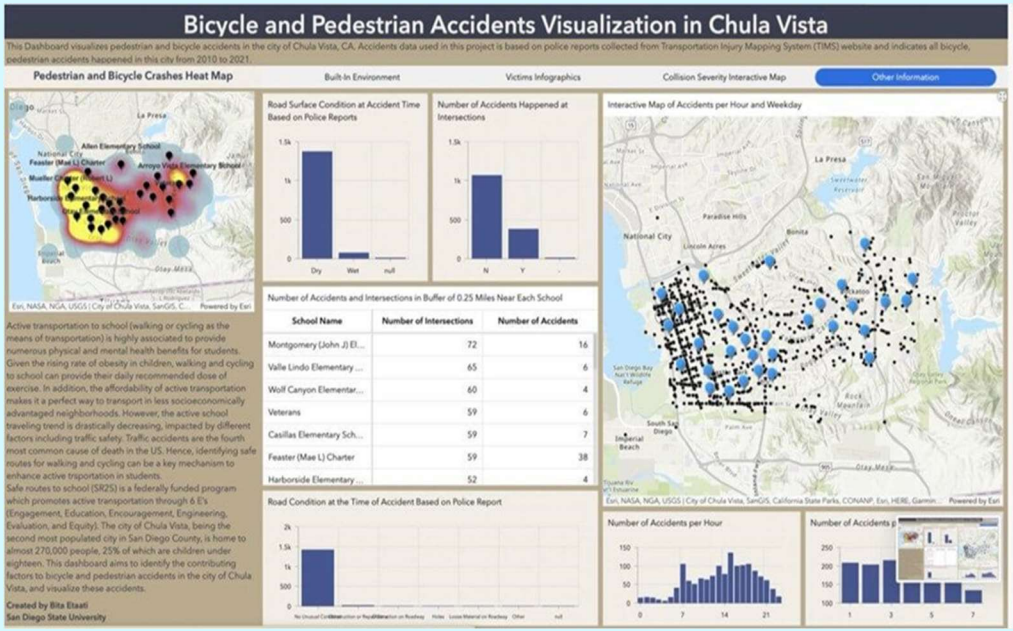
Victims' Infographics



Collision Severity Map



Other Information



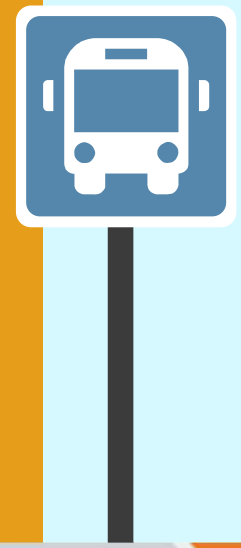
Feaster Charter Elementary Survey Analysis

Collected Surveys

New Tallies and Parents survey collected

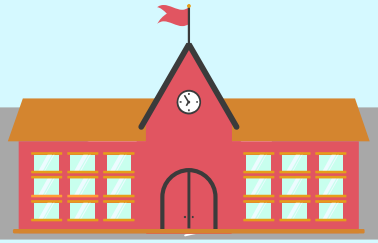
Twenty-eight Parent surveys collected from 7th and 8th grade students

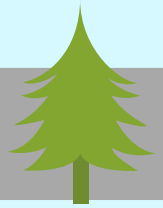
Tallies collected for 200 students in 8 classes (7th and 8th grade) for 3 consecutive days in February 2023.



Feaster Charter Elementary Survey Analysis

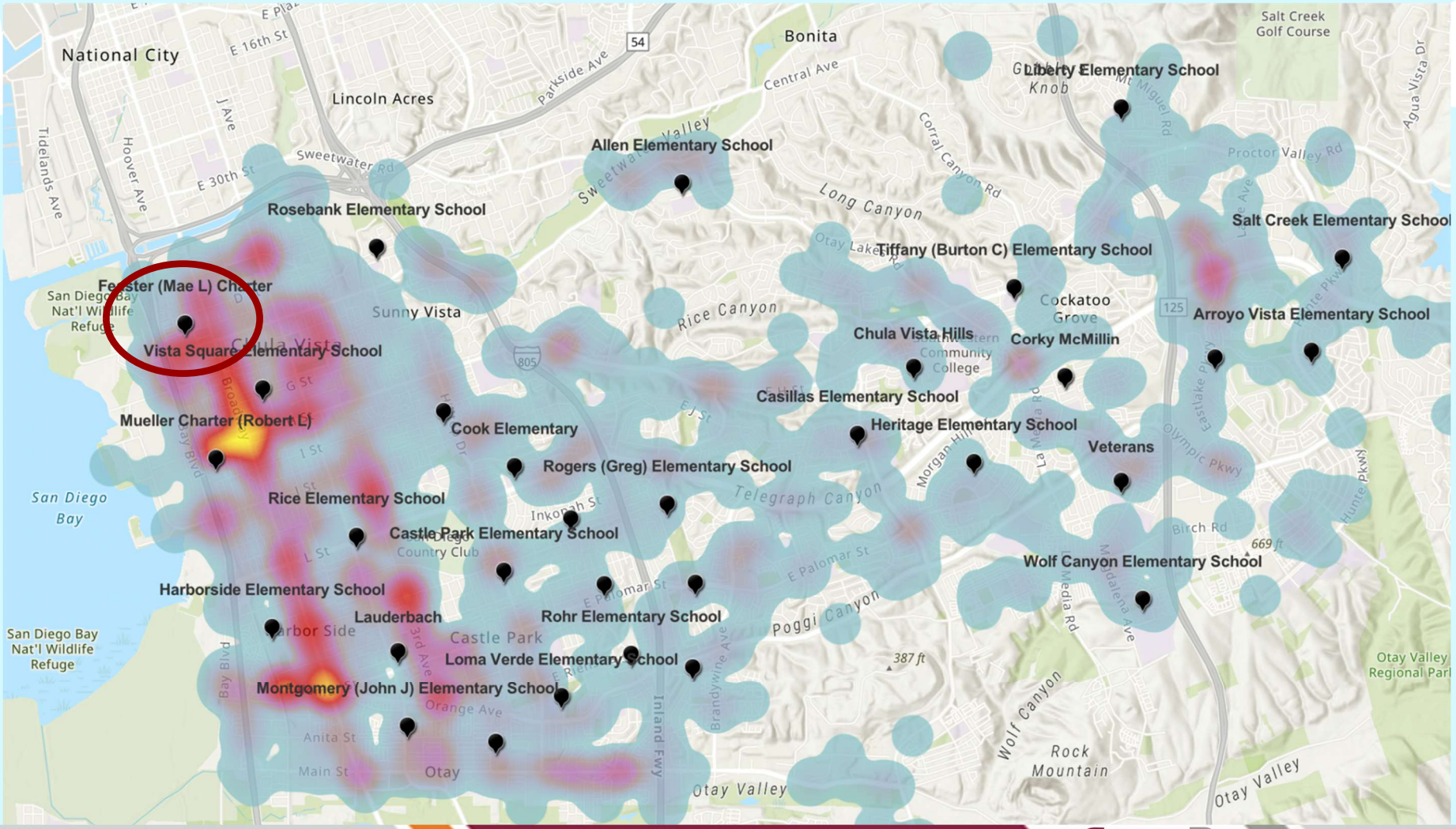
Located in a high risk accident spot based on the dashboard analysis





High number of students and notable student diversity

Very helpful staff!


National City
Lincoln Acres
Bonita
Salt Creek Golf Course
Liberty Elementary School
Allen Elementary School
Rosebank Elementary School
Salt Creek Elementary School
Tiffany (Burton C) Elementary School
Fenster (Mae L) Charter
Vista Square Elementary School
Sunny Vista
Chula Vista
Chula Vista Hills
Corky McMillin
Cockatoo Grove
Arroyo Vista Elementary School
Casillas Elementary School
Mueller Charter (Robert L)
Cook Elementary
Heritage Elementary School
Veterans
Rogers (Greg) Elementary School
Rice Elementary School
Castle Park Elementary School
Harborside Elementary School
Lauderbach
Rohr Elementary School
Loma Verde Elementary School
Montgomery (John J) Elementary School
Wolf Canyon Elementary School
San Diego Bay
San Diego Bay Nat'l Wildlife Refuge
Castle Park
Otay
Otay Valley
Rock Mountain
Wolf Canyon
Rice Canyon
Long Canyon
Telegraph Canyon
Poggi Canyon
Sweetwater Valley
Otay Valley Regional Park

Results and Discussions

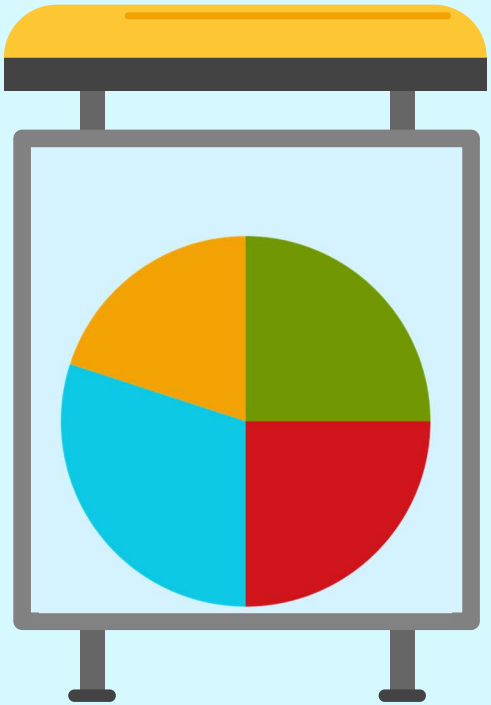
Results

1. The distance between a student's home and their school is the most important factor in determining their decision to walk to/from school

2. Only around 50% of students living in a walking distance use active transportation.

3. The data indicate that students are more likely to walk to school when the SRTS program is active (Mid Program)

Results



4 Student perception of active transportation can positively influence their decision to walk to school

5 Crime and distance were among the top concerns parents raised as to why their children do not walk to school, however convenience was found to be a stricter factor affecting students' decisions.

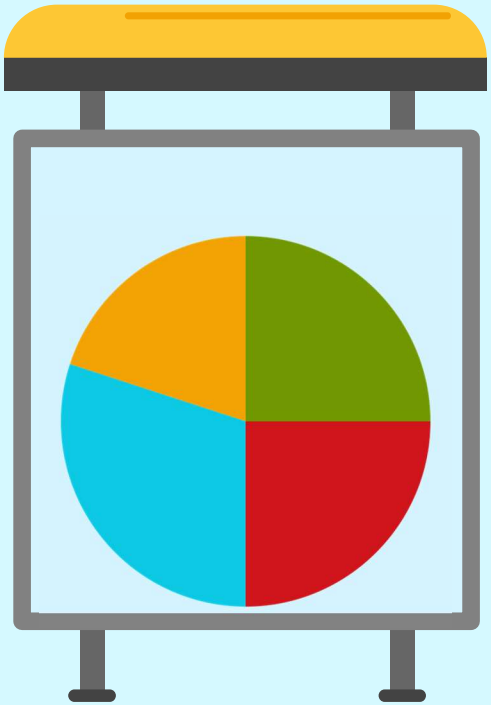
6 The presence of sidewalks, crossing guards, and intersection safety were found to be significant in promoting walking to/from school.

7 Less than 1% of students in CVESD use bicycling as their primary mode of transportation to school.

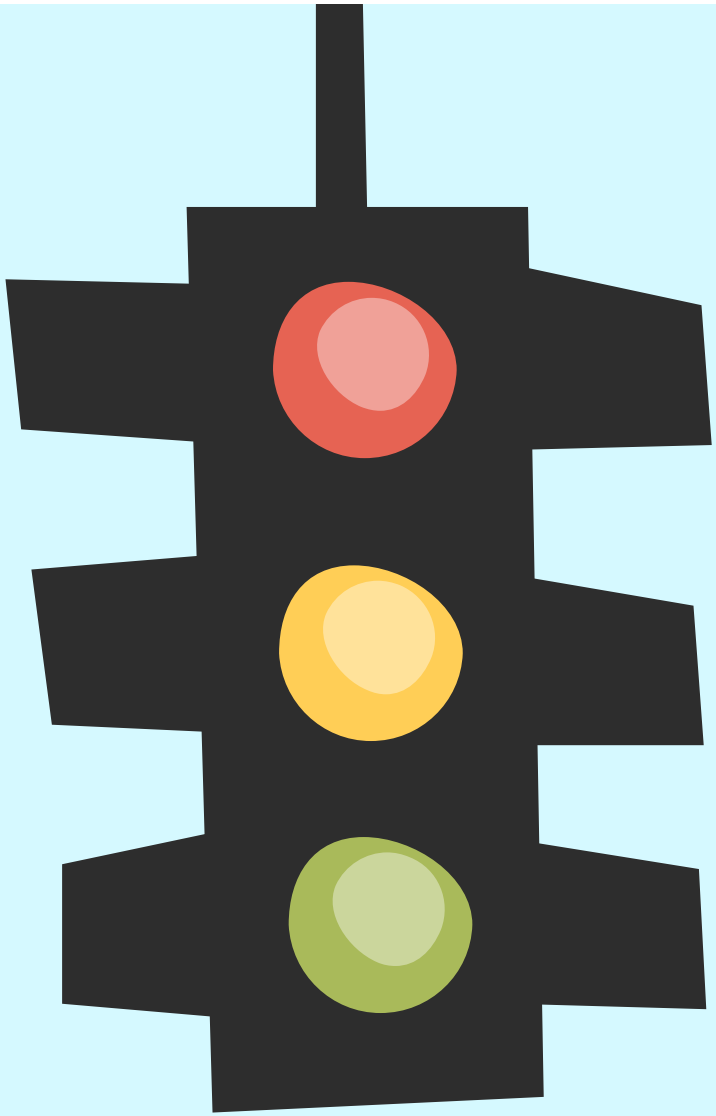
Feaster Charter School Observations

1. Around 35% of parents are not comfortable with their children walking to school in any grade
2. More than 50% of parents were concerned with issues such as distance, time, violence and crime, safety of intersections
3. An average of 27% of walk percentage in the morning and 40% of walk percentage in the evening

Limitations and Future Research



- Limited data availability for recent SRTS projects (2017 onward)
- Limited number of students riding a bike to school
- Unable to find detail data on STRS activities (before, mid and after program)



Section 2:

KIDS 4 Safe Routes VR Game

Presented by Dr. Gabriela Fernandez

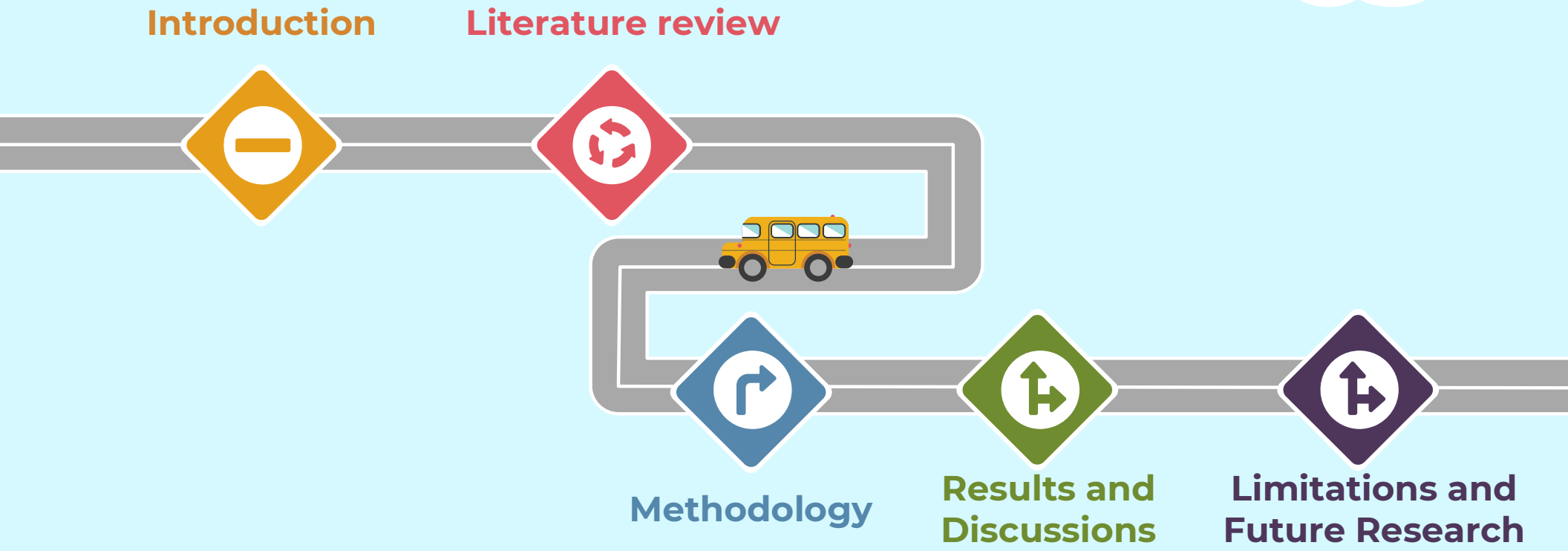
SDSU San Diego State University

KIDS 4 Safe Routes VR Game Intervention

Feaster Charter Elementary School

SAFE-D SAFETY THROUGH DISRUPTION

Section 2 Overview



Introduction

Objectives

- Evaluate the overall performance of students in a virtual environment to develop their own road awareness skills.
- To ensure safety, the proposed tool has an extra examination layer for children's abilities evaluation.
- The VR game tool allows a child that is considered fit for real world practices achieve a set score.

Kids 4 Safe Routes VR Game Activities

Educate children to follow road signs and traffic lights properly.

Walk properly on the pedestrian walkways or designated lanes.

Cross road intersections and junctions carefully at/without designated zebra crossings.

Literature Review

Literature Review Structure

01

Previous studies on VR educational technologies

02

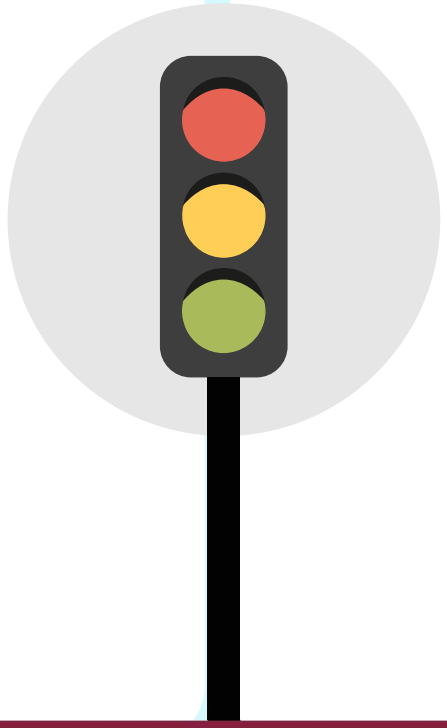
Exploring the opportunities of VR technologies to advocate for transit safety and children.

Previous Studies

VR technologies to improve transit safety among children

1. There have been limited VR tools specifically designed for enhancing transit safety among children. The majority of educational VR tools primarily concentrate on medical topics.

2. Virtual Road World (2017), educated children ages 7-11 how to practice traffic safety through in game-feedback, by guiding the player on what not to do and scores them accordingly. The user is given a series of quests, as they navigate their way around a virtual city (lack of instructions).

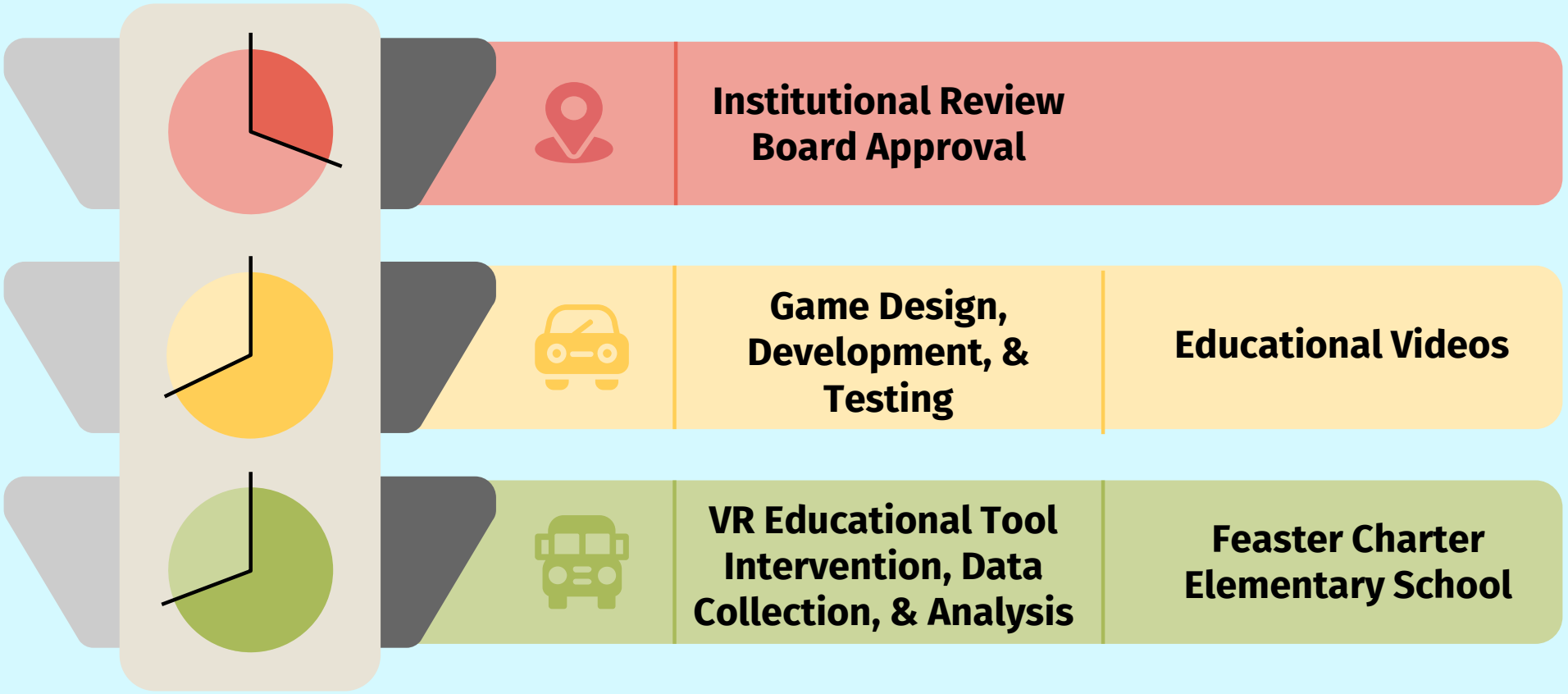


Importance of VR educational technologies

1. VR focused tools allow for accessibility to all ages, given that the vast majority have phones, they would only need access to VR headsets, which can be bought for as little as 6 dollars.
2. VR tools allow to learn from the comfort of your home, without ever having to step outside on any actual roads, and thus preventing harm to people that use this technologies.

Methodology

Methodology Sections



Kids 4 Safe Routes VR Game Stages

1

Unity Software
(Game Engine for the creation of the 3D virtual world).

2

Google Cardboard
(Support VR on IOS and Android mobile devices).

3

Firebase Software and C#
(Primary cloud storage provider and programmed to collect user game scores using real-time hosting of databases, communication server on IOS and Android and more).

4

Build 3-D Environment
(Features: cars that interact with the player, stopping and cars honking when in front or near crossings, 4 different signages, stop signs, stop lights, school crossing, walk button at intersections, signal timing, countdown, railroad crossing, peds, traffic behavior, and 4 transit safety edu videos).

5

Play-Test Feaster Charter Elementary School
(The VR game gives personalized feedback based on the player's performance and provides educational videos to watch to aid their abilities and thus improve their scores).

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Feaster Charter Elementary Participants

Date: February 3, 2023 at 8:10 am 10:20 am | Chula Vista, CA

Total of **26 participants**
Ages 11-14 years of age
IRB Approval

73.07% are 7th and 8th grade females (N=19). Compared to 26.92% 7th and 8th grade males (N=7).

46.15% of participants are **7th grade** females. Compared to 23% 7th grade males.

26.92% (N=7) of participants are **8th grade** females. Compared to 3.84% of 8th graders are male.

Kids 4 Safe Routes VR Game Levels

0

Tutorial
(Users learn how to play the game. Users can leave anytime)

No grading for the tutorial level.

1

Level 1: Go to the coffee shop
(4 corner intersection with white ped. Zebra crosswalk & traffic lights with button with sound and ped sign countdown of 12 sec)

1.Cars stopped. 2. Time on road 3. Time crossing when ped light is red.

2

Level 2: Go to the basketball court

(T style stop sign intersection, with white pedestrian zebra crosswalk)

1.Cars stopped. 2. Time on road 3. Time crossing when ped light is red.

3

Level 3: Go to your friend's house
(School crossing intersection with button to request stop, with yellow ped. zebra crossing)

1.Cars stopped. 2. Time on road 3. Time crossing when ped light is red.

4

Level 4: Railroad intersection
(Railroad intersection that emits sound and flashes lights when train passes)

1.Cars stopped. 2. Time on road 3. Time crossing when ped light is red.

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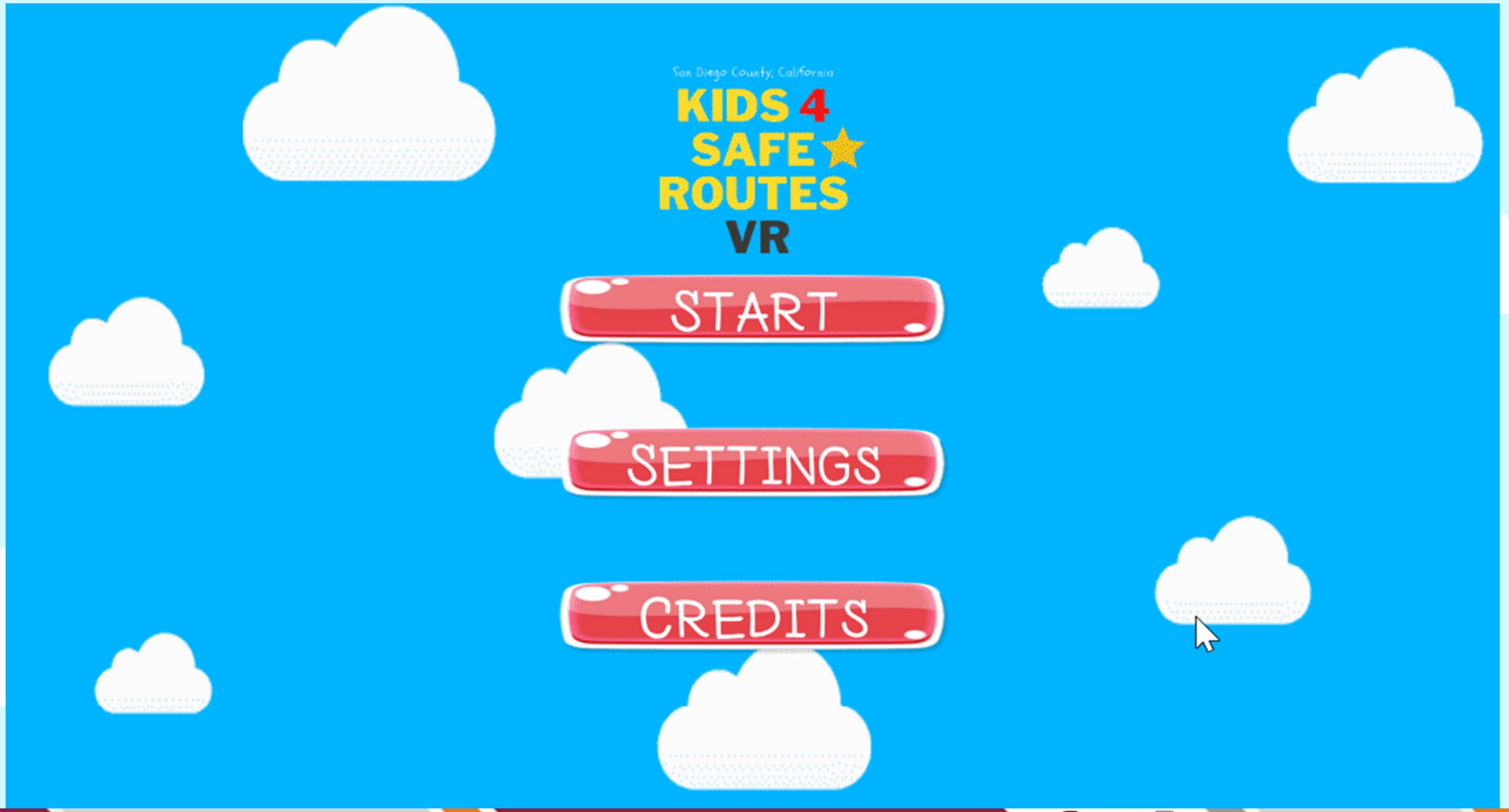
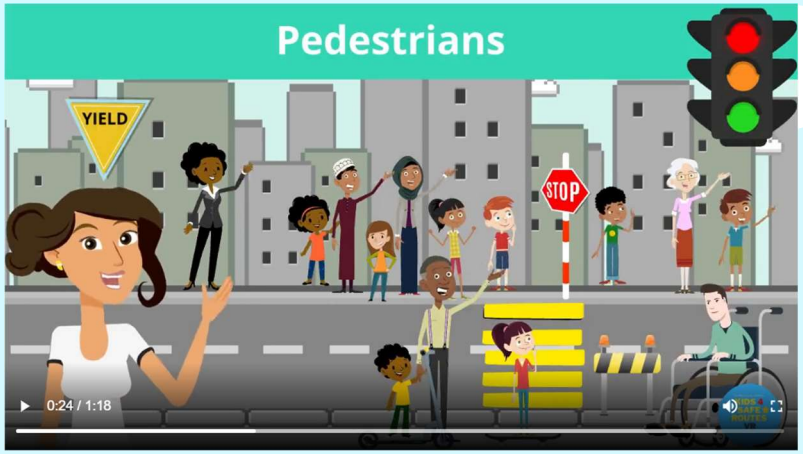

San Diego County, California
KIDS 4 SAFE ROUTES VR
START
SETTINGS
CREDITS

Kids 4 Safe Routes VR Game: Educational Videos



Pedestrian and Vehicle Safety

Road and Traffic Signal Safety

Crosswalk Safety

Railroad Safety

Kids 4 Safe Routes VR

Kids 4 Safe Routes VR Game: A Closer Look

Time on Levels
(seconds)

Time on Roads
(seconds)

Time on red light crossing
(seconds)

Cars Stopped

Evaluation/Grade

Kids 4 Safe Routes VR Game

SAFE-D
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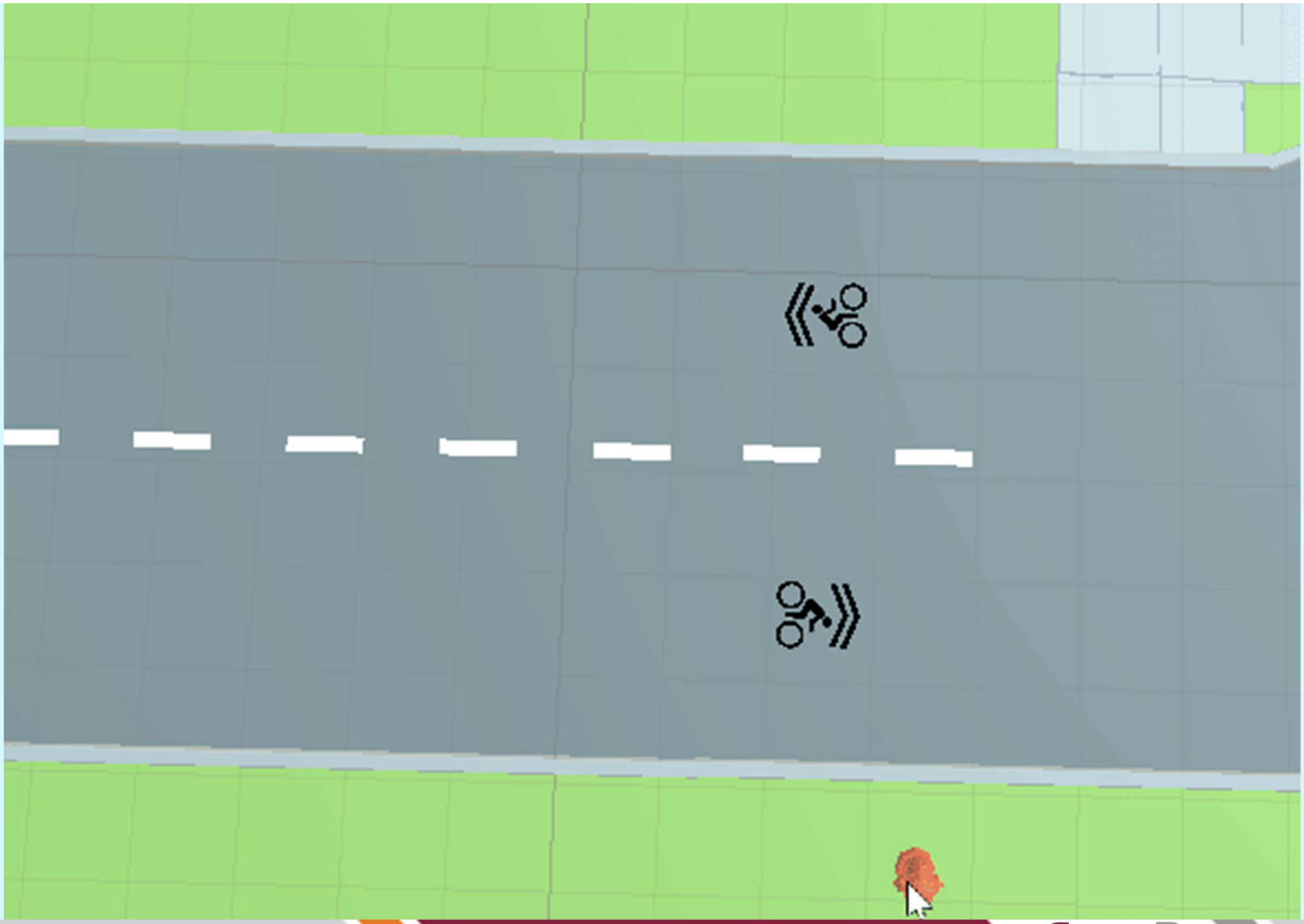
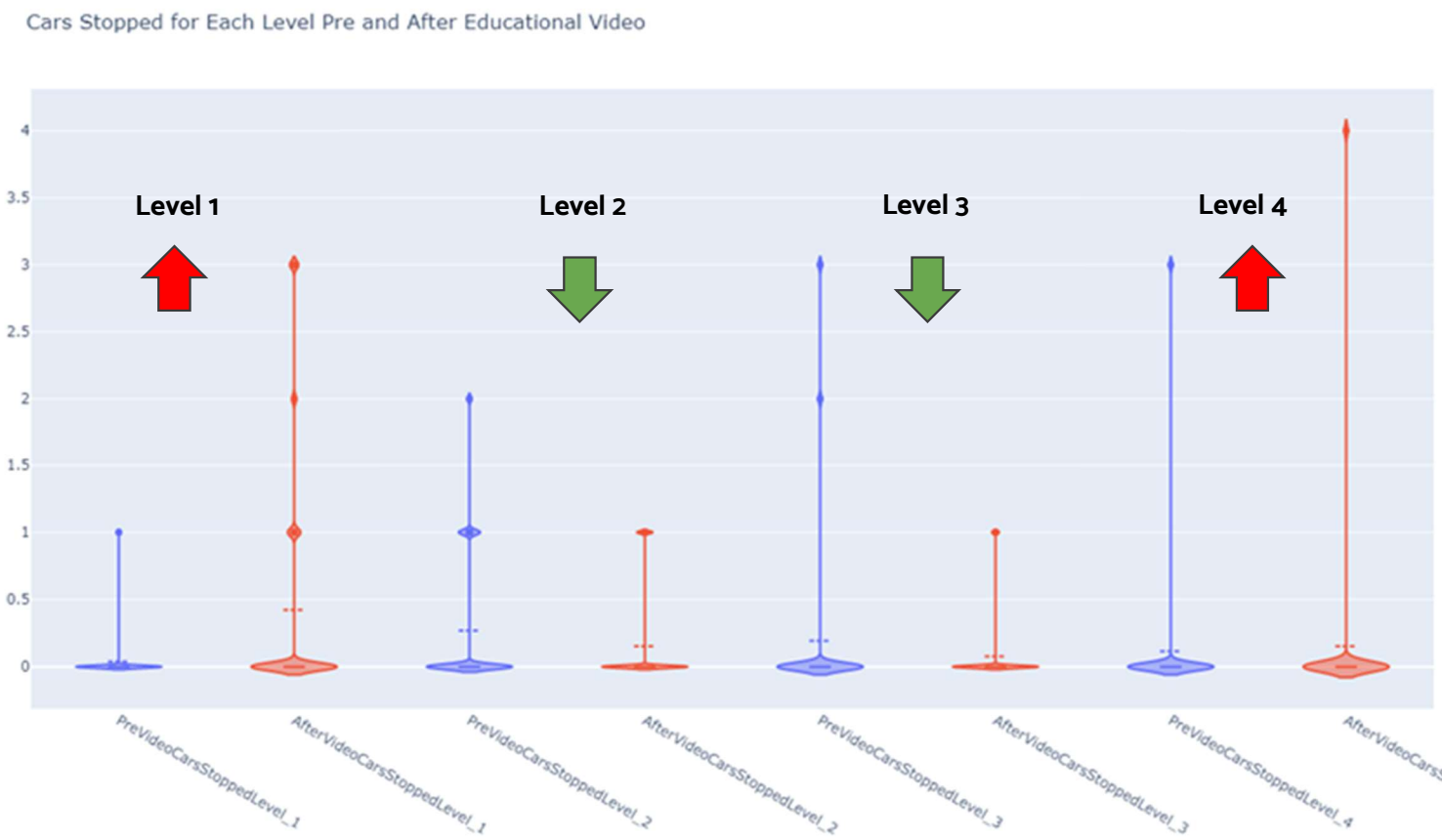


Feaster Charter Elementary School

Results and Discussion

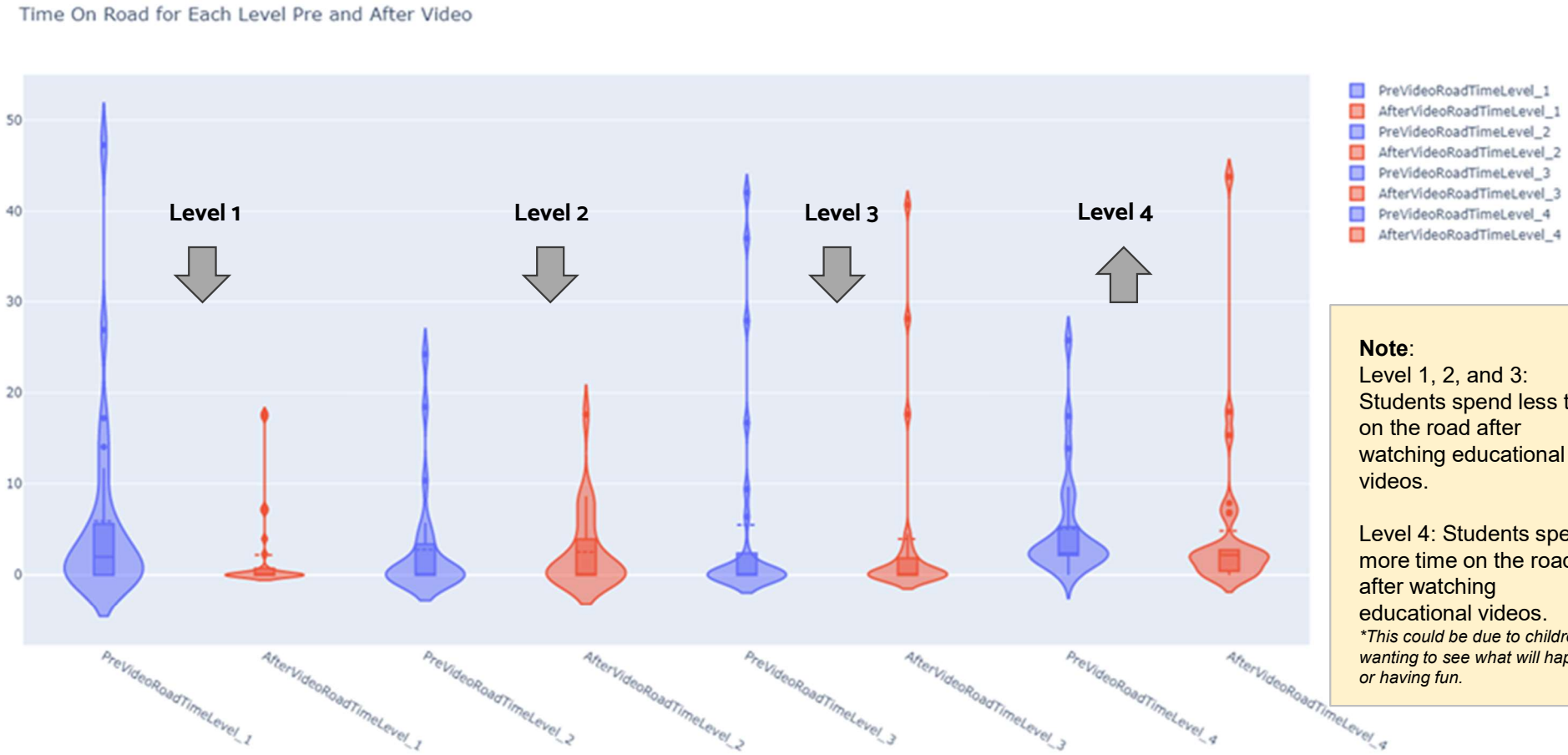
Cars Stopped for each level pre and after educational video



Note:
Level 1, 4: More students stopped more cars after watching educational videos.
**This could be due to children wanting to see what will happen or having fun.*

Level 2, 3: Students performed better after watching the educational videos.

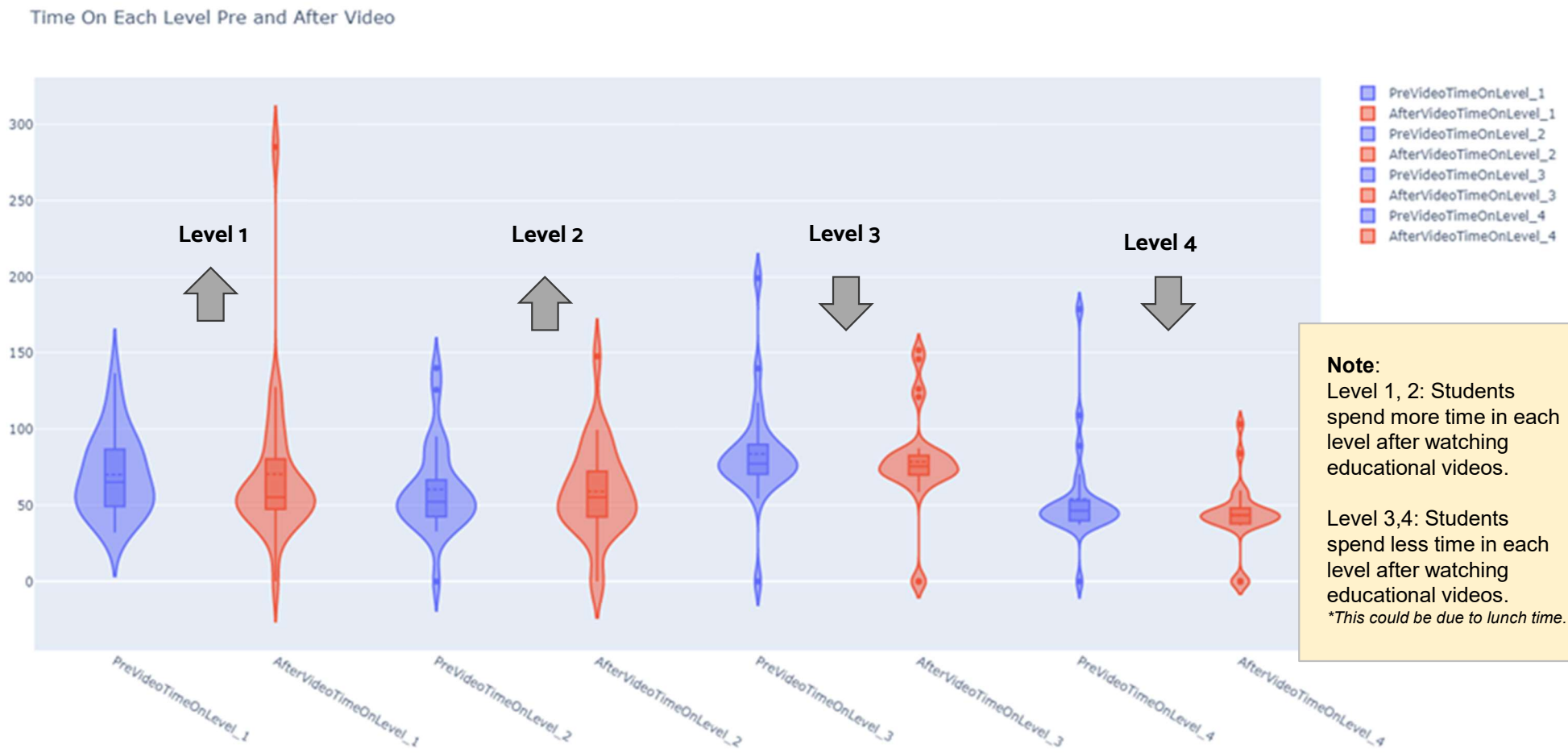
Time on road for each level pre and after video



Note:
Level 1, 2, and 3: Students spend less time on the road after watching educational videos.

Level 4: Students spend more time on the road after watching educational videos.
**This could be due to children wanting to see what will happen or having fun.*

Time on each level pre and after video



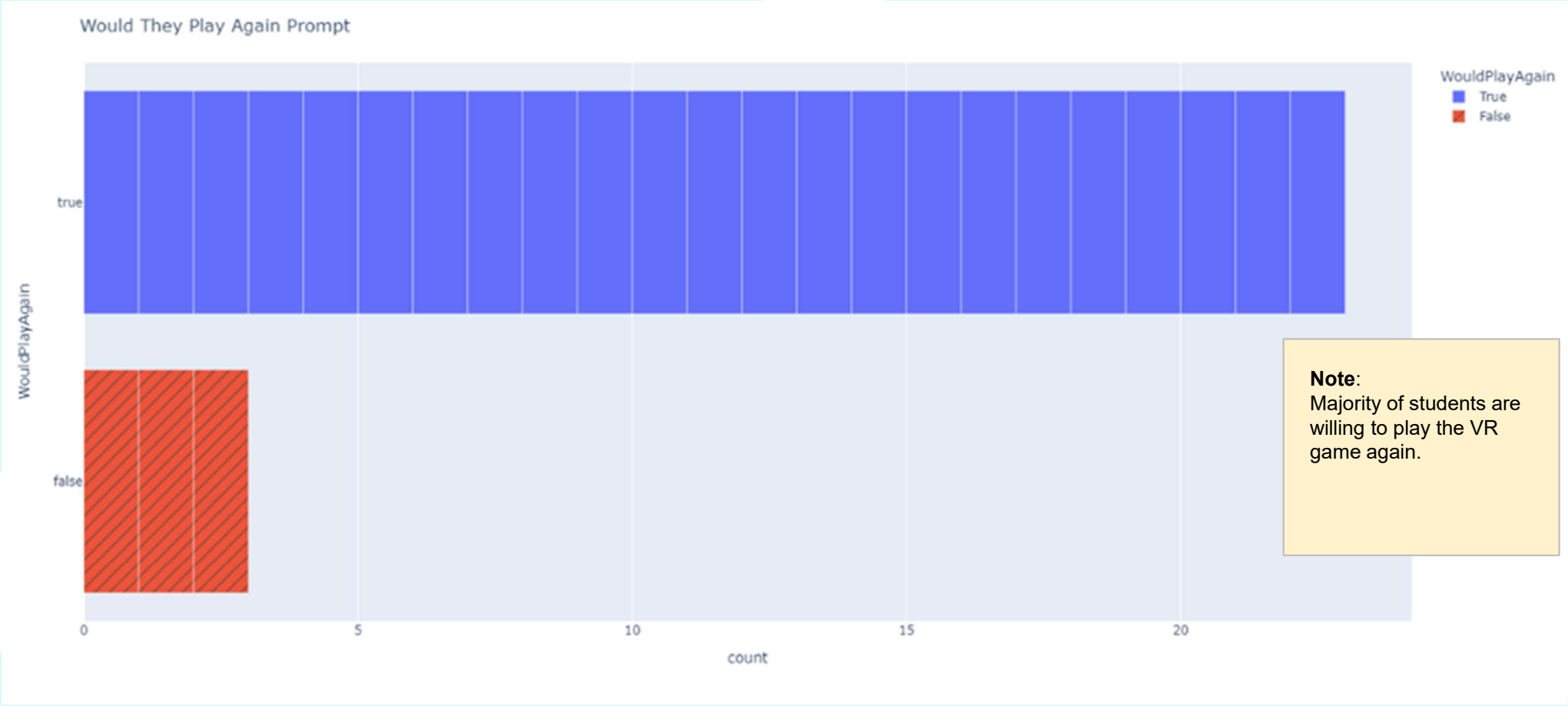
Note:
Level 1, 2: Students spend more time in each level after watching educational videos.

Level 3,4: Students spend less time in each level after watching educational videos.
**This could be due to lunch time.*

Time on red light crossing for each level pre and after video

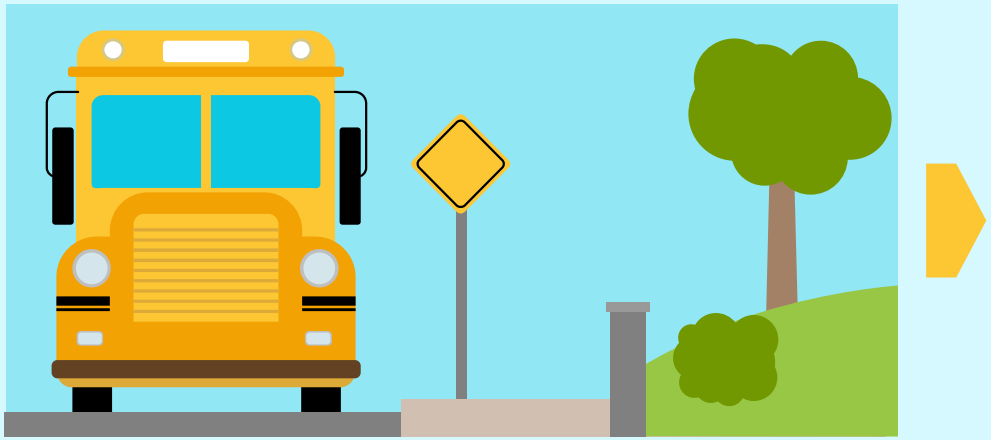
Note:
Students performed better on all levels after watching the educational videos and crossed less on red (jaywalked).

Would you play again?



Note:
Majority of students are willing to play the VR game again.

Results



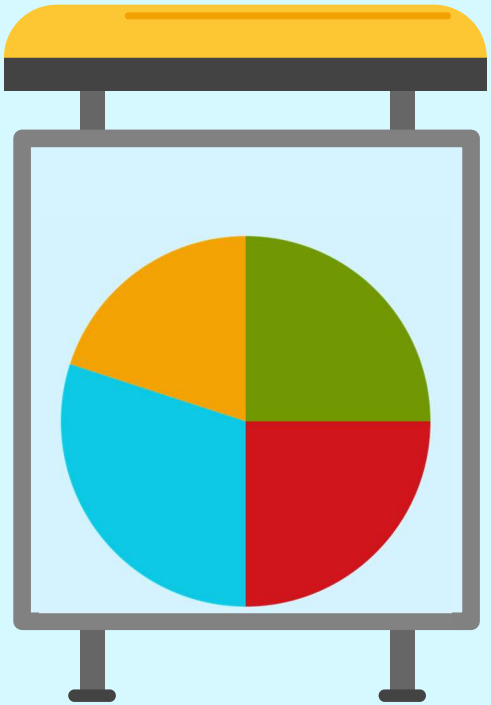
1

2

From the total 26 samples collected, we can say for certain that **time taken on each level reduced drastically in Level 3 and Level 4, after students watched the educational videos**. While Level 1 and Level 2 students spend more time in each level after watching the educational videos.

In Level 1, 2, and 3 students' spend less time walking on the road after watching the educational videos. However, in **Level 4** students spend more time on the road after watching educational videos.

Results



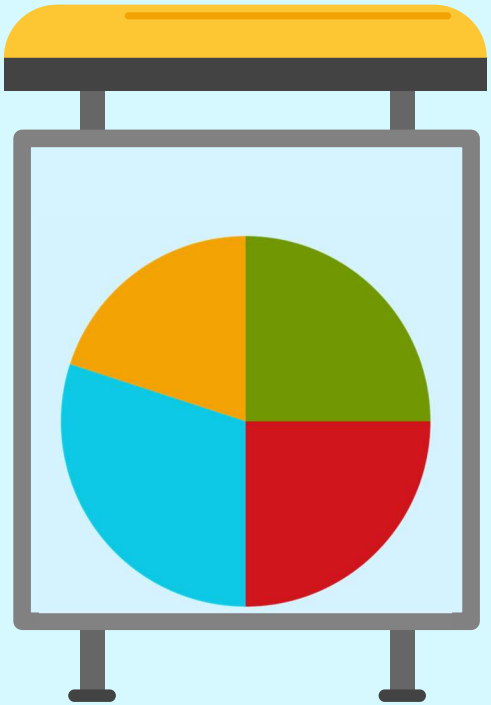
3

Another metric collected was the **number of cars each student stopped per level**. **Level 1 and Level 4** more students stopped cars after watching educational videos. These were students that did not follow safe walking behaviors. The number of cars each student stopped per level decreased in **Level 2 and Level 3** after watching the educational videos.

4

Lastly, the last metric collected was how many **seconds it took students to cross intersections when pedestrian lights were red**, and for this, **time was reduced across the board for all levels** after watching educational videos, with a few exceptions of students that just wanted to finish the game, this occurred more often in boys.

Limitations and Future Research



1. Some of the major limitations include the device the game is running on, things such as compatibility are important to consider when playing this game on new devices. The data gives us much more to be desired, with things such as whether they looked both ways when crossing, where they ran at intersections, and even the path they chose to the end goal.

2. Test the Kids 4 Safe Routes VR Game in other elementary schools in San Diego County, CA.

3. Target younger children below the ages of 11. Develop shorter educational animated videos and integrate new transit safety features/themes into the VR game environment.

4. Collect further data relating to behaviors during the VR game intervention such as running speed, looking side to side before crossing, and much more.

Acknowledgements

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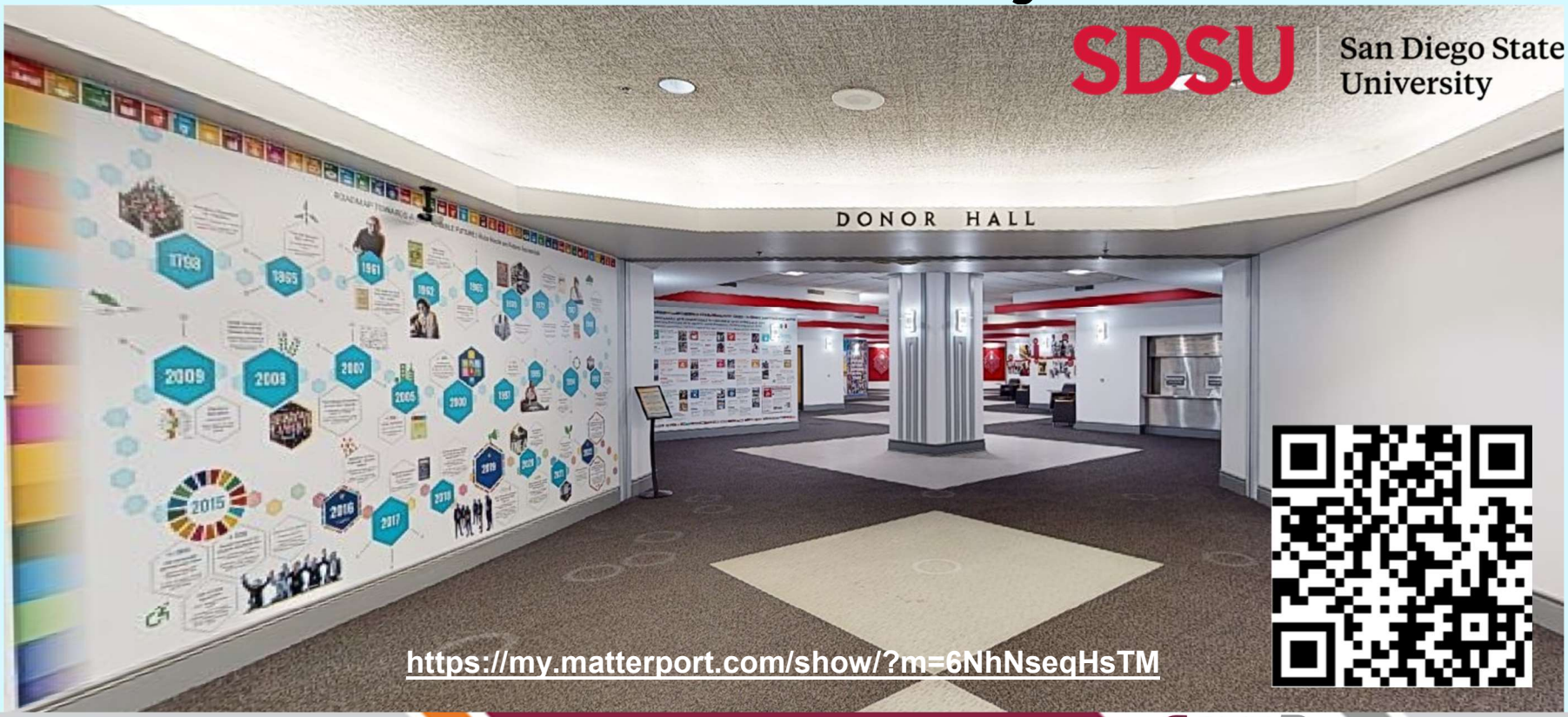
Publications and Presentations

Four poster presentations resulted from this project as listed on the project website: **SDSU Student Research Symposium** (San Diego, CA), **ESRI User Conference** (San Diego, CA), **One Health International Conference** (Catania, Italy), and the **International Conference on Sustainable Development** (New York, New York).

San Diego State University Library Exhibition, "Metabolism of Cities Living Lab SDSU 4 SDGs Leave No One Behind Exhibition" (San Diego, CA)

Metabolism of Cities Living Lab SDSU 4 SDGs Leave No One Behind Virtual Exhibition at SDSU Library



Evaluating the Safe Routes 2 School transportation program in socially vulnerable communities in San Diego County, CA

This project explored socially **vulnerable communities in San Diego County** to evaluate the impacts of the **Safe Routes 2 School (SR2S) federal program** and identified accident (injuries and fatalities) hot spot areas for future routing improvements, developed and designed: a SR2S web-based visualization tool for easy road safety monitoring and reporting, a virtual reality educational transit safety training game for children ages 11 to 14 years old, and strengthened community collaboration across San Diego County.

Project ID: 06-011 | **Fund:** Safe-D National UTC | **PI: Dr.** Gabriela Fernandez (Metabolism of Cities Living Lab, SDSU) | **Co-PI:** Dr. Sahar Ghanipoor Machiani (Star Lab, SDSU), Dr. Arash Jahangiri (Star Lab, SDSU), and Dr. Ming-Hsiang Tsou (Center for Human Dynamics in the Mobile Age, SDSU) | **SDSU Researchers:** Andrick Mercado and Bita Etaati | **Volunteers:** Carol Maione, Kyle Fontelera, Chris Swindell, Amir Reza Sadeghi, and Nell Ahangarfabrik | **Feaster Charter Elementary:** Rosario Villareal (Executive Director) and Meagan Ramirez (Principal) | **Location:** Chula Vista, CA

VR Transit Safety Game

Dashboards

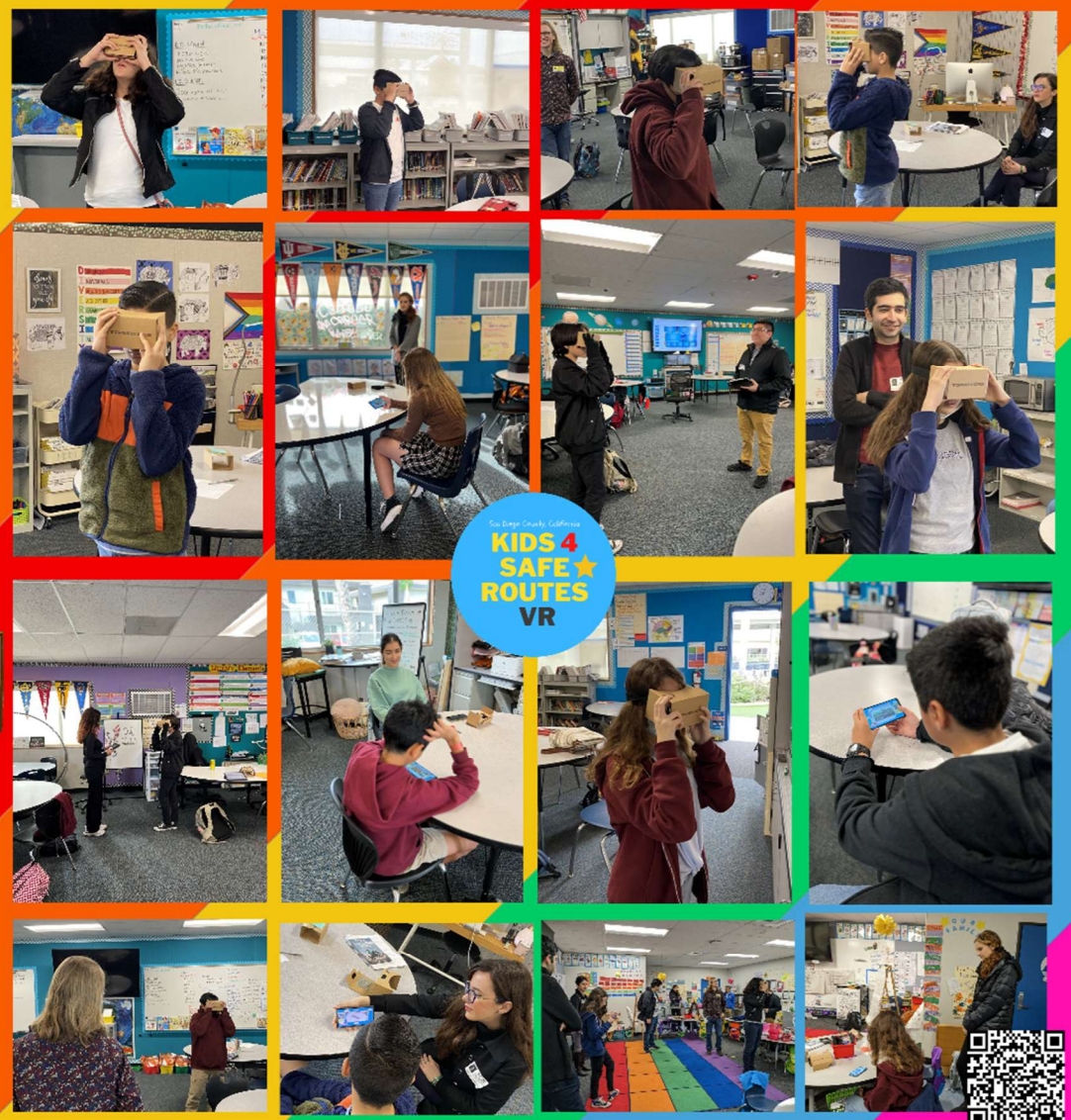
Network

SAFE-D SAFETY THROUGH DISRUPTION

SDSU METABOLISM OF CITIES Together for the SDGs LIVING LAB

SDSU-STAR Lab

HDMA @SDSU



Pedestrian and Bicycle Safety Visualization Tool in Chula Vista, CA

Thank you for your attention!

Questions?

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Project Website: https://storymaps.arcgis.com/stories/9b51cd43c22f4868be64c1ae74e458f8

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