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

May 2023 | Final Report

SAFE-D
SAFETY THROUGH DISRUPTION

Texas A&M Transportation Institute

San Diego State University
Leadership Starts Here

VT | Virginia Tech Transportation Institute
Virginia Tech

Disclaimer

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. This document is disseminated in the interest of information exchange. The report is funded, partially or entirely, by a grant from the U.S. Department of Transportation's University Transportation Centers Program. However, the U.S. Government assumes no liability for the contents or use thereof.

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. 06-011	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Evaluating the Safe Routes to School (SRTS) Transportation Program in Socially Vulnerable Communities in San Diego County, California		5. Report Date May 2023 6. Performing Organization Code:
7. Author(s) Gabriela Fernandez, Bita Etaati, Andrick Mercado, Arash Jahangiri, Sahar Ghanipoor Machiani, Ming-Hsiang Tsou, Christian Mejia		8. Performing Organization Report No. 06-011
9. Performing Organization Name and Address: Safe-D National UTC San Diego State University 5500 Campanile Dr. San Diego, CA 92182		10. Work Unit No. 11. Contract or Grant No. 69A3551747115 Project Number: 06-011
12. Sponsoring Agency Name and Address Office of the Secretary of Transportation (OST) U.S. Department of Transportation (US DOT)		13. Type of Report and Period Final Research Report Start Date: 01/2022 End Date:05/2023 14. Sponsoring Agency Code

15. Supplementary Notes
This project was funded by the Safety through Disruption (Safe-D) National University Transportation Center, a grant from the U.S. Department of Transportation – Office of the Assistant Secretary for Research and Technology, University Transportation Centers Program.

16. Abstract
Child safety concerns are among the strongest impediments to children walking or biking to school, but some students must walk or bike due to financial or other circumstances. These travel modes are more than twice as common among students from low-income households than students from higher income households. The Safe Routes to School (SRTS) program fosters opportunities for students to walk and bike to school safely and routinely. This study provides insights into the SRTS program's effectiveness and potential to improve walking and biking safety in socially vulnerable communities by evaluating the program's impact on schools in the Chula Vista Elementary School District, a vulnerable area in San Diego County. (i) A linear regression model was used to assess the program's impact on each school, and a logistic regression model was employed to identify factors influencing students' walking behavior. (ii) An SRTS web-based interactive tool (ArcGIS Experience) was developed to identify traffic incident hot spots and facilitate future routing improvements. (iii) A virtual reality (VR) road safety training tool for children was developed, and a case study at Feaster Charter Elementary School was conducted to assess its effectiveness. Twenty-six students played the VR game before and after watching traffic safety educational videos, and observations from the VR session were recorded. (iv) The outreach and deliverables from this study strengthened community collaboration across San Diego County.

17. Key Words Pedestrian and bicycle safety, Safe Routes to School, virtual reality, transit safety	18. Distribution Statement No restrictions. This document is available to the public through the Safe-D National UTC website, as well as the following repositories: VTechWorks, The National Transportation Library, The Transportation Library, Volpe National Transportation Systems Center, Federal Highway Administration Research Library, and the National Technical Reports Library.

19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 20	22. Price $0

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Abstract

Child safety concerns are among the strongest impediments to children walking or biking to school, but some students must walk or bike due to financial or other circumstances. These travel modes are more than twice as common among students from low-income households than students from higher income households. The Safe Routes to School (SRTS) program fosters opportunities for students to walk and bike to school safely and routinely. This study provides insights into the SRTS program's effectiveness and potential to improve walking and biking safety in socially vulnerable communities by evaluating the program's impact on schools in the Chula Vista Elementary School District, a vulnerable area in San Diego County.

i. *A linear regression model was used to assess the program's impact on each school, and a logistic regression model was employed to identify factors influencing students' walking and bicycling behavior.*
ii. *An SRTS web-based interactive tool (ArcGIS Experience) was developed to identify traffic incident hot spots and facilitate future routing improvements.*
iii. *A virtual reality (VR) road safety training tool for children was developed, and a case study at Feaster Charter Elementary School was conducted to assess its effectiveness. Twenty-six students played the VR game before and after watching traffic safety educational videos, and observations from the VR session were recorded.*
iv. *Furthermore, this project strengthened community collaboration across San Diego County with outreach and deliverables.*

Acknowledgements

This project was funded by the Safety through Disruption (Safe-D) National University Transportation Center, a grant from the U.S. Department of Transportation – Office of the Assistant Secretary for Research and Technology, University Transportation Centers Program. Special thanks to Feaster Charter Elementary School (Rosario Villareal, Meagan Ramirez, and Jennifer Diaz), San Diego State University, Metabolism of Cities Living Lab, Center for Human Dynamics in the Mobile Age, and Star Lab volunteers and researchers for making this project possible (Dr. Gabriela Fernandez, Dr. Ming-Hsiang Tsou, Dr. Sahar Machiani, Dr. Arash Jahangiri, Bita Etaati, Andrick Mercado, Christian Mejia, Carol Maione, Chris Swindell, Kyle Fontelera, Nell Ahangarfabrik, and Amir Sadeghi). We also appreciate the invaluable contributions of Mila and Ella Camarena to our project logo. Thank you to Ella Camarena for her permission to use her exceptional voice in our educational animated Powtoon videos. Thank you to Laurel Glenn, Lydia Lunning, and Michael Buckley at Safe-D for editing our final report. Finally, special thanks to the San Diego Association of Governments staff for serving as our Project Champions (Marisa Mangan and Samual Sanford) and Subject Matter Experts (Josh Clark).

Table of Contents

List of Figures

List of Tables

Introduction

Chula Vista, the second most populated city in San Diego County, is home to almost 270,000 people, 25% of whom are children under 18 [1]. There are at least 52 elementary schools located in this city, mostly elementary schools with students from kindergarten to sixth grade [2].

The Social Vulnerability Index (SVI) from the Centers for Disease Control and Prevention (CDC) and Agency for Toxic Substances and Disease Registry identifies Chula Vista as one of the highest socially vulnerable cities in San Diego County [3]. This index measures the social vulnerability of census tracts based on 16 census-derived factors, such as poverty and an individual's vehicle access, and summarizes them into four main themes. Figure 1 shows the 2020 SVI themes for all census tracts in San Diego County (socioeconomic status, household characteristics, racial and ethnic minority status, and housing type/transportation).

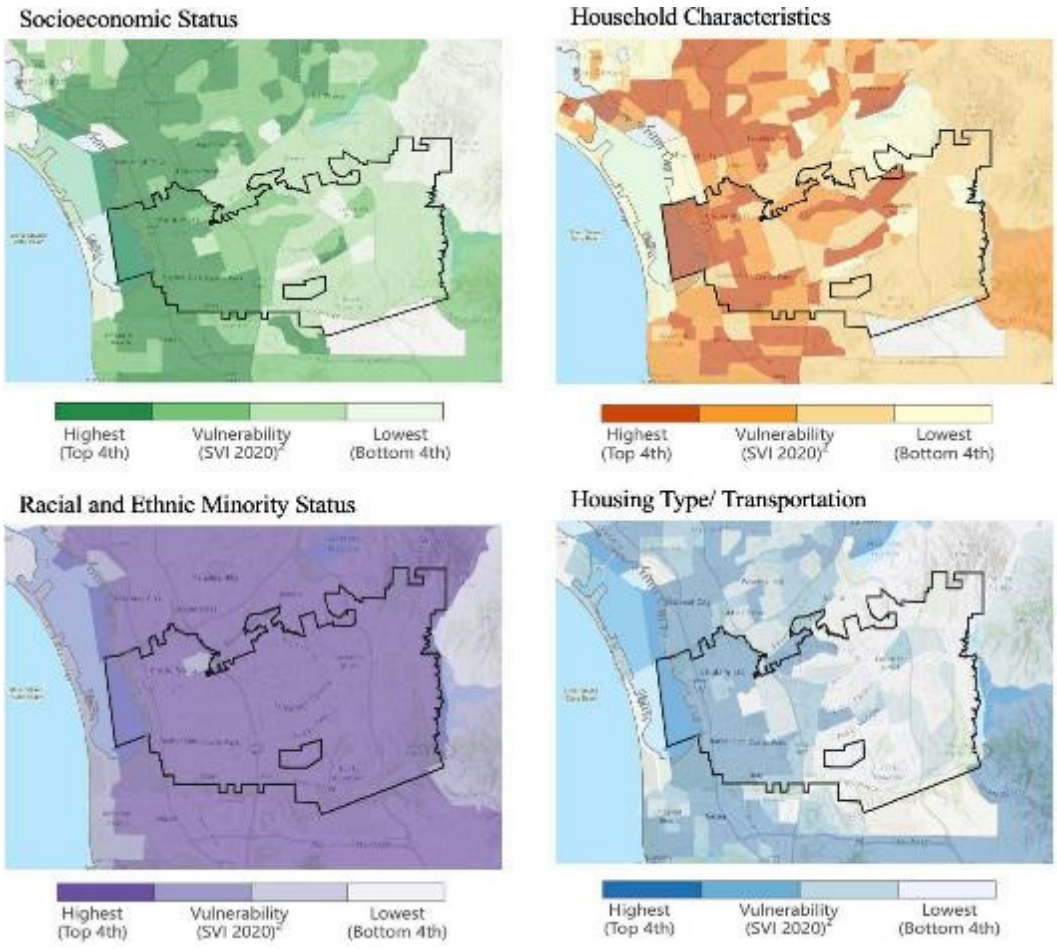


Figure 1. Maps. Chula Vista SVI (created with ArcGIS).

Approximately 37.8% of school-aged children in Chula Vista were reported as overweight/obese by 2010 [4]. Per the CDC recommendation, school-aged children and adolescents need to be physically active for at least 60 minutes every day [5]. However, only one third of children are

reportedly getting this amount of daily exercise. Daily physical activity can play an important role for children who are obese. Children and adolescents who participate in physical activity are less likely to become overweight and obese during their youth and adolescence, and they are less likely to become obese as adults [6]. Researchers believe an active commute to school may contribute to boosting physical activity and decreasing childhood obesity [7, 8].

Safe Routes to School (SRTS) is a federally funded program developed by the U.S. Department of Transportation that encourages students to walk and cycle to school. The program is based on the "6 Es": engagement, equity, engineering, encouragement, education, and evaluation. The program focuses on both infrastructure improvements and educational programs, with the goal of increasing active transportation among students. Since 2005, more than 14,000 schools across the United States have participated in SRTS [9].

In the 40 years from 1969 to 2009, the average number of students walking or cycling to school decreased from 42% to 13%. In 1969, 87% of students who lived within 1 mile of school would walk or bicycle to school; this number decreased to almost half (47%) in 2009 [10].

The Chula Vista Elementary School District (CVESD) has been an active SRTS participant since 2007. Numerous activities and projects were initiated by SRTS in CVESD, including pedestrian safety educational programs and bicycle rodeos [11].

Surveys can be a powerful and cost-effective tool for gathering information from a large population [12]. The National Center for Safe Routes to School program (saferoutesinfo.org) offers two standardized surveys: Parent and Tally. These surveys gather information about student arrival/departure modes of transport and influential elements when traveling to/from school, what factors affect whether parents allow their child to walk or bike to school, the presence of key safety-related conditions along routes to school, and related background information. These surveys help to determine how to improve opportunities for children to walk or bike to school and measure parental attitude changes as local SRTS programs are implemented [13]. To evaluate the SRTS program's effectiveness in improving the walking and biking trends of CVESD students, Tally and Parent surveys were collected before, during, and after SRTS activities.

This research investigated parental concerns regarding active transportation to/from school, how these concerns have impacted students' willingness to walk/bike to school, and if socioeconomic/demographic features affect active transportation statistics in CVESD. The study also analyzed whether the SRTS activities increased the percentage of students using active transportation and whether the number of students walking/cycling to school changed with respect to the program period (before, during, and after the program ended).

In addition, to analyze student traffic behavior, this research analyzed pedestrian and bicycle crashes located near CVESD schools and how area characteristics, crash characteristics, and demographics may have impacted these incidents.

In 2019, crashes were the fourth major cause of death in the United States [14]. Hence, reviewing school neighborhood traffic safety and crash rates is an important step for communities to ensure safe school trips for students. This research investigated the underlying factors contributing to crashes involving a pedestrian or bicycle and how they can be prevented or at least minimized.

Young pedestrians are among the groups most vulnerable to becoming traffic crash victims [15]. Previous studies have suggested that, with the right instruction and direction, children as young as 7 and 8 years of age can learn how to become safer pedestrians, and behavioral interventions are effective in improving children's traffic safety [16]. Therefore, developing educational tools tailored for children to learn about traffic safety can be extremely beneficial.

Transit road safety is not currently part of the core curriculum in K-12 education. In the second section of this research, a virtual reality (VR) transit safety simulation game (Kids 4 Safe Routes VR Game) was developed to incorporate more engaging methods to illustrate safe and dangerous traffic situations and task scenarios for students. The VR game simulates an animated virtual urban environment in which users need to complete tasks to navigate their way around the virtual city.

This VR transit simulation game is a training tool that aims to make the trip to and from school safer for children. This affordable and accessible VR game can be installed on smartphones and only costs $6 to $10 to purchase Google Cardboard VR glasses to play. The Kids 4 Safe Routes VR Game is a fun and interactive tool that simulates different traffic scenarios for students in four different levels and teaches children how to safely navigate roads, intersections, crosswalks, traffic, and suitable crossing points. It also familiarizes users with transit signage to make safe decisions when crossing the road to/from school.

Background

Previous SRTS Evaluation Studies

Previous studies on the SRTS program's effectiveness have focused primarily on safety and travel behavior changes before and after the program interventions. However, these studies mostly highlight the effects of infrastructure improvement. In a pre-post analysis on the infrastructure improvement in selected parts of California, Boarnet et al. [17] observed an increase in walking or bicycling trends of students whose safe route differed from their usual route. In an analysis of Parent survey responses and 2-day observations before and after construction improvements at each school site, Boarnet et al. concluded that traffic improvements may not be sufficient to increase cycling and walking in schools with low levels of activity [18].

Previous work suggests that both infrastructure and non-infrastructure measures can be effective in promoting walking and biking to school. Educational activities and encouragement can be as important as infrastructure improvements in increasing the percentage of students who walk and bike. Results from Parent and Tally surveys revealed that SRTS encouragement programs were associated with a 25% increase in walking and bicycling, while infrastructure improvements were

related to an 18% relative increase in active travel to school in Texas, Florida, and Oregon [19]. Another study by Lizarazo et al. [20] found that education and encouragement programs had a more significant effect on walking and bicycling trends than did infrastructure measures such as new sidewalks, crosswalks, and bike lanes. Even 1-day encouragement events such as "International Walk to Day School" and the "Fill the Rack!" program in Idaho showed an increase in student participation on the day of the event and a few weeks after [21]. In California, the SRTS program increased the rate of students walking and bicycling to school in the long-term. Even after 10 years of the SRTS program, Ragland et al. [22] noted that the participant schools continued to report a higher percentage of students walking and bicycling than schools that did not participate.

In some cases, SRTS educational programs have also contributed to improving traffic safety, leading to a reduced number of pedestrian and bicycle injuries [23]. Nevertheless, identifying factors affecting pedestrian/bicycle crashes should not be taken lightly. In a study by McArthur et al. [24], traffic volume, speed limit, and a higher proportion of commercial land use were the most significant factors affecting the frequency of child pedestrian and bicycle crashes near schools.

Traffic Incident Hot Spot Visualization Tool

Heat maps are commonly used to classify and visualize spatial and geographic information system (GIS) data, particularly in the field of traffic safety. These tools can be a practical method to identify high-risk areas, also known as black spots, based on the frequency of crashes, injuries, and fatalities [25]. For example, tools such as Safe Road Maps utilize heat maps to showcase crash frequencies and traffic fatalities considering two factors: the severity of the collision and the radius of the center of its density. This refers to the specific buffer of location [26].

Researchers have proposed using heat map tools to identify the major factors that contribute to pedestrian injury severity in pedestrian-vehicle crashes and to locate high-risk locations [27]. In one study, Slaughter et al. [28] used hot spot map analysis to identify the location of pedestrian and bicycle injuries and to quantify injury severity levels based on road type and individual behaviors. Therefore, this research team has proposed a visualization tool to identify traffic incident hot spots near schools in the city of Chula Vista.

VR Educational Tool

VR is an artificial environment that users can experience through images and sounds provided by their phone or computer, and they can use that device to interact with the virtual world [29]. This technology can be used to educate children on traffic safety by creating a realistic and inviting artificial environment as an alternative to real-world conditions, including cars, pedestrians, and trains that interact with the user. Even though there have been fewer tests with younger audiences, the outcome of testing adults with VR technology proved to be noticeable, as the technology created more engagement with the material, thus improving the learning process [30].

Similar applications of this technology have already been made to address the problem of child traffic safety, such as Virtual Road World [31]. In this VR game, the objective is to teach children

ages 7 to 11 how to practice traffic safety through in-game feedback. Virtual Road World guides the player on what not to do and scores them, accordingly, requiring the user to complete a series of quests as they navigate their way around a virtual city. Another study from 2016 described how a sample of children completed six 15-minute VR training sessions in the virtual world the researchers had created, with results demonstrating improvement in the children's traffic behavior. Those researchers concluded that the VR environment showed promise for teaching children to be safer pedestrians; however, more testing was required to confirm results [32].

Method

The National Center for Safe Routes to School has defined the 6 Es framework (engagement, equity, engineering, encouragement, education, and evaluation) as the key steps to ensure the program's effectiveness. The National Center has also emphasized the importance of program evaluation as the final step. Program evaluation is essential to assess if the objectives of the strategies are being achieved and to ensure that resources are allocated to initiatives with the highest probability of success.

As part of the evaluation tools this center offers, researchers are encouraged to study Tally and Parent surveys for better insight into the school travel environment. According to the *Safe Routes to School National Partnership Local School Project Evaluation Handbook* [33], it is best to collect and compare data from the SRTS surveys before, during, and after SRTS program activities at each school. Accordingly, this research highlights the impact of the SRTS program time frame (before, during, and after program implementation) on students walking/bicycling to school.

CVESD Safe Routes to School Background

The SRTS program in CVESD has partnered with the San Diego County Bicycle Coalition and Circulate San Diego to provide bicycle education activities to students. These activities equipped students with the skills to stay safe while biking and walking to and/from school [11].

The SRTS program has also implemented several other initiatives to make it safer for students to walk and bike to school. These initiatives include:

- Established SRTS programs in four pilot schools: Cook Elementary, Juarez Lincoln Elementary, Kellogg Elementary, and J. Calvin Lauderbach Elementary school.
- Conducted walk audits on 27 out of the 46 schools in CVESD: These audits identified and evaluated areas where improvements could be made to make routes to school safer for pedestrians.
- Implemented a weekly "Walk on Wednesdays" event at all CVESD schools: This event encouraged students to walk to school on Wednesdays.
- Partnered with senior citizens to participate in enforcement activities during Walk to School Days: This has increased safety and brought different members of the community together.

- Created suggested route maps and deficiency maps: These maps have been used to inform decisions about infrastructure improvements and to obtain future funding.
- Conducted travel surveys at the beginning and end of a project to analyze change over time: These surveys have shown that the number of students walking and biking to/from school has increased significantly since the program began.

Data Collection

Various data sources were collected and analyzed for this project. The National Center for Safe Routes to School [34] Tally and Parent datasets were gathered and consolidated for all SRTS participant schools in CVESD. The Parent survey collects information from parents/guardians on their children's travel behavior, including their usual transportation mode and how far they live from their school, and the concerns parents may have about active transportation. The Parent survey mainly focuses on the issues that may affect parents' willingness or permission for their children to walk/bicycle to school. This survey includes information about the child's usual transportation mode, child background information (age, gender), and if parents are concerned about the 12 issues mentioned in the survey (Appendix A). This survey can be used as a powerful tool to investigate the underlying reasons why students are (or are not) considering active school travel, and if these issues arise from safety concerns or parents' perceptions. In addition to the Parent survey, student travel behavior can be tracked via the Tally survey. The Tally survey is used to count the number of students using different transportation modes and climate conditions when traveling to and from school in a particular week. The Tally survey gathers data on the number of students and their transportation mode to and from school and is collected by teachers for three consecutive days in a particular week.

For this study, the Parent dataset included 7,508 surveys collected from 19 schools between 2009 and 2011, which was reduced to 6,426 observations after removing missing values. The Tally dataset contained 19,926 students from 41 schools between 2009 and 2019. However, after removing missing values, data from only 12,500 students from 19 schools were used in the analysis due to the availability of SRTS information in the appropriate time frame.

In addition to the available survey data, the research team retrieved new Parent and Tally datasets from a selected school to conduct a case study. The visualization dashboard was created using Esri ArcGIS Dashboards to display the Transportation Information Mapping System (TIMS) dataset in combination with shapefile data from the San Diego Association of Governments (SANDAG) and Chula Vista Open Data. The interactive dashboard displays data in an easy-to-read format and helps make decisions, visualize trends, monitor transit safety status, and facilitate understanding.

Walk Percentage Linear Regression Model

In this study, we have proposed a linear regression model based on the Parent survey data to identify the most important factors influencing a student's decision to walk to school regularly. The walk and bicycle percentage is the proportion of students who walk or bicycle to school, calculated as a percentage of the total number of students at each school. This percentage is

determined for each participating school during three SRTS program periods (before, during, and after the program) based on the Parent survey. However, due to the very low number of observations for bicycling (less than 1% of students bicycle to school), further analysis only focused on the walking percentage. Furthermore, student walking trends can vary between morning and evening, as students may use different modes of transportation to travel to and from school. Therefore, this analysis was conducted for both time frames.

Parent surveys were collected for 19 schools located in the CVESD between 2009 and 2011. However, not all schools conducted surveys for all three periods (see Appendix C for survey availability). We extracted independent variables from the Parent survey and used them alongside the walk percentage as the dependent variable in our analysis. These independent variables included student 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. All independent variables were converted to percentages per school for consistency. To analyze the impact of the independent variables on the student walk percentage, multiple linear regression was chosen. Multiple linear regression is a statistical method used to investigate the relationship between two or more independent variables and a continuous dependent variable and can be applied to behavioral sciences studies [35]. Having two or more highly correlated independent variables in a regression model can cause multicollinearity, which can impact the *p*-value and the ability to identify the statistical significance of predictors. Therefore, identifying highly correlated independent variables is crucial [36, 37].

Data plays an important role in model accuracy. Small datasets can be subject to overfitting, leading to biased error estimation [38, 39]. Hence, many researchers suggest applying cross-validation to get more precise results. After splitting the data into test and train datasets (80:20 ratio), a five-fold cross-validation was applied to the linear model to improve its accuracy.

To further improve our linear model's accuracy, a wrapper method was implemented to select the best feature subset. Wrapper methods can improve the model performance and prevent overfitting for high-dimension data [40]. Stepwise selection, which is a combination of forward selection and backward elimination, repeats adding and removing one variable at a time until no more improvement is seen in the model. By applying stepwise selection to our linear model on the high-dimensional dataset, we were able to select the most significant features. This approach led to a notable improvement in our model's accuracy compared to using all available features. The linear and stepwise models were carried out using the R Stats library.

Walk Prediction Logistic Regression Model

Additionally, we developed a classification model to predict whether students will walk to school based on Parent survey responses. This model was built using the same features as the linear regression model extracted from the Parent survey. The binary response variable indicates whether the student walks as their usual commuting mode (walk = 1) or if they use any other transportation mode (walk = 0). The classification model (logistic regression) is used to find the most significant

factors influencing student walking to/from school. Similar to the linear regression model, logistic regression is a regression model where the response variable is binomial [41]. Using logistic regression, the odds ratio can be derived in the presence of multiple explanatory variables. The odds ratio is a measurement of how strongly outcome and exposure are associated [42].

The Parent dataset exhibits a visible class imbalance, with 80% of instances in the "walk = 0" class and only 20% in the "walk = 1" class. A class imbalance occurs when the number of instances in one or more classes is significantly smaller than those in another class and can negatively impact the accuracy of the classification model. To address the issue of class imbalance in the logistic regression model, this study proposed an under-sampling method using the Synthetic Minority Over-sampling Technique (SMOTE) algorithm. To evaluate the effectiveness of this approach, two 10-fold cross-validation models were developed using the Boot and Stats libraries in R. One model was developed using the full dataset, while the other was developed using the under-sampled dataset. An 80:20 train-to-test ratio was employed for both models. Accuracy and area under the curve (AUC) were used as performance metrics, and the two models were compared to determine which was more accurate. Additionally, feature significance and odds ratios were calculated to identify the significant factors affecting students' walking habits. By utilizing these advanced statistical techniques, the study was able to develop a comprehensive model of the factors affecting student walking behavior and evaluate the effectiveness of the SRTS program in promoting safe and routine walking habits.

Model Evaluation Metric

It is common practice to use both the root mean square error (RMSE) and mean absolute error (MAE) when evaluating regression models. Both metrics measure the difference between predicted and actual values of the response variable, but they behave differently when dealing with errors. RMSE is calculated by taking the square root of the mean of the squared differences between the estimated and actual values, whereas MAE takes the mean of the absolute differences between the estimated and actual values. To evaluate the performance of a model, it is necessary to use a variety of metrics, which may include RMSEs and MAEs [43, 44]. Therefore, RMSE and MAE were selected as the evaluation metrics for the proposed linear regression.

The AUC measure is used as a metric to evaluate the performance of a classification model [45, 46]. A value of 1 indicates an ideal model that can accurately separate positive and negative classes, while 0.5 indicates that the model performs no better than random. In addition to the AUC, a confusion matrix can be used to further evaluate the discrimination of the best (optimal) classifier [47]. For the logistic regression classification models proposed in this study, we analyzed both the AUC and confusion matrix to evaluate their performance.

Analyzing the SRTS Impact on Walking Trends

To evaluate the effectiveness of the SRTS program on influencing walking trends, it is important to investigate its impact across the three program periods. To examine the association between two categorical independent variables, namely walking to school and program period, the chi-square

test can be used. The chi-square test conducted in this research investigated the difference in the means of the response variable, which is the percentage of students walking to/from school based on the Parent survey, and the independent variable, which is the program period with three levels: before (Before Program), during (Mid Program), and after (Post Program).

The percentage of students walking was also calculated based on the Tally survey, and the results were compared to validate the findings from the chi-square test. Almost 12,500 students from 19 schools participated in the Tally survey from 2010 to 2019 before, during, and after the program. In this case, the walk percentage represents the average percentage of students walking to/from school over three consecutive Tally days. To examine the association between walking trends and student age, the walk percentage was calculated per grade for different program periods.

Web-based Crash Visualization Tool

Studying crashes that occur near schools can help identify the causes of crashes that may affect students; this, in turn, can lead to the development of targeted interventions to reduce the likelihood of such incidents and potentially change policies. The TIMS is a transportation database managed by the Federal Highway Administration [48] that provides information on geocoded crashes, including crash types, collision severity, time, and contributing factors. As part of this project, an interactive dashboard was created using ArcGIS Dashboards based on the TIMS dataset of pedestrian and bicycle crashes in Chula Vista from 2010 to 2021, which was collected from police reports and includes over 1,400 crash reports.

Using shapefiles provided by SANDAG [49] and the City of Chula Vista Open Data [50], several indicators related to the built environment were taken into consideration, including information such as speed limits, streetlights, and available bike routes. Additionally, an infographic shows information about victims of the crashes, including gender, race, and age. The interactive map allows users to view crashes based on collision severity.

This dashboard consists of three tabs (Built-in Environment, Collision Severity Interactive Map, and Other Information). The pedestrian and bicycle heat map at the top left of the dashboard indicates the historical pedestrian and bicycle crashes with CVESD schools pinned on the map. The Bicycle and Pedestrian Accidents Visualization in Chula Vista web tool displays general information such as bike routes, streetlight maps, land use, road condition, and road surface in Chula Vista. It also displays the number of collisions by age, race, and gender and provides a heat map of collisions where the victims were under 19 years of age. In addition, the dashboard displays the victim's infographic and the collision's built-in environment; two interactive maps (crash locations based on collision severity and crashes based on time and weekday) are shown to provide more in-depth information (Appendix I). Figure 2 provides a screenshot of the dashboard interface.

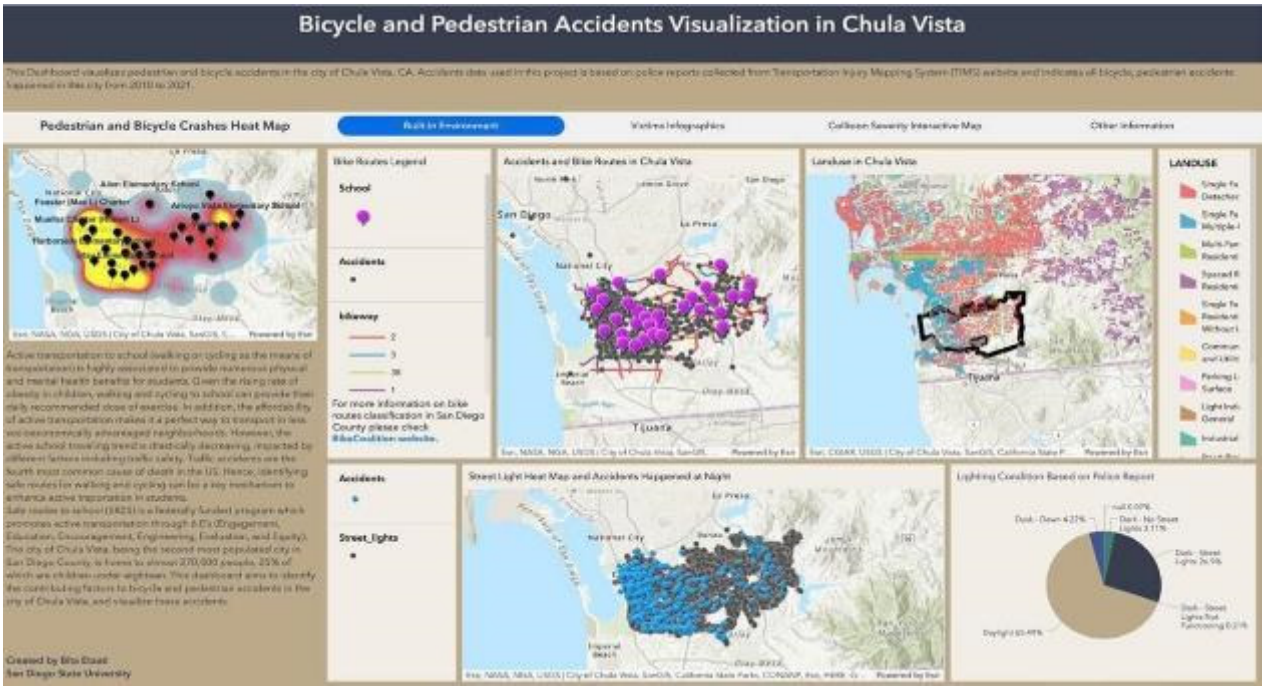


Figure 2. Screen capture. Dashboard built-in environment.

The analysis of the pedestrian and bicycle crash data in Chula Vista highlights several important trends and patterns. Most of these crashes occurred in the western areas of the city, with daytime being the most common time for crashes to occur. Males were the most common victims of these crashes, accounting for 70% of all recorded cases. While most crashes were not severe, with victims mainly complaining of pain, 15% of the crashes were fatal. It is particularly noteworthy that most of these fatal crashes occurred in the western areas of Chula Vista, indicating the need for targeted interventions and improvements in this region to reduce the risk of severe crashes.

Kids 4 Safe Routes VR Game

Given the small amount of VR educational tools of this nature, the Kids 4 Safe Routes VR Game training tool implemented features based on what other available tools did not have. The study team employed a popular game engine called Unity to create the 3D virtual world [51] and used Google Cardboard to support VR on iOS and Android devices (Figures 3 and 4).

The backend of the VR game was programmed to collect player game scores, using Firebase software as a primary cloud storage provider, which is a set of hosting services for any type of application, including Android and iOS (Appendix K). The software offers NoSQL and real-time hosting of databases, content, social authentication, and notifications, or services, such as a real-time communication server that is free after a set size is reached. The features of the Kids 4 Safe Routes VR Game include cars that interact with the player, such as stopping and honking when the player is in front of or near cars; two different types of intersections, a T-intersection and highway-railroad grade crossings; four different signages, including stop signs, stop lights, school crossing, and walk button at intersection; signal timing; countdown; bike lanes; and railroad

crossings (Appendix N and Appendix O). Pedestrians are a feature the player can see while navigating the game, which allows users to observe proper traffic safety behavior.

Lastly, the VR training tool gives personalized feedback based on the player's performance, and the player receives educational videos to improve their abilities and thus improve their scores. The team based this personalized feedback on parameters they created using C# and Firebase; essentially, users receive feedback based on each grading category—if they do well, the game will tell them, and if they do badly, they receive short tips on what behavior to avoid.

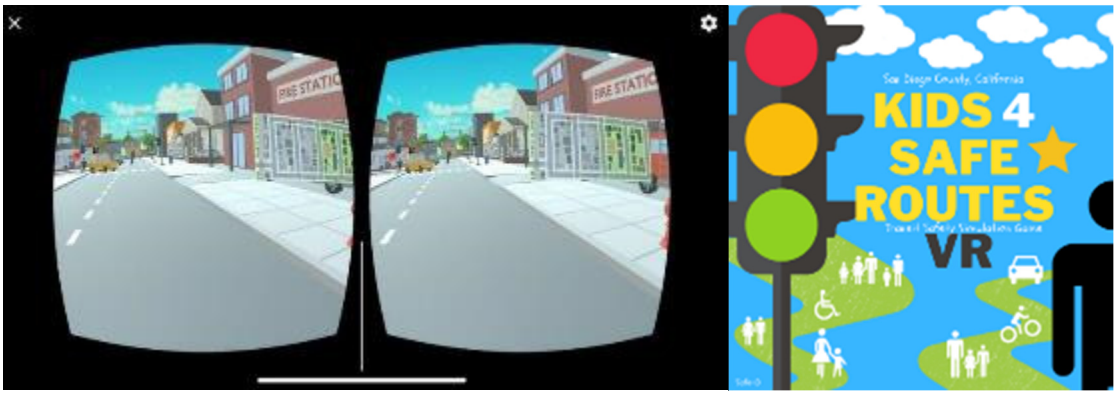


Figure 3. Screen capture. Kids 4 Safe Routes VR Game user interface without Google Cardboard.

Figure 4. Screen captures. Kids 4 Safe Routes VR Game screenshot.

Feaster Charter Elementary School VR Intervention Case Study

To test our VR game intervention tool, Kids 4 Safe Routes, the team conducted an intervention session at Feaster Charter Elementary School in Chula Vista, which was selected based on pedestrian and bicycle collision data acquired from the TIMS database and highlighted as being in one of the highest pedestrian and bicycle crash rate areas in CVESD (a crash hot spot). The school is in a highly congested area and is surrounded by both commercial areas (E Street trolley; Interstate 5; bridge; car and tire shops) and residential, single-family buildings. Feaster Charter Elementary School participated in previous SRTS programs between 2015 and 2019.

To study children's knowledge of transit safety at Feaster Charter Elementary School, our team worked closely with school administrators, teachers, and parents to test seventh- and eighth-grade students who were 11 to 14 years old. The VR game intervention session took place on Friday, February 9, 2023, at Feaster Charter Elementary School between 8:10 and 10:10 a.m. during school hours. Twenty-six students from seventh and eighth grade participated in the study with parent and student consent. The study was approved by the San Diego State University (SDSU) Institutional Review Board (Appendix P and Appendix Q). Students had to play four levels of the Kids 4 Safe Routes VR Game before and after watching traffic safety educational videos of 1 to 2 minutes each. The educational videos were made using Powtoon, an animation software to create kid-friendly videos. Appendix M shows descriptions and preview images of the four educational videos based on topics related to Level 1: Pedestrian and Vehicle Safety; Level 2: Road and Traffic Signal Safety; Level 3: Crosswalk Safety, and Level 4: Railroad Safety. Observations of students' traffic behavior before and after viewing the educational video were gathered and analyzed.

In addition to the VR game intervention, new Parent and Tally surveys were collected from Feaster Charter Elementary School to provide a deeper insight into parents' greatest concerns and walking trends at this school. The surveys were conducted both electronically and through hard copy. The Tally surveys were given to seventh- and eighth-grade teachers for students ages 11 to 14 years. The Parent surveys were available in Spanish and English to accommodate the population. An Institutional Review Board process through SDSU was conducted and approved to conduct the surveys. Twenty-eight Parent surveys were collected from seventh- and eighth-grade students. Tally surveys were also collected for 200 students in eight classes (seventh and eighth grade) for three consecutive days in February 2023.

Results

Walk Percentage Linear Regression Model

As discussed in the methodology section, the proposed linear regression model examines the relationship between walk percentage (for traveling to/from school) and various demographic features and perceptions extracted from the Parent survey (Table 1). Figure 5 indicates the Pearson's correlation matrix for the independent variables, which illustrates their statistical

association based on covariance. Based on Pearson's *R*-value, highly correlated features were eliminated from the dataset.

Appendix D includes tables showing the significance of features before and after implementing the wrapper methods with five-fold cross-validation. However, based on the research evaluation metrics (RMSE and MAE), the stepwise model outperformed the linear regression model.

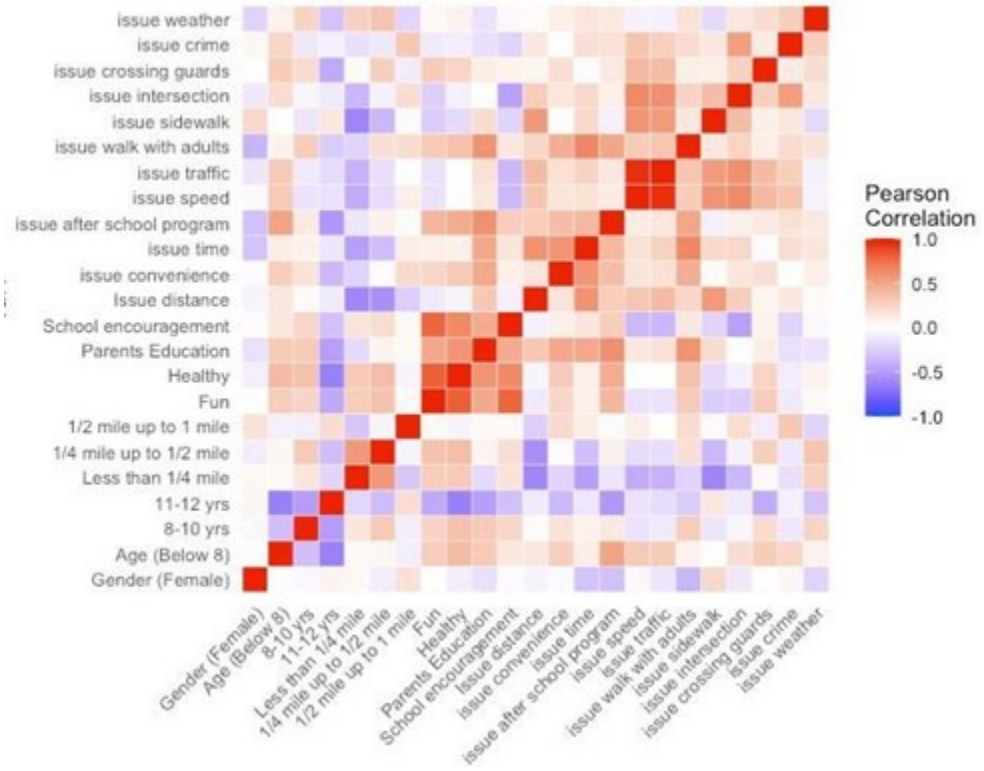


Figure 5. Illustration. Correlation matrix for linear regression model predictors.

Table 1. Evaluation of Linear Models for Morning and Evening (Left to Right)

Model	RMSE – Morning	MAE – Morning	RSME – Evening	MAE – Evening
Linear Regression	0.12	0.09	0.10	0.09
Stepwise Linear Regression	0.07	0.06	0.06	0.05

As indicated by the results (Appendix E), the distance from home to school (when the distance is less than a quarter mile) plays the most significant role in a student's decision to walk to school. Moreover, the morning model shows a positive association with a walk percentage increase if students perceive active transportation to school as enjoyable, and the evening model suggests a positive association with a walk percentage increase if the school encourages walking.

Walk Prediction Logistic Regression Model

Both morning and evening response variables were used to deploy a 10-fold cross-validation logistic regression model. The accuracy of both models was found to be 80% without any under-sampling. Applying the under-sampling method resulted in a decrease of 9% in the accuracy of both models. Therefore, under-sampling was not considered for further analysis (Figure 6).

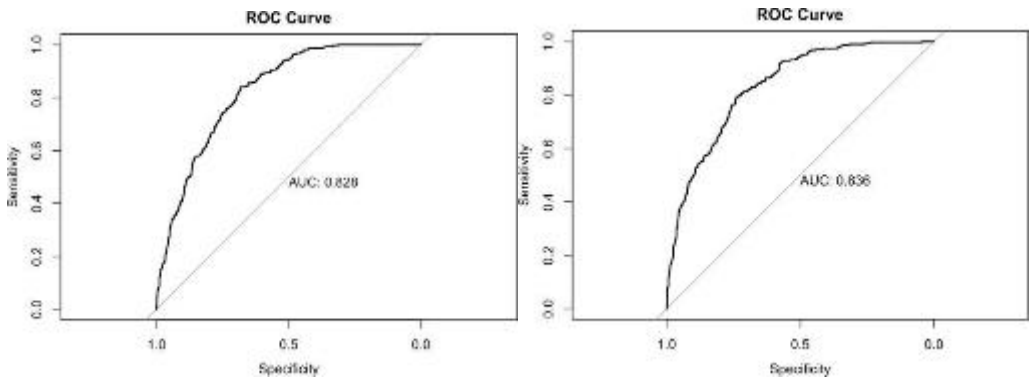


Figure 6. Graphs. AUC for morning and evening logistic regression model (left to right).

Based on our analysis (Appendix D), holding all other variables constant, the odds ratio indicates that during the program (Mid Program), participants have 1.27 times higher odds of walking in the evening compared to participants before the program starts (Before Program) or after it has ended (Post Program). The results also suggest that odds ratios for before and after the program were approximately the same, meaning that the effects of promoting walking to/from school vanish quickly after the SRTS programs end. Furthermore, the odds of walking in the evening are found to increase with distance from school, with the highest odds observed for students living less than a quarter mile from school.

Even though distance was the most significant factor in students walking to/from school, participants who reported distance as an issue had almost double the odds of walking in the evening than those who did not report distance as an issue. Less than one third of parents who were concerned with convenience had children who were likely to walk to school. These findings suggest that addressing concerns related to distance and convenience may help increase the likelihood of students walking to/from school. Additionally, the analysis showed that parental education level and child gender did not have a significant effect on the odds of walking in the evening. However, factors such as the presence of sidewalks, crossing guards, and intersection safety were found to be significant in promoting walking to/from school.

Analyzing the SRTS Impact on Walking Trends

Although the SRTS program may not be the most influential factor in increasing the walk percentage among students, the results for the chi-square test suggest an association between the walk percentage and program period. The null hypothesis of chi-square was rejected (p = 0.03698 for morning, and p = 4.25e-05 for evening) for 7,720 observations. Statistics indicate that students tended to walk more often to school during the program compared to before and after the program.

In terms of SRTS program effectiveness in increasing the walking trend among students, results from the Tally survey were also aligned with the results captured from the Parent survey. The walk percentage was also calculated based on the Tally survey. To find the association of walking trends and student age, walk percentage was calculated per grade for different program periods.

Figure 7 illustrates the walk percentage for morning and evening per different program periods. As the figure suggests, walk percentage is highest when there is an active SRTS program at school and declines after the program ends. Furthermore, results also illustrate that there is no meaningful walk percentage difference across the grades (between 19% and 26%), where the evening percentage is slightly higher than the morning percentage.

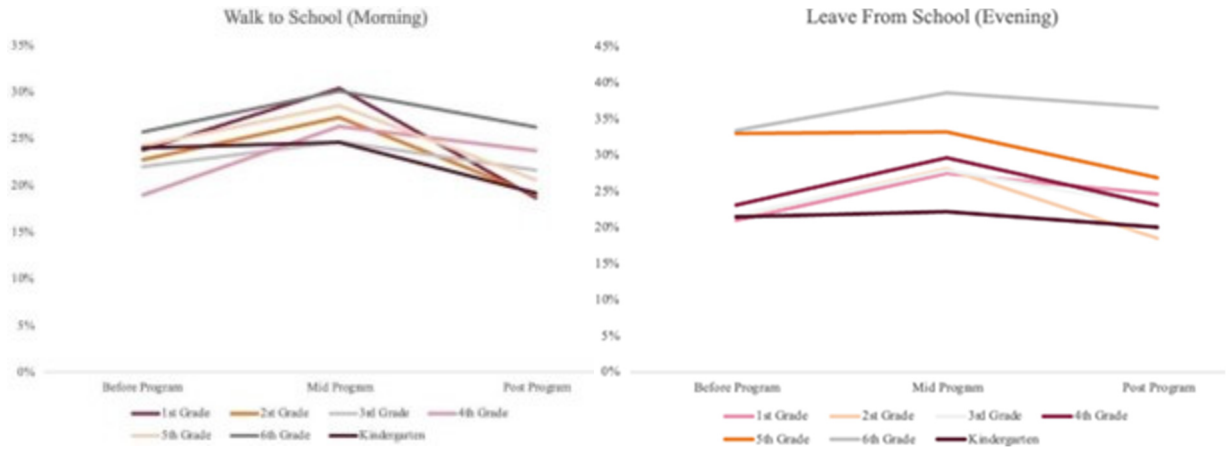


Figure 7. Graphs. Average walk percentage per SRTS program period (Tally survey).

Feaster Charter Elementary School Survey Analysis

Based on the information acquired from the Parent survey from Feaster Charter Elementary School, around 35% of parents were not comfortable with their children walking to school in any grade. Even though 30% of students in the study group walked to school as their main transportation mode, more than 50% of parents were concerned with issues such as distance, time, violence and crime, safety of intersections and crossings, weather and climate, sidewalks or pathways, traffic, and speed along the route. Detailed graphs appear in Appendix F. Results from the Tally survey show that an average of 27% of students walked in the morning and 40% of students walked in the evening, where the leaving from school percentage is higher than the CVESD average (30%).

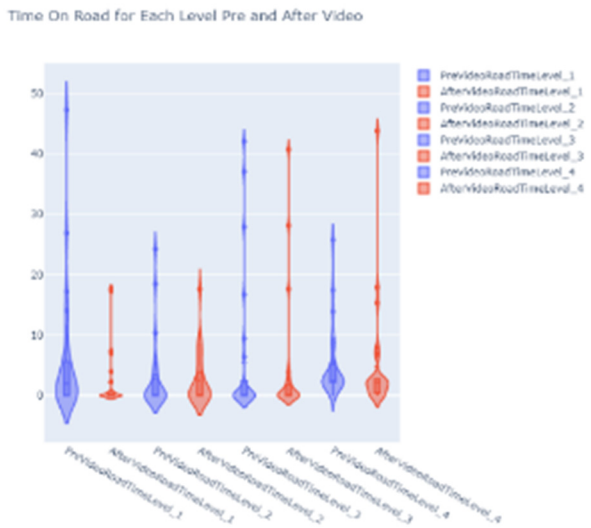
Kids 4 Safe Routes VR Game Training Tool

After the VR application (Kids 4 Safe Routes VR Game) was ready for testing, we obtained permission from Feaster Charter Elementary School to ask parents to allow their children to test the game to measure the app's performance. We gathered data from a total of 26 students ranging from 11 to 14 years old. Data were collected and analyzed to see if there were any improvements in the players' navigation behaviors before and after watching four transit safety educational videos (Appendix L). The game scores improved for all students who played (Appendix J). Figure

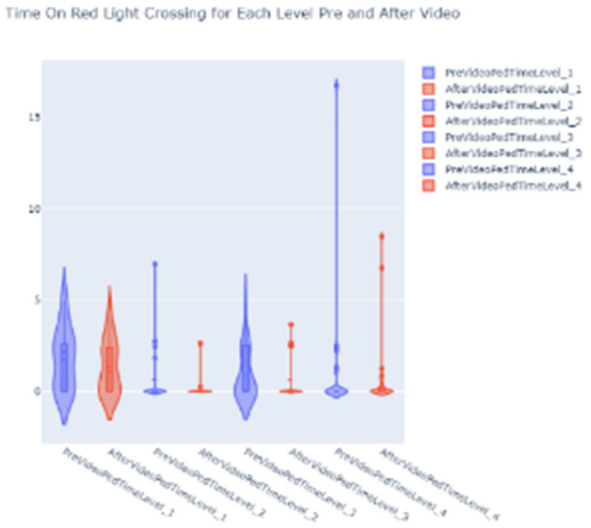
8 shows a graph with a list [PreVideoRoadTimeLevel_x and AfterVideoRoadTimeLevel_x], which was one of the metrics used to score each student's performance. The sample mean scores dropped on each level after watching the four educational videos we provided, indicating that students' safe walking behaviors on roads improved in this simulated city. This was a result of active learning while playing the game and watching the educational videos shown to them to facilitate the learning process. Some of the most important data collected were how many seconds the player spent on the road per each level and their scores before and after we showed them an educational video that helped them understand the different intersections in the game. The time on road scores drastically improved after watching the educational video with a mean of 5.92 seconds before watching and 2.19 seconds after, as seen in Figure 8. We assessed other metrics based on the number of cars players stopped per level before and after viewing the educational video. In terms of student gender, we concluded that males were more likely to stop cars than females. For the few outliers (i.e., students stopping cars in scenarios when the rest of the sample did not), we assumed those to be a result of users actively trying to "play the game" or push the application to see what was possible inside the virtual world. For the last metric collected, which was seconds spent crossing an intersection while the pedestrian light was red, the results were similar to those for the amount of time on roads; after watching the educational videos, all scores dropped, indicating that players spent less time crossing illegally after watching the videos. The Virtual Road World app mentioned earlier does not have a feature to provide directions for how to play the game—the player starts in a big city setting they are not familiar with and thus may get confused. To remedy this in our application, we decided to add a tutorial level that gives the player instructions on how to play.

In addition to having our application give personalized feedback, we added videos that teach players about different types of crossings and how a pedestrian should practice the best safe walking behaviors.

a)



b)



c)

d)

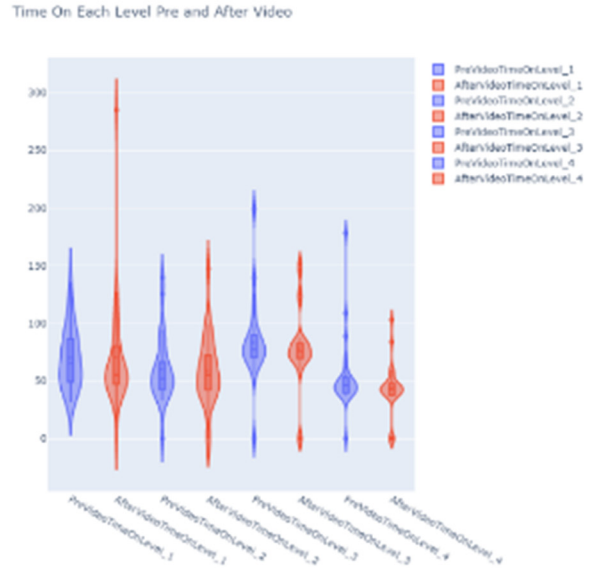


Figure 8. Graphs. Kids 4 Safe Routes VR Game: a) Time on road before and after VR game. b) Time on red light crossing for each level before and after. c) Cars stopped for each level before and after educational video. d) Time on each level before and after video (left to right).

Conclusions and Recommendations

The analysis of the Parent survey database of CVESD highlights that the distance between a student's home and their school is the most important factor in determining their decision to walk

to/from school. However, despite living within a quarter mile of school being the most significant variable, only around 50% of students who lived within that distance chose to walk as their primary mode of transportation. Therefore, targeted strategies are required to encourage the remaining 50% to walk to school, particularly as achieving this target is only possible when an active SRTS program is in place.

The data indicate that students are more likely to walk to school when the SRTS program is active (Mid Program) and, in some cases, walk trends decrease after the program ends, highlighting the importance of continued program support. Furthermore, student perception of active transportation can positively influence their decision to walk to school, and schools can play a vital role in encouraging this behavior. The data also suggests that walk percentages increase in the evening when students are going back home. Comparing observations from all models, crime and distance were among the top concerns parents raised as to why their children do not walk to school. However, despite distance being a common concern, parents who reported it as an issue had children with higher odds of walking to/from school, while convenience was found to be a stricter factor affecting students' decisions.

The analysis also showed that parental education level and child gender did not significantly affect the odds of walking. However, the presence of sidewalks, crossing guards, and intersection safety were found to be significant in promoting walking to/from school.

Lastly, the study highlights that less than 1% of students in CVESD use bicycling as their primary mode of transportation to school. This suggests that SRTS should focus more on identifying the underlying reasons for this trend, and further in-depth research is needed to determine the best strategies for promoting cycling to school.

In the analysis of the Kids 4 Safe Routes VR Game training tool, results showed how, through our simulated virtual world, the student sample size of 26 improved their in-game scores. These scores were created by our team to fully assess different intersection performances and grade players based on our metrics. These metrics were the number of seconds spent on roads, the number of cars stopped while on roads and/or at red light pedestrian crossings, and the number of seconds spent crossing pedestrian crossings at a red light. With results from the sample demonstrating that each student improved their scores after their second iteration of each level and after we showed them four educational videos based on each different type of intersection, we saw a reduction of more than half on the seconds spent on roads for Level 1, with the rest of the levels following along closely. For the other metric, cars stopped per level, numbers were significantly higher for male students than for female students, as males were more likely to stop cars than females. To conclude, our VR tool demonstrated that students were actively learning while playing this game, and thus their results improved by all measures. The main negative element of this tool was a lack of engagement after the second iteration of the levels played, as students, when asked, said they got bored after playing for a second time, with some stating they felt that the game was intended for a younger demographic. Overall, we believe that the Kids 4 Safe Routes VR Game training

tool can be used by other school administrators across San Diego County and beyond to educate children on transit safety.

The project's outcome and findings were presented to SANDAG, San Diego County's official Metropolitan Planning Organization that also served as the Safe-D project Champion. SANDAG staff invited our team to join the "Vision Zero Action Plan" project sponsored by the U.S. Department of Transportation to focus on developing transportation safety strategies across San Diego County's 17 cities and 18 tribal lands.

Additional Products

The Education and Workforce Development and Technology Transfer products created as part of this project are located on the project page of the Safe-D website. The final project dataset is located in the Safe-D Collection of the VTTI Dataverse.

Education and Workforce Development Products

The following resulted from project activities:

1. A master's student (Bita Etaati) has been an integral part of all project activities, developing a comprehensive understanding of methods to perform statistical analysis on traffic behavior changes with respect to the SRTS program and developing the visualization interactive dashboard. This project has been a valuable contribution to the student's master's thesis, and they are currently working on a related journal paper. The student is scheduled to defend their Master of Science thesis in Fall 2023 in the Master of Science in Big Data Analytics, having gained experience and expertise through their involvement in the project.

2. A bachelor's student graduate (Andrick Mercado) in Computer Science at SDSU has been an integral part of the Kids 4 Safe Routes VR Game planning, design, and implementation (VR Stages). The student is currently working on a related journal paper.

3. The data collected and processed throughout the project were utilized in the final project for the Master of Science in Big Data Analytics (BDA) 696 Smart Cities & Sustainability course at SDSU with instructor Dr. Gabriela Fernandez.

Technology Transfer Products

The following Technology Transfer products resulted from project activities:

1. 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).

2. A web-based interactive tool was developed using ArcGIS Dashboards to visualize pedestrian and bicycle collisions and their features near schools located in CVESD.

3. A VR educational game "Kids 4 Safe Routes VR Game" (Transit Safety VR Simulation Game) was developed using Unity, Firebase, and Powtoon videos.

4. The project was showcased at the Metabolism of Cities Living Lab SDSU 4 SDGs Leave No One Behind Exhibition at the SDSU Library in San Diego, CA curated by Dr. Gabriela Fernandez. The virtual exhibition is available online.

Data Products

- Links to Dataset –

  https://dataverse.vtti.vt.edu/dataverse/safed

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

  https://andrick-mercado.github.io/myprojectsfolder/SR2S

  https://andrick-mercado.itch.io/kids-4-safe-routes-vr

  https://app.milanote.com/1OK8D11fgOhJ2y/hdma-scsa?p=RXfLY9KR3xV

- Project Description – The objective of this study was to determine the factors that impact walking behavior in students related to the SRTS program. Additionally, the study proposed a new technique, a VR training game with educational animated videos, to enhance understanding of traffic safety for children ages 11 to 14. Multiple sources provided data for the study, including SRTS Parent and Tally survey results, Statewide Integrated Traffic Records System crash data from 2010 to 2021, and GIS shapefiles from SANDAG and the Chula Vista Open Data portal.

- Data Specification – A detailed description of each variable in the dataset can be found in Appendices G, H, and L.

References

1. *Chula Vista, CA*. Data USA. https://datausa.io/profile/geo/chula-vista-ca. Accessed March 6, 2023.

2. *Home.* Chula Vista Elementary School District. https://www.cvesd.org/. Accessed March 6, 2023.

3. *CDC/ATSDR SVI Fact Sheet*. Centers for Disease Control and Prevention, 2022. https://www.atsdr.cdc.gov/placeandhealth/svi/fact_sheet/fact_sheet.html. Accessed March 6, 2023.

4. Babey, S. H., J. Wolstein, A. L. Diamant, A. Bloom, and H. Goldstein. *Overweight and Obesity Among Children by California Cities-2010*. eScholarship, University of California, 2012.

5. *How Much Physical Activity Do Children \Need?* Centers for Disease Control and Prevention, 2022. https://www.cdc.gov/physicalactivity/basics/children/index.htm. Accessed March 6, 2023.

6. Hills, A. P., L. B. Andersen, and N. M. Byrne. (2011). Physical Activity and Obesity in Children. *British Journal of Sports Medicine*, Vol. 45, No. 11, 2011, pp. 866-870.

7. Appleyard, B. S. Planning Safe Routes to School. *Planning*, Vol. 69, No. 5, 2003, pp. 34-37.

8. Tudor-Locke, C., B. E. Ainsworth, and B. M. Popkin. Active Commuting to School: An Overlooked Source of Children's Physical Activity? *Sports Medicine*, Vol. 31, 2001, pp. 309-313.

9. Mennesson, M. *Safe Routes to School: The Story Begins* [blog post]. Safe Routes Partnership, July 8, 2015. https://www.saferoutespartnership.org/blog/safe-routes-school-story-begins. Accessed March 6, 2023.

10. *The Decline of Walking and Bicycling*. SRTS Guide. http://guide.saferoutesinfo.org/introduction/the_decline_of_walking_and_bicycling.cfm. Accessed March 6, 2023.

11. *Safe Routes to School Toolkit*. Chula Vista Elementary School District. https://cdnsm5-ss12.sharpschool.com/UserFiles/Servers/Server_411950/File/CVESD%20SRTS%20Toolkit%20with%20Bookmarks.pdf. Accessed March 6, 2023.

12. Coughlan, M., P. Cronin, and F. Ryan. Survey Research: Process and Limitations. *International Journal of Therapy and Rehabilitation*, Vol. 16, No. 1, 2009, pp. 9-15.

13. *B. Safe Routes to School Parent Survey*. SRTS Guide. http://guide.saferoutesinfo.org/evaluation/appendix_b_safe_routes_to_school_parent_survey.cfm. Accessed March 15, 2023.

14. *FASTSTATS: Leading Causes of Death*. Centers for Disease Control and Prevention, January 13, 2022. https://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm. Accessed May 11, 2022.

15. Zegeer, C. V., and M. Bushell. Pedestrian Crash Trends and Potential Countermeasures from Around the World. *Accident Analysis & Prevention*, Vol. 44, No. 1, 2012, pp. 3-11.

16. Schwebel, D. C., B. K. Barton, J. Shen, H. L. Wells, A. Bogar, G. Heath, and D. McCullough. Systematic Review and Meta-analysis of Behavioral Interventions to Improve Child Pedestrian Safety. *Journal of Pediatric Psychology*, Vol. 39, No. 8, 2014, pp. 826-845.

17. Boarnet, M. G., C. L. Anderson, K. Day, T. McMillan, and M. Alfonzo. Evaluation of the California Safe Routes to School Legislation: Urban Form Changes and Children's Active Transportation to School. *American Journal of Preventive Medicine*, Vol. 28, No. 2, 2005, pp. 134-140.

18. Boarnet, M. G., K. Day, C. Anderson, T. McMillan, and M. Alfonzo. California's Safe Routes to School Program: Impacts on Walking, Bicycling, and Pedestrian Safety. *Journal of the American Planning Association*, Vol. 71, No. 3, 2005, pp. 301-317.

19. McDonald, N. C., R. L. Steiner, C. Lee, T. Rhoulac Smith, X. Zhu, and Y. Yang. Impact of the Safe Routes to School Program on Walking and Bicycling. *Journal of the American Planning Association*, Vol. 80, No. 2, 2014, pp. 153-167.

20. Lizarazo, C. G., T. Hall, and A. Tarko. Impact of the Safe Routes to School Program: Comparative Analysis of Infrastructure and Non-Infrastructure Measures in Indiana. *Journal of Transportation Engineering, Part A: Systems*, Vol. 147, No. 1, 2021, 04020151.

21. Buckley, A., M. B. Lowry, H. Brown, and B. Barton. Evaluating Safe Routes to School Events that Designate Days for Walking and Bicycling. *Transport Policy*, Vol. 30, 2013, pp. 294- 300.

22. Ragland, D. R., S. Pande, J. Bigham, and J. F. Cooper. Examining the Long-term Impact of the California Safe Routes to School Program: Ten Years Later. *Transportation Research Record*, Vol. 2464, No. 1, 2014, pp. 86-92.

23. DiMaggio, C., S. Frangos, and G. Li. National Safe Routes to School Program and Risk of School-age Pedestrian and Bicyclist Injury. *Annals of Epidemiology*, Vol. 26, No. 6, 2016, pp. 412-417.

24. McArthur, A., P. T. Savolainen, and T. J. Gates. Spatial Analysis of Child Pedestrian and Bicycle Crashes: Development of Safety Performance Function for Areas Adjacent to Schools. *Transportation Research Record*, Vol. 2465, No. 1, 2014, pp. 57-63.

25. Colacino, V. G., and L. Po. Managing Road Safety through the Use of Linked Data and Heat Maps. *In Proceedings of the 7th International Conference on Web Intelligence, Mining and Semantics*, 2017, pp. 1-8.

26. Hilton, B. N., T. A. Horan, R. Burkhard, and B. Schooley. SafeRoadMaps: Communication of Location and Density of Traffic Fatalities through Spatial Visualization and Heat Map Analysis. *Information Visualization*, Vol. 10, No. 1, 2011, pp. 82-96.

27. Billah, K., H. O. Sharif, and S. Dessouky. Analysis of Pedestrian–Motor Vehicle Crashes in San Antonio, Texas. *Sustainability*, Vol. 13, No. 12, 2021, p. 6610.

28. Slaughter, D. R., N. Williams, S. P. Wall, N. E. Glass, R. Simon, S. R. Todd, and S. G. Frangos. A Community Traffic Safety Analysis of Pedestrian and Bicyclist Injuries Based on the Catchment Area of a Trauma Center. *Journal of Trauma and Acute Care Surgery*, Vol. 76, No. 4, 2014, pp. 1103-1110.

29. *Virtual reality*. Merriam-Webster Online Dictionary. https://www.merriam-webster.com/dictionary/virtual%20reality. Accessed March 10, 2023.

30. Freina, L., and M. Ott. A Literature Review on Immersive Virtual Reality in Education: State of the Art and Perspectives. In *The International Scientific Conference eLearning and Software for Education*, Vol. 1, No. 133, 2015, pp. 10-1007.

31. Gidley, S. *Virtual Reality App to Teach Road Safety to Children*. BBC News, May 21, 2017. https://www.bbc.com/news/uk-wales-south-east- wales-39892030. Accessed March 10, 2023.

32. Schwebel, D. C., T. Combs, D. Rodriguez, J. Severson, and V. Sisiopiku. Community-based Pedestrian Safety Training in Virtual Reality: A Pragmatic Trial. *Accident Analysis & Prevention*, Vol. 86, 2016, pp. 9-15. https://doi.org/10.1016/j.aap.2015.10.002

33. McMillan, T. E., and Cooper, J. F. *Safe Routes to School National Partnership Local School Project Evaluation Handbook*. Traffic Safety Center, PPH Partners, 2008. https://www.saferoutespartnership.org/sites/default/files/pdf/SRTS.Eval.Handbook-Final_9_08.pdf

34. *SRTS DataTools: Online Data Entry and Analysis System*. SafeRoutes National Center for Safe Routes to School. https://saferoutesdata.org. Accessed March 10, 2023.

35. Cohen, J., P. Cohen, S. G. West, and L. S. Aiken. *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*, 4th ed. Psychology Press, New York, NY, 2014.

36. Vatcheva, K. P., M. Lee, J. B. McCormick, and M. H. Rahbar. Multicollinearity in Regression Analyses Conducted in Epidemiologic Studies. *Epidemiology (Sunnyvale, Calif.)*, Vol. 6, No. 2, 2016, p. 227.

37. Tu, Y. K., V. Clerehugh, and M. S. Gilthorpe. Collinearity in Linear Regression is a Serious Problem in Oral Health Research. *European Journal of Oral Sciences*, Vol. 112, No. 5, 2004, pp. 389-397.

38. Kohavi, R. A Study of Cross-validation and Bootstrap for Accuracy Estimation and Model Selection. In *IJCAI*, Vol. 14, No. 2, August 1995, pp. 1137-1145.

39. Varma, S., and R. Simon. Bias in Error Estimation When Using Cross-validation for Model Selection. *BMC Bioinformatics*, Vol. 7, No. 1, 2006, pp. 1-8.

40. Guyon, I., and A. Elisseeff. An Introduction to Variable and Feature Selection. *Journal of Machine Learning Research*, Vol. 3, March 2003, pp. 1157-1182.

41. Sperandei, S. Understanding Logistic Regression Analysis. *Biochemia Medica*, Vol. 24, No. 1, 2014, pp. 12-18.

42. Szumilas, M. Explaining Odds Ratios. *Journal of the Canadian Academy of Child and Adolescent Psychiatry*, Vol. 19, No. 3, 2010, p. 227.

43. Chai, T., and R. R. Draxler. Root Mean Square Error (RMSE) or Mean Absolute Error (MAE)? Arguments Against Avoiding RMSE in the Literature. *Geoscientific Model Development*, Vol. 7, No. 3, 2014, pp. 1247-1250.

44. Chai, T., and R. R. Draxler. Root Mean Square Error (RMSE) or Mean Absolute Error (MAE). *Geoscientific Model Development Discussions*, Vol. 7, No. 1, 2014, pp. 1525-1534.

45. Halimu, C., A. Kasem, and S. S. Newaz. Empirical Comparison of Area Under ROC Curve (AUC) and Mathew Correlation Coefficient (MCC) for Evaluating Machine Learning Algorithms on Imbalanced Datasets for Binary Classification. In *Proceedings of the 3rd International Conference on Machine Learning and Soft Computing*, 2019, pp. 1-6.

46. Cortes, C., and M. Mohri. (2004). Confidence Intervals for the Area Under the ROC Curve. In *NIPS'04: Proceedings of the 17th International Conference on Neural Information Processing Systems*, 2004, 305-312.

47. Hossin, M., and M. N. Sulaiman. (2015). A Review on Evaluation Metrics for Data Classification Evaluations. *International Journal of Data Mining & Knowledge Management Process*, Vol. 5, No. 2, 2015, p. 1.

48. Transportation Injury Mapping System (TIMS), Safe Transportation Research and Education Center, University of California, Berkeley, CA, 2023.

49. SANDAG Open Data Portal. Tyler Data & Insights, https://opendata.sandag.org.

50. *Chula Vista GIS Open Data Por*tal. City of Chula Vista. https://chulavista-cvgis.opendata.arcgis.com. Accessed March 9, 2023.

51. *Compare Unity Plans: Pro vs Plus vs Free. Choose the Best 2D - 3D Engine for Your Project!* Unity. https://store.unity.com/compare-plans. Accessed March 11, 2023.

Appendix A – Parent Survey: English and Spanish

(English)

Parent Survey About Walking and Biking to School

Dear Parent or Caregiver,
Your child's school wants to learn your thoughts about children walking and biking to school. This survey will take about 5 - 10 minutes to complete. We ask that each family complete only one survey per school your children attend. If more than one child from a school brings a survey home, please fill out the survey for the child with the next birthday from today's date.

After you have completed this survey, send it back to the school with your child or give it to the teacher. Your responses will be kept confidential and neither your name nor your child's name will be associated with any results.
Thank you for participating in this survey!

CAPITAL LETTERS ONLY – BLUE OR BLACK INK ONLY

School Name:

1. What is the grade of the child who brought home this survey? ☐☐ Grade (PK,K,1,2,3…)

2. Is the child who brought home this survey male or female? ☐ Male ☐ Female

3. How many children do you have in Kindergarten through 8th grade? ☐☐

4. What is the street intersection nearest your home? (Provide the names of two intersecting streets)

and

Place a clear 'X' inside box. If you make a mistake, fill the entire box, and then mark the correct box.

5. How far does your child live from school?

☐ Less than ¼ mile ☐ ½ mile up to 1 mile ☐ More than 2 miles
☐ ¼ mile up to ½ mile ☐ 1 mile up to 2 miles ☐ Don't know

Place a clear 'X' inside box. If you make a mistake, fill the entire box, and then mark the correct box.

6. On most days, how does your child arrive and leave for school? (Select one choice per column, mark box with X)

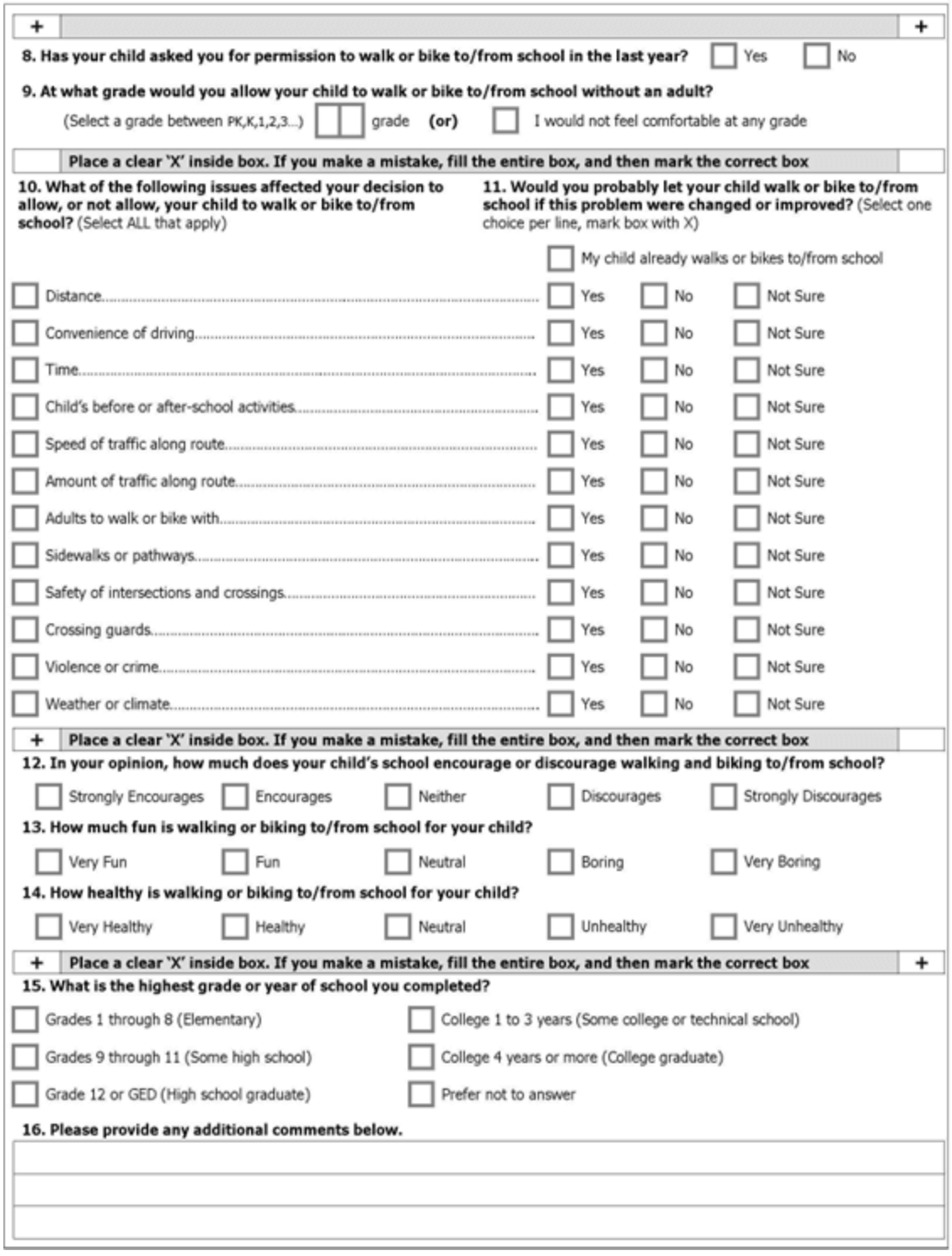
Arrive at school	**Leave from school**
☐ Walk	☐ Walk
☐ Bike	☐ Bike
☐ School Bus	☐ School Bus
☐ Family vehicle (only children in your family)	☐ Family vehicle (only children in your family)
☐ Carpool (Children from other families)	☐ Carpool (Children from other families)
☐ Transit (city bus, subway, etc.)	☐ Transit (city bus, subway, etc.)
☐ Other (skateboard, scooter, inline skates, etc.)	☐ Other (skateboard, scooter, inline skates, etc.)

Place a clear 'X' inside box. If you make a mistake, fill the entire box, and then mark the correct box

7. How long does it normally take your child to get to/from school? (Select one choice per column, mark box with X)

Travel time to school	**Travel time from school**
☐ Less than 5 minutes	☐ Less than 5 minutes
☐ 5 – 10 minutes	☐ 5 – 10 minutes
☐ 11 – 20 minutes	☐ 11 – 20 minutes
☐ More than 20 minutes	☐ More than 20 minutes
☐ Don't know / Not sure	☐ Don't know / Not sure

(English)



8. Has your child asked you for permission to walk or bike to/from school in the last year? ☐ Yes ☐ No

9. At what grade would you allow your child to walk or bike to/from school without an adult?
(Select a grade between PK,K,1,2,3...) ☐☐ grade **(or)** ☐ I would not feel comfortable at any grade

Place a clear 'X' inside box. If you make a mistake, fill the entire box, and then mark the correct box

10. What of the following issues affected your decision to allow, or not allow, your child to walk or bike to/from school? (Select ALL that apply)

11. Would you probably let your child walk or bike to/from school if this problem were changed or improved? (Select one choice per line, mark box with X)

	☐ My child already walks or bikes to/from school		
☐ Distance	☐ Yes	☐ No	☐ Not Sure
☐ Convenience of driving	☐ Yes	☐ No	☐ Not Sure
☐ Time	☐ Yes	☐ No	☐ Not Sure
☐ Child's before or after-school activities	☐ Yes	☐ No	☐ Not Sure
☐ Speed of traffic along route	☐ Yes	☐ No	☐ Not Sure
☐ Amount of traffic along route	☐ Yes	☐ No	☐ Not Sure
☐ Adults to walk or bike with	☐ Yes	☐ No	☐ Not Sure
☐ Sidewalks or pathways	☐ Yes	☐ No	☐ Not Sure
☐ Safety of intersections and crossings	☐ Yes	☐ No	☐ Not Sure
☐ Crossing guards	☐ Yes	☐ No	☐ Not Sure
☐ Violence or crime	☐ Yes	☐ No	☐ Not Sure
☐ Weather or climate	☐ Yes	☐ No	☐ Not Sure

Place a clear 'X' inside box. If you make a mistake, fill the entire box, and then mark the correct box

12. In your opinion, how much does your child's school encourage or discourage walking and biking to/from school?
☐ Strongly Encourages ☐ Encourages ☐ Neither ☐ Discourages ☐ Strongly Discourages

13. How much fun is walking or biking to/from school for your child?
☐ Very Fun ☐ Fun ☐ Neutral ☐ Boring ☐ Very Boring

14. How healthy is walking or biking to/from school for your child?
☐ Very Healthy ☐ Healthy ☐ Neutral ☐ Unhealthy ☐ Very Unhealthy

Place a clear 'X' inside box. If you make a mistake, fill the entire box, and then mark the correct box

15. What is the highest grade or year of school you completed?
☐ Grades 1 through 8 (Elementary)
☐ Grades 9 through 11 (Some high school)
☐ Grade 12 or GED (High school graduate)
☐ College 1 to 3 years (Some college or technical school)
☐ College 4 years or more (College graduate)
☐ Prefer not to answer

16. Please provide any additional comments below.

(Spanish)

Encuesta sobre ir caminando o andando en bicicleta a la escuela

- PARA PADRES -

Estimado Padre o Encargado,

La escuela donde su hijo/hija asiste desea saber sus opiniones sobre niños caminando y andando en bicicleta a la escuela. Esta encuesta tomará entre 5 y 10 minutos para completar. Le pedimos a las familias que completen sólo una encuesta por escuela a la que asisten sus niños. Si recibe más de un formulario de la misma escuela, por favor complete solo una encuesta, la del niño que cumpla años en la fecha más próxima al día de hoy.

Después de completar esta encuesta, devuélvala a la escuela a través de su hijo o entréguesela a la maestra. Sus respuestas se mantendrán confidencial y no se asociará su nombre ni el de su hijo a ningún resultado.

¡Gracias por participar en esta encuesta!

+ LETRA MAYUSCULA SOLAMENTE USE TINTA AZUL O NEGRA +

Nombre de la Escuela:

1. **¿En qué grado esta el niño que trajo esta encuesta al hogar?** ☐☐ Grado (PK,K,1,2,3...)
2. **¿El niño que trajo a casa la encuesta es niño o niña?** ☐ Niño ☐ Niña
3. **¿Cuántos niños tiene usted entre Kindergarten y el 8vo grado?** ☐☐
4. **¿Cuál es la intersección más cerca de su casa? (el cruce de las dos calles)**

Y

+ ¿Cómo llenar este formulario?: Escriba en letras MAYUSCULAS. Marque las cajas con "X" +

5. **¿A qué distancia vive su niño de la escuela?**
   - ☐ Menos de 1/4 milla
   - ☐ media milla hasta 1 milla
   - ☐ Más de 2 millas
   - ☐ Entre 1/4 y ½ milla
   - ☐ Entre 1 y 2 millas
   - ☐ No lo sé
6. **La mayoría de los días, ¿cómo va su niño a la escuela y cómo regresa a la casa después de la escuela?**

Llega a la escuela	Regresa a casa
☐ Caminando	☐ Caminando
☐ Bicicleta	☐ Bicicleta
☐ Autobús escolar	☐ Autobús escolar
☐ Vehículo de la familia (solo con niños de la familia)	☐ Vehículo de la familia (solo con niños de la familia)
☐ Compartiendo el viaje en auto con niños de otras familias	☐ Compartiendo el viaje en auto con niños de otras familias
☐ Tránsito (autobús de la ciudad, subterráneo, etc.)	☐ Tránsito (autobús de la ciudad, subterráneo, etc.)
☐ Otro (patineta, monopatín, patines, etc.)	☐ Otro (patineta, monopatín, patines, etc.)

+ ¿Cómo llenar este formulario?: Escriba en letras MAYUSCULAS. Marque las cajas con "X" +

7. **¿Cuánto tiempo le toma a su niño para ir y regresar de la escuela?** (una respuesta por columna con una "X" en la caja)

Tiempo del recorrido a la escuela	Tiempo del recorrido para llegar a casa
☐ Menos de 5 minutos	☐ Menos de 5 minutos
☐ 5 a 10 minutos	☐ 5 a 10 minutos
☐ 11 a 20 minutos	☐ 11 a 20 minutos
☐ Más de 20 minutos	☐ Más de 20 minutos
☐ No lo sé / No estoy seguro/a	☐ No lo sé / No estoy seguro/a

+ +

(Spanish)

8. ¿En el último año, le ha pedido permiso su hijo para caminar o andar en bicicleta hacia o desde la escuela? ☐ Sí ☐ No

9. ¿En qué grado permitiría que su hijo camine o ande en bicicleta solo a/o de la escuela?

(seleccione un grado entre PK,K,1,2,3...) ☐☐ grado O ☐ No me sentiría cómodo/a en ningún grado

¿Cómo llenar este formulario?: Escriba en letras MAYUSCULAS. Marque las cajas con "X"

10. ¿Cuáles de las siguientes situaciones afectaron su decisión de permitir, o no permitir, que su niño camine o ande en bicicleta hacia o desde la escuela? (marque todas las que correspondan)

11. ¿Probablemente dejaría que su hijo caminara o usara la bicicleta para ir a /regresar de la escuela si este problema cambiara o mejorara? (elija una respuesta por línea)

☐ Mi hijo(a) ya viaja a pié o en bicicleta a/desde la escuela

☐ Distancia	☐ Sí	☐ No	☐ No estoy seguro/a
☐ Conveniencia de manejar	☐ Sí	☐ No	☐ No estoy seguro/a
☐ Tiempo	☐ Sí	☐ No	☐ No estoy seguro/a
☐ Actividades antes o después de la escuela	☐ Sí	☐ No	☐ No estoy seguro/a
☐ Velocidad del tránsito en la ruta	☐ Sí	☐ No	☐ No estoy seguro/a
☐ Cantidad de tránsito en la ruta	☐ Sí	☐ No	☐ No estoy seguro/a
☐ Adultos que acompañen a su niño	☐ Sí	☐ No	☐ No estoy seguro/a
☐ Aceras o caminos	☐ Sí	☐ No	☐ No estoy seguro/a
☐ Seguridad de las intersecciones y cruces	☐ Sí	☐ No	☐ No estoy seguro/a
☐ Guardias de cruce peatonal	☐ Sí	☐ No	☐ No estoy seguro/a
☐ Violencia o crimen	☐ Sí	☐ No	☐ No estoy seguro/a
☐ Tiempo o clima	☐ Sí	☐ No	☐ No estoy seguro/a

¿Cómo llenar este formulario?: Escriba en letras MAYUSCULAS. Marque las cajas con "X"

12. En su opinión, ¿cuánto apoyo provée la escuela de su hijo a caminar y usar la bicicleta para ir o regresar de la escuela?

☐ Anima Fuertemente ☐ Anima ☐ Ni uno ni otro ☐ Desalienta ☐ Desalienta Fuertemente

13. ¿Qué tan DIVERTIDO es caminar o andar en bicicleta hacia o desde la escuela para su niño?

☐ Muy Divertido ☐ Divertido ☐ Neutral ☐ Aburrido ☐ Muy Aburrido

14. ¿Qué tan SANO es caminar o andar en bicicleta hacia o desde la escuela para su niño?

☐ Muy Sano ☐ Sano ☐ Neutral ☐ Malsano ☐ Muy Malsano

¿Cómo llenar este formulario?: Escriba en letras MAYUSCULAS. Marque las cajas con "X"

15. ¿Cuál es el grado o el año más alto de educación que usted terminó?

☐ Grados 1 a 8 (Escuela primaria)
☐ Grados 9 a 11 (alguna High School/secundaria)
☐ Grado 12 o GED (graduado High School/secundaria)
☐ Universidad 1 a 3 años (alguna universidad o escuela técnica)
☐ Universidad 4 años o más (graduado de la universidad)
☐ Prefiero no contestar

16. Por favor proporcione comentarios adicionales:

Appendix B – Tally Survey

Tally Survey Electronic Link

Safe Routes to School Students Arrival and Departure Tally Sheet

+ CAPITAL LETTERS ONLY – BLUE OR BLACK INK ONLY +

School Name: | Teacher's First Name: | Teacher's Last Name:

Grade: (PK,K,1,2,3...) 0 2 | Monday's Date (Week count was conducted) M M D D Y Y Y Y | Number of Students Enrolled in Class: 1 5

- Please conduct these counts **on two of the following three days Tuesday, Wednesday, or Thursday. (Three days would provide better data if counted)**
- **Please do not conduct these counts on Mondays or Fridays.**
- Before asking your students to raise their hands, please read through all possible answer choices so they will know their choices. Each Student may only answer once.
- Ask your students as a group the question **"How did you arrive at school today?"**
- Then, reread each answer choice and record the number of students that raised their hands for each. **Place just one character or number in each box.**
- Follow the same procedure for the question **"How do you plan to leave for home after school?"**
- You can conduct the counts once per day but during the count please ask students both the school arrival and departure questions.
- Please conduct this count regardless of weather conditions (i.e., ask these questions on rainy days, too).

Step 1. Fill in the weather conditions and number of students in each class

Step 2. **AM** – **"How did you arrive at school today?"** Record the number of hands for each answer. **PM** – **"How do you plan to leave for home after school?"** Record the number of hands for each answer.

Key	Weather	Student Tally	Walk	Bike	School Bus	Family Vehicle	Carpool	Transit	Other
	S= sunny R= rainy O=overcast SN=snow	Number in class when count made	-	-	-	Only with Children from your family	Riding with children from other families	City bus, subway, etc.	Skate-board, scooter, etc.
Sample AM	S N	2 0	2	3	8	3		3	1
Sample PM	R	1 9	3	3	8	1	2	2	
Tues. AM									
Tues. PM									
Wed. AM									
Wed. PM									
Thurs. AM									
Thurs. PM									

Please list any disruptions to these counts or any unusual travel conditions to/from the school on the days of the tally.

+ +

Appendix C – CVESD Survey Availability

Parent survey availability:

School	Before	Mid	Post
Allen Elementary School	✓	✓	✓
Arroyo Vista Elementary School	✓	✓	✓
Casillas Elementary School	✓	✓	✓
Chula Vista Hills	✓	✓	✓
Heritage Elementary School	✓	✓	✓
Liberty Elementary School	✓	✓	✓
Olympic View Elementary School	✓	✓	✓
Otay Elementary School	✓	✓	✓
Palomar Elementary School	✓	✓	✓
Rice Elementary School	✓	✓	✓
Rohr Elementary School	✓	✓	✓
Valley Vista Elementary School		✓	✓
Veterans	✓		✓
Wolf Canyon Elementary School	✓		✓
Cook Elementary School	✓		
Corky McMillin	✓		✓
Loma Verde Elementary School	✓		✓
Salt Creek Elementary School			✓
Valle Lindo Elementary School	✓		

Appendix D – Linear Regression Model Significant Variables

Linear Regression model for going to school (morning):

N= 46		Regression Model		Stepwise Model	
		Features	P-Value Significance	Features	P-Value Significance
Program Period	Before Program				
	Mid Program	✓	0.22484		
	Post Program	✓	0.03304*		
		✓	0.55375		
Gender	Female				
	Male	✓	0.89635		
Age Group	Age (Below 8)	✓	0.74739		
	8-10 yrs	✓	0.84724		
	11-12 yrs	✓	0.00903**		
Distance From Home	Less than 1/4 mile			✓	6.26E-10***
	1/4 mile up to 1/2 mile	✓	0.17677		
	1/2 mile up to 1 mile	✓	0.92931	✓	3.58E-05***
Parents Perception	Fun	✓	0.2106		
	Healthy	✓	0.60586		
issues	Parents Education	✓	0.38691		
	School encouragement	✓	0.79433		
	Issue distance	✓	0.88355		
	issue convenience				
	issue time	✓	0.7538		
	issue after school program	✓	0.25504		
	issue speed	✓	0.18741		
	issue traffic	✓	0.23907		
	issue walk with adults	✓	0.85595		
	issue sidewalk	✓	0.26383		
	issue intersection	✓	0.40902		
	issue crossing guards	✓	0.45697		
	issue crime				
	issue weather				

Linear Regression model for leaving from school (evening):

N = 46		Regression Model			Stepwise Model		
		Features	P-Value	Significance	Features	P-Value	Significance
Program Period	Before Program						
	Mid Program		0.55929				
	Post Program		0.82865				
Gender	Female		0.94326				
	Male						
Age Group	Age (Below 8)		0.99471				
	8-10 yrs		0.99471				
	11-12 yrs		0.97691				
Distance From Home	Less than 1/4 mile		0.00405	**		3.91E-13	***
	1/4 mile up to 1/2-mile 1/2 mile up to 1 mile						
Parents Perception	Fun		0.67799				
	Healthy		0.48563				
issues	Parents Education		0.45092				
	School encouragement		0.81062			5.50E-05	***
	Issue distance		0.70178				
	issue convenience		0.38316				
	issue time		0.86523				
	issue after school program						
	issue speed		0.68795				
	issue traffic		0.70694				
	issue walk with adults		0.72423				
	issue sidewalk		0.80713				
	issue intersection		0.38529				
	issue crossing guards		0.54275				
	issue crime		0.65561				
	issue weather		0.83841				

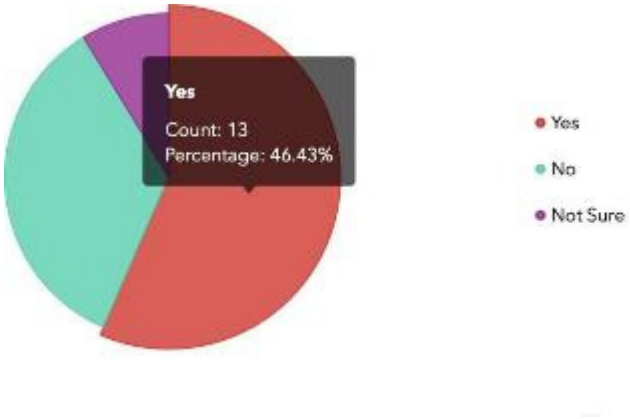
Appendix E – Logistic Regression Model Results

N = 6217		Logistic Regression (Morning)	Logistic Regression (Evening)
		Features P-Value Significance	Features P-Value Significance
Program Period	Before Program		
	Mid Program	0.80043	0.01664 *
	Post Program	0.18985	0.92728
Gender	Female		
	Male	0.18588	0.09977
Age Group	Age (Below 8)	0.10506	7.59E-06 ***
	8-10 yrs	0.01336 *	0.00043 ***
	11-12 yrs	2.00E-16 ***	2.00E-16 ***
Distance From Home	Less than 1/4 mile		2.00E-16 ***
	1/4 mile up to 1/2 mile	2.00E-16 ***	1.32E-11 ***
	1/2 mile up to 1 mile	1.03E-07 ***	2.98E-06 ***
	More than 2 miles	2.32E-05 ***	0.00013 ***
	Don't know	3.65E-06 ***	4.93E-04 ***
		8.36E-10 ***	0.00029 ***
Pa rents Perception	Fun		0.84963
	Healthy	0.02144 *	0.31851
Parents Education	College 4 years or more (College graduate)	0.92534	0.00277 **
	Grade 12 or GED (High school graduate)	0.13517	0.156
	Grades 1 through 8 (Elementary)	0.03332 *	0.00742 **
	Grades 9 through 11 (Some high school)	0.30154	5.31E-01
	Prefer not to answer	0.10473	1.84E-10 ***
School Encouragement	Not Encourage	0.65898	2.51E-12 ***
		2.00E-12 ***	0.42144
Issues	Issue distance (Yes)		0.00312 **
	issue convenience (Yes)	1.27E-06 ***	0.00065 ***
	issue time (Yes)	0.00281 **	0.27981
	issue after school program (Yes)	0.34029	0.25248
	issue speed (Yes)	0.00484 **	0.0024 **
	issue traffic (Yes)	0.06421	0.28338
	issue walk with adults (Yes)	0.52362	0.03084 *
	issue sidewalk (Yes)	0.01801 *	7.06E-06 ***
	issue intersection (Yes)	0.13059	0.57402
	issue crossing guards (Yes)	0.01657 *	
	issue crime (Yes)	l.27E-06 ***	
	issue weather (Yes)	0.58599	

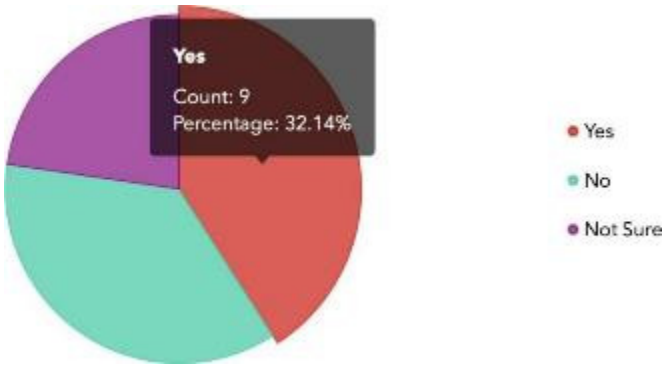
		Odds Ratio (Morning)	Odds Ratio (Evening)
		Intercept: 0.07331834	Intercept: 0.05139881
Program Period	Before Program		
	Mid Program	1.02611125	1.26541833
	Post Program	0.87895233	0.99134447
Gender	Female		
	Male	1.11137486	1.13497157
Age Group	Age (Below 8)	0.80965598	0.80965598
	8-10 yrs	0.72627144	0.72627144
	11-12 yrs		
Distance From Home	Less than 1/4 mile	20.50091877	19.63413631
	1/4 mile up to 1/2 mile	7.98507701	8.24893681
	1/2 mile up to 1 mile	3.30080834	3.94842374
	More than 2 miles	0.19093968	0.19038889
	Don't know	3.89252628	2.91640269
Parents Perception	Fun	1.72306527	1.34032079
	Healthy (Unhealthy)	0.70861227	0.59836292
Parents Education	College 4 years or more (College graduate)	0.9909891	0.98247782
	Grade 12 or GED (High school graduate)	0.80625411	0.8718786
	Grades 1 through 8 (Elementary)	1.50030347	1.72504304
	Grades 9 through 11 (Some high school)	1.2115022	1.29359228
	Prefer not to answer	1.34203616	1.59314621
School Encouragement	Not Encourage	0.96431843	1.0510339
Issues	Issue distance (Yes)	2.12486258	1.92465029
	issue convenience (Yes)	0.46462544	0.33332711
	issue time (Yes)	0.67961753	0.90700504
	issue after school program (Yes)	0.88152126	0.68140345
	issue speed (Yes)	0.70985973	0.67131365
	issue traffic (Yes)	0.79354485	0.87897311
	issue walk with adults (Yes)	0.92576453	0.87464088
	issue sidewalk (Yes)	1.36986597	1.46843506
	issue intersection (Yes)	0.85041093	0.89603119
	issue crossing guards (Yes)	1.39752088	1.33745784
	issue crime (Yes)	0.63707115	0.67072805
	issue weather (Yes)	0.94121603	1.06115598

Appendix F – Feaster Charter Elementary School Survey Graphs

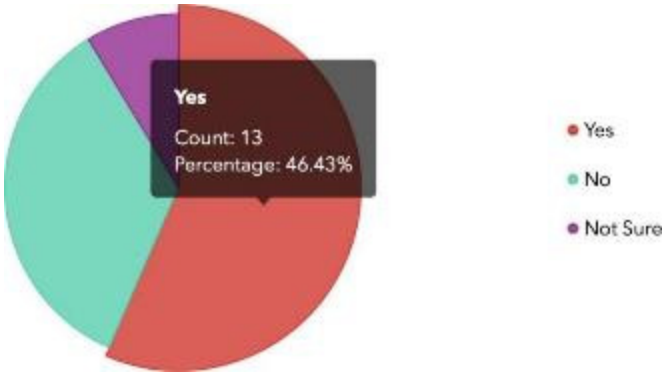
Issue: Distance



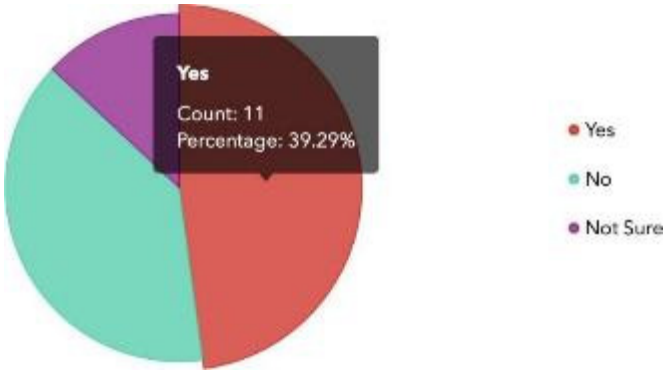
Issue: Convenience of driving



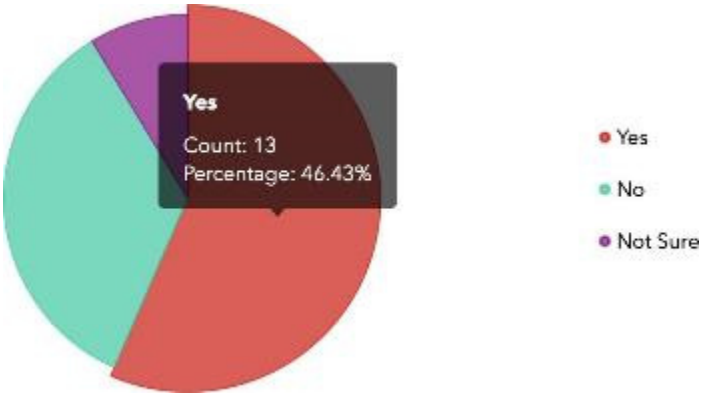
Issue: Time



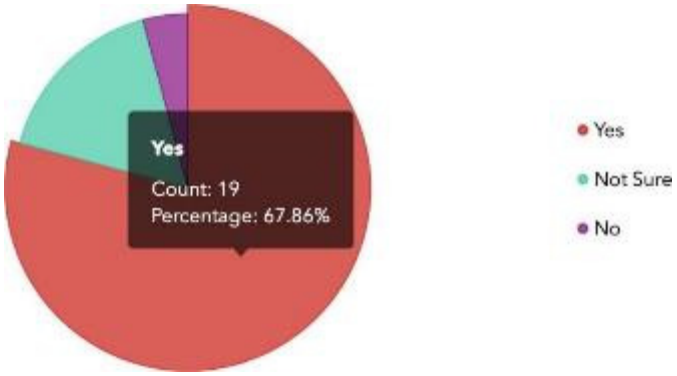
Issue: Child's before or after school activity



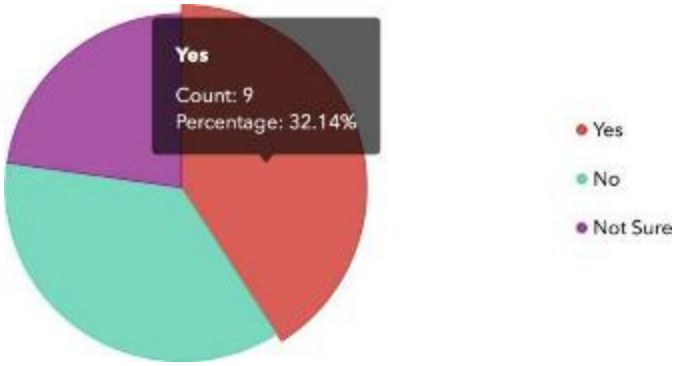
Issue: Speed or traffic along route



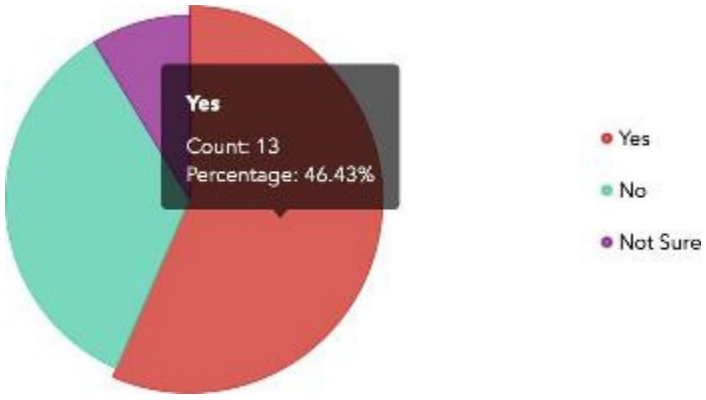
Issue: Amount of traffic along route



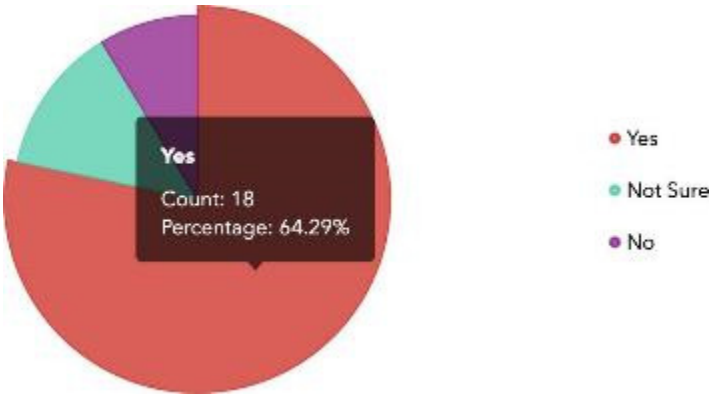
Issue: Adults to walk or bike



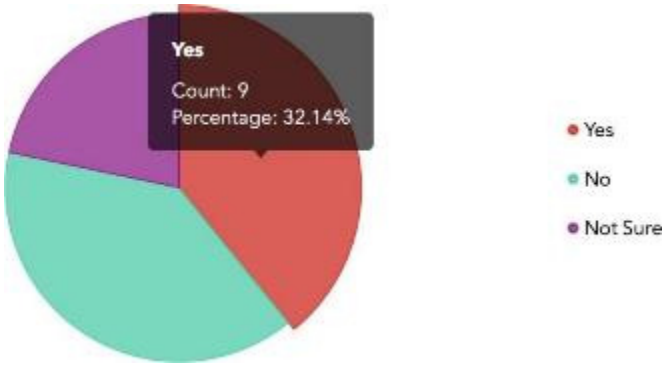
Issue: Sidewalk or pathways



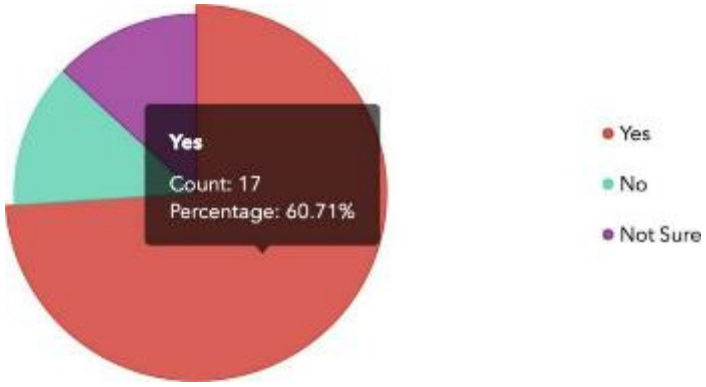
Issue: Safety of Intersections



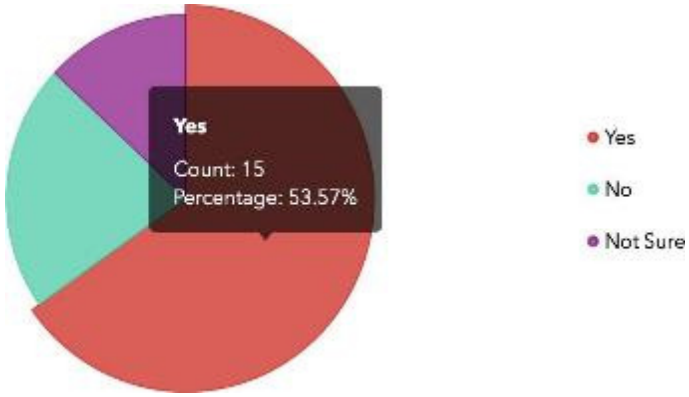
Issue: Crossing guards



Issue: Violence or crime



Issue: Weather or climate



Appendix G – Linear Regression Model Data Specification

Walk Percentage (Morning) (Double)
- The percentage of total number of students who walk to school in the morning (going to school) relative to total number of students per school.

Walk Percentage (Evening) (Double)
- The percentage of total number of students who walk to home in the evening (leaving from school) relative to total number of students per school.

Period (Chr)
- SRTS program status at the time of survey collection. Three classes: before, mid, post

Gender Female (Int)
- The percentage of female students relative to total number of students per school

Gender Male (Int)
- The percentage of male students relative to total number of students per school

Age Below 8 (Int)
- The percentage of students aged below 8 years old relative to total number of students per school.

8-10 yrs (Int)
- The percentage of students aged between 8 and 10 years old relative to total number of students per school.

11-12 yrs (Int)
- The percentage of students aged between 11 and 12 years old relative to total number of students per school.

Less than ¼ mile (Int)
- The percentage of students who lived closer than ¼ mile to school relative to total number of students per school.

¼ to ½ mile (Int)
- The percentage of students who lived between ¼ mile and ½ mile to school relative to total number of students per school.

½ to 1 mile (Int)

- The percentage of students who lived between ½ mile and 1 mile to school relative to total number of students per school.

1 to 2 miles (Int)

- The percentage of students who lived between 1 mile and 2 miles to school relative to total number of students per school.

More than 2 miles (Int)

- The percentage of students who lived further than 2 miles from school relative to total number of students per school.

Don't know (Int)

- The percentage of students who did not report their home distance to school relative to total number of students per school.

Fun (Int)

- The percentage of parents who perceived walk to school is enjoyable (fun) relative to total number of students per school.

Healthy (Int)

- The percentage of parents who perceive walk to school is healthy relative to total number of parents per school.

Parents Education (Int)

- Percentage of parents with higher education (more than high school) relative to the total number of parents per school.

School Encouragement (Int)

- The percentage of parents who perceived school encourages active transportation to school relative to total number of parents per school.

Issue distance (Int)

- The percentage of parents who reported distance as an issue for active travel to school relative to total number of parents per school.

Issue time (Int)

- The percentage of parents who reported time as an issue for active travel to school relative to total number of parents per school.

Issue convenience (Int)

- The percentage of parents who reported convenience as an issue for active travel to school relative to total number of parents per school.

Issue after school programs (Int)

- The percentage of parents who reported after school programs as an issue for active travel to school relative to total number of parents per school.

Issue speed (Int)

- The percentage of parents who reported speed as an issue for active travel to school relative to total number of parents per school.

Issue walk with adults (Int)

- The percentage of parents who reported children not walking with adults as an issue for active travel to school relative to total number of parents per school.

Issue sidewalk (Int)

- The percentage of parents who reported sidewalk as an issue for active travel to school relative to total number of parents per school.

Issue intersection (Int)

- The percentage of parents who reported intersection safety as an issue for active travel to school relative to total number of parents per school.

Issue crossing guards (Int)

- The percentage of parents who reported crossing guards as an issue for active travel to school relative to total number of parents per school.

Issue crime (Int)

- The percentage of parents who reported crime as an issue for active travel to school relative to total number of parents per school.

Issue weather (Int)

- Percentage of parents who reported weather as an issue for active travel to school relative to total number of parents per school.

Appendix H – Logistic Regression Model Data Specification

Walk (Morning) (int)
- Identifies if students' walk to school (walk=1) or use other transportation modes in the morning (go to school)

Walk (Evening) (int)
- Identifies if students' walk to school (walk=1) or use other transportation modes in the evening (leave from school)

Period (chr)
- SRTS program status at the time of survey collection.
  Three Classes: "before," "mid," "post"

Gender (chr)
- Student's gender
  Two Classes: "Male," "Female"

Age (chr)
- Student's age
  Three Classes: "below 8," "8-10 years," "10-12 years"

Distance (chr)
- Student's home distance from school
  Six Classes: "less than ¼ mile," "¼ to ½ mile," "between ½ to 1 mile," "between 1 to 2 miles," "more than 2 miles," "don't know"

Fun (chr)
- Parent's perception of enjoyment related to active travel to school
- Three Classes: "Fun," "Neutral," "Boring"

Healthy (chr)
- Parent's perception of active travel to school healthiness
- Three Classes: "Healthy," "Neutral," "Unhealthy"

School Encouragement (chr)
- Parent's opinion about school role in encouraging students to use active transportation
- Three Classes: "Encourages," "Neither," "Discourages"

Parents Education (Int)

- Parent's level of education
- Six Classes: "College 4 years or more (College graduate)," Grade 12 or GED (High school graduate)," "College 1 to 3 years (Some college or tech school)," "Grades 9 through 11 (Some high school)," "Grades 1 through 8 (Elementary)," "Prefer not to answer."

Issue distance (chr)

- If parents are concerned about distance as an active travel to school issue
- Two Classes: "Yes," "No"

Issue time (chr)

- If parents are concerned about time as an active travel to school issue
- Two Classes: "Yes," "No"

Issue convenience (chr)

- If parents are concerned about convenience as an active travel to school issue
- Two Classes: "Yes," "No"

Issue after school programs (chr)

- If parents are concerned about after school programs as an active travel to school issue
- Two Classes: "Yes," "No"

Issue speed (chr)

- If parents are concerned about speed as an active travel to school issue
  Two Classes: "Yes," "No"

Issue walks with adults (chr)

- If parents are concerned about walk with adults as an active travel to school issue
- Two Classes: "Yes," "No"

Issue sidewalk (chr)

- If parents are concerned about sidewalk as an active travel to school issue
- Two Classes: "Yes," "No"

Issue intersection (chr)

- If parents are concerned about intersection as an active travel to school issue
- Two Classes: "Yes," "No"

Issue crossing guards (chr)

- If parents are concerned about crossing guards as an active travel to school issue
- Two Classes: "Yes," "No"

Issue crime (chr)

- If parents are concerned about crime as an active travel to school issue
- Two Classes: “Yes,” “No”

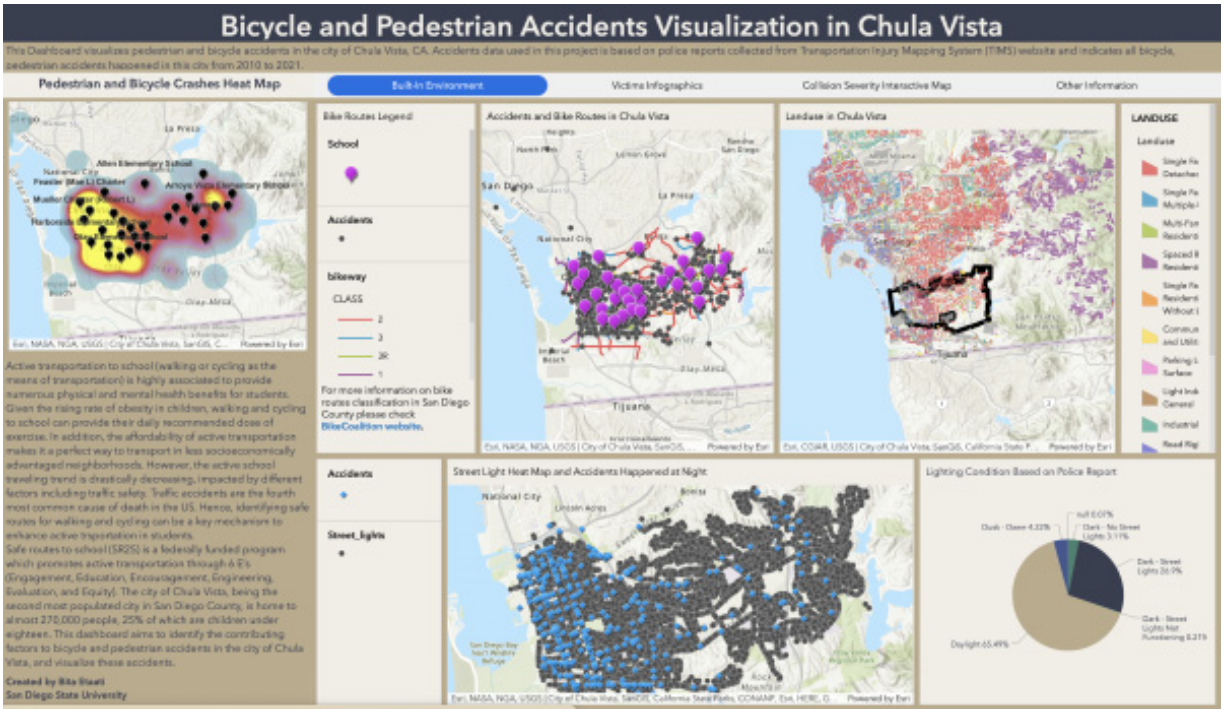
Issue weather (chr)

- If parents are concerned about weather as an active travel to school issue
- Two Classes: “Yes,” “No”

Appendix I – Interactive Visualization Dashboard

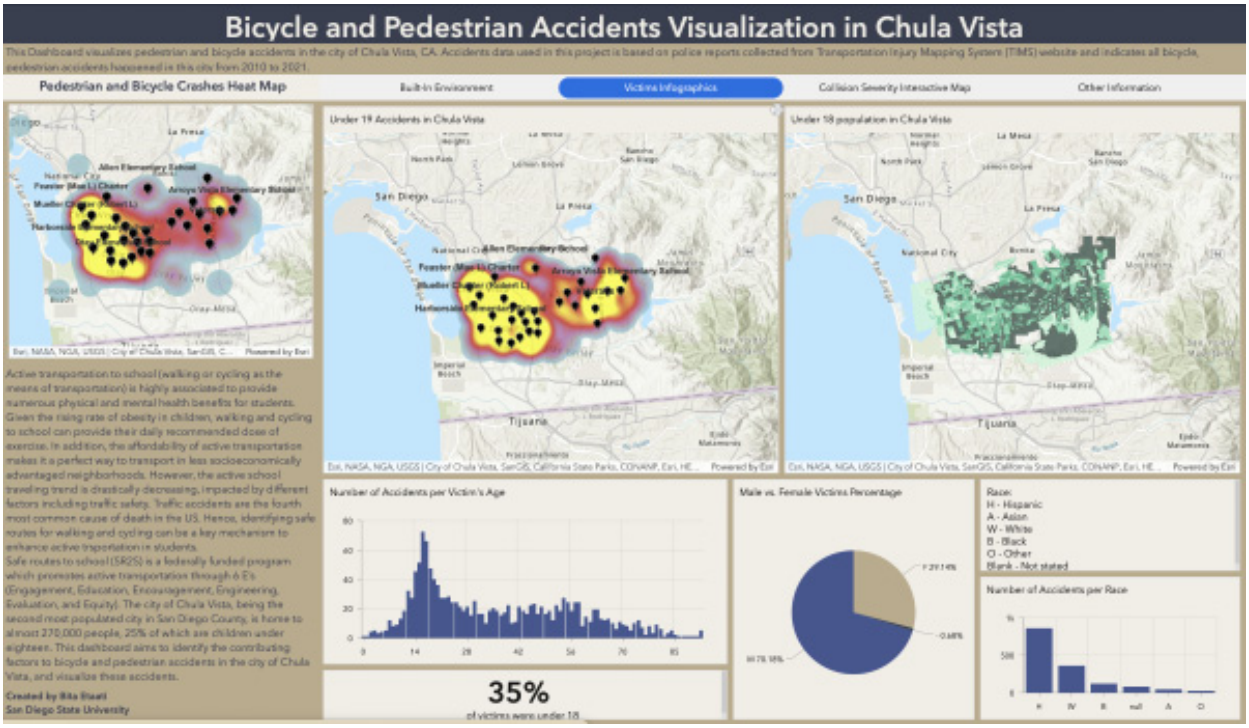
This interactive dashboard is developed using Esri Dashboards and consists of four tabs (Built-In Environment, Built-in Environment, Collision Severity Interactive Map, and Other Information). The pedestrian and bicycle heat map at the top left of the dashboard indicates the heat map of total accidents, as well as Chula Vista Elementary District schools.

The Built-In Environment figure includes information on available bike routes, streetlights map, and land use in Chula Vista.

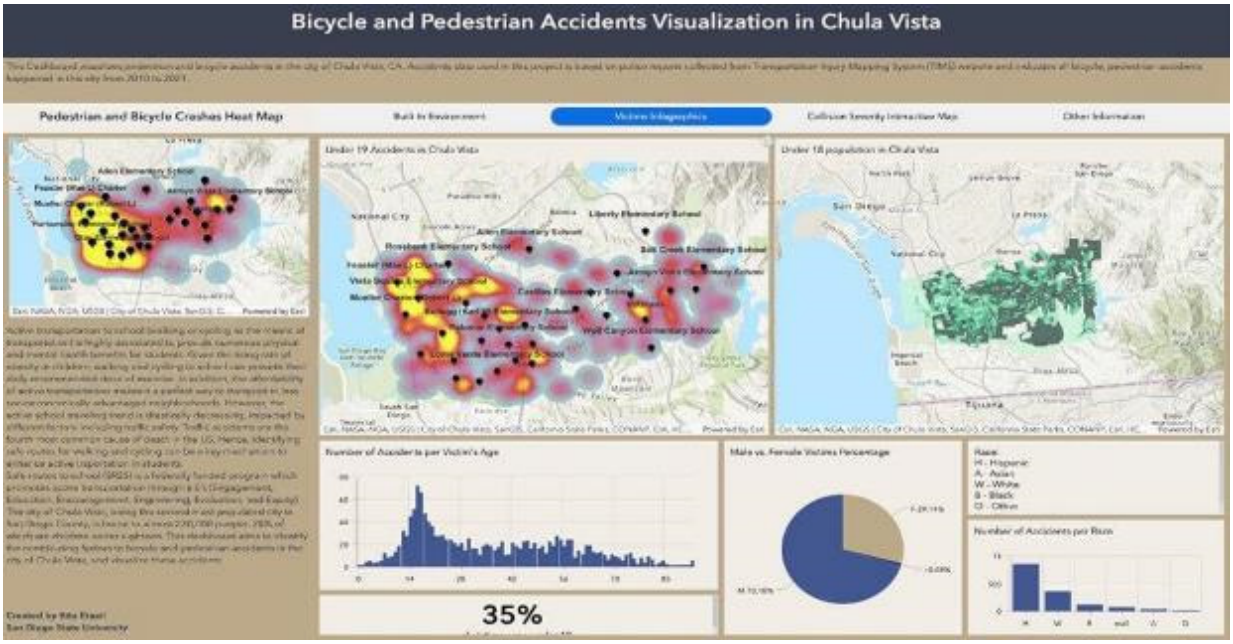


Built-in environment.

The victim's infographics below visualize the number of accidents per age, race, and gender. It also includes a heat map of accidents where the victim was under 19.

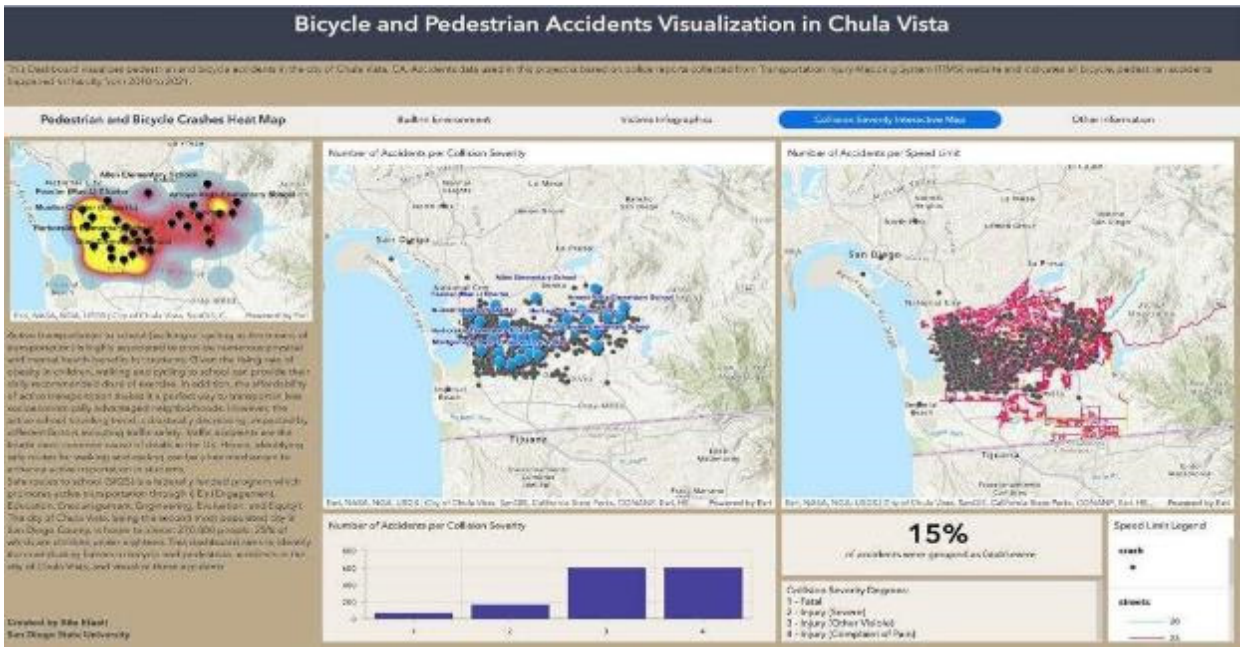


Victims' infographics



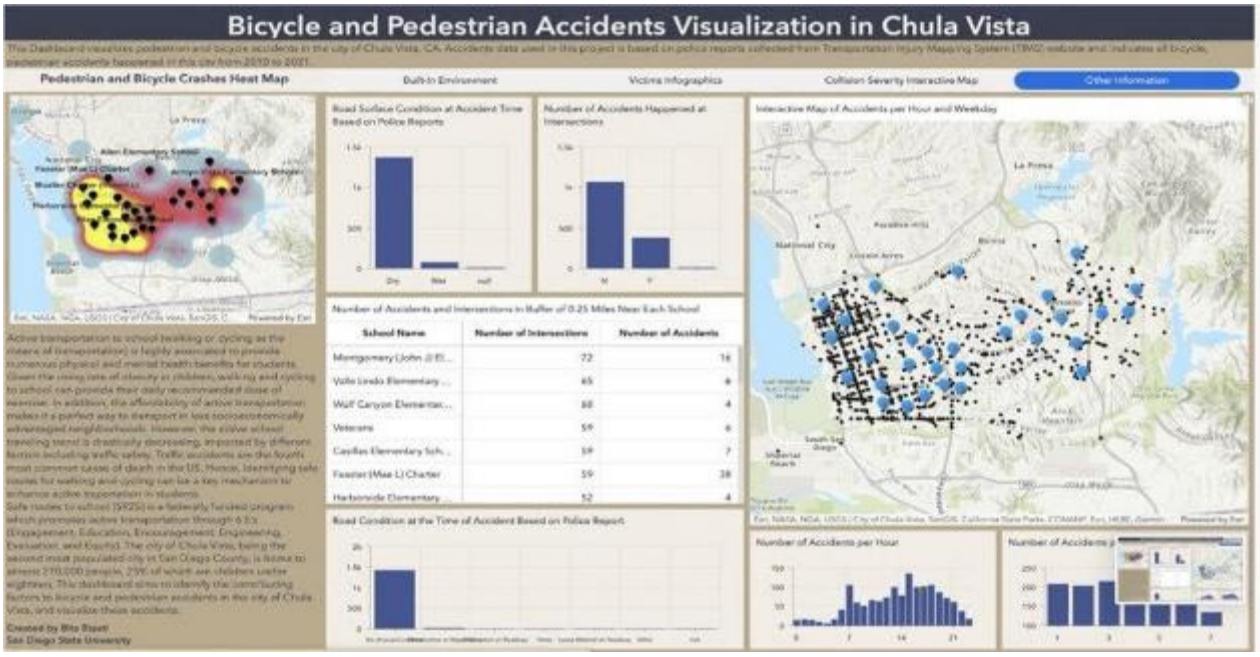
Victims' infographics (continued)

The Collision Severity tab visualizes an interactive map of accident locations based on collision severity.



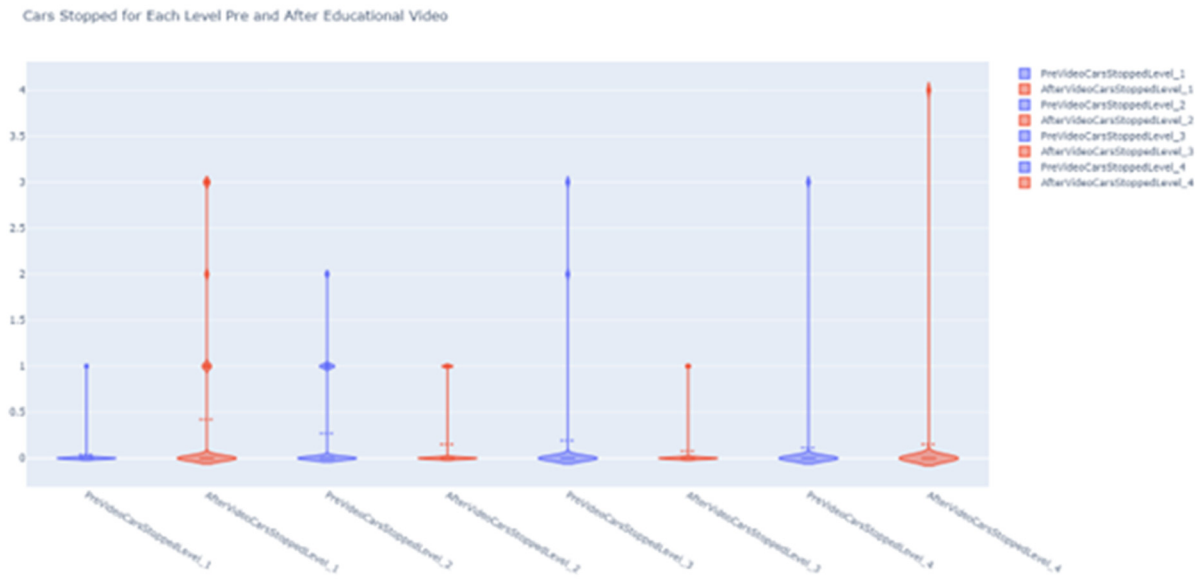
Collision severity interactive map

Other information in the figure below provides information on road conditions and surface. The interactive map on the top right of this tab shows accidents based on time and weekday.

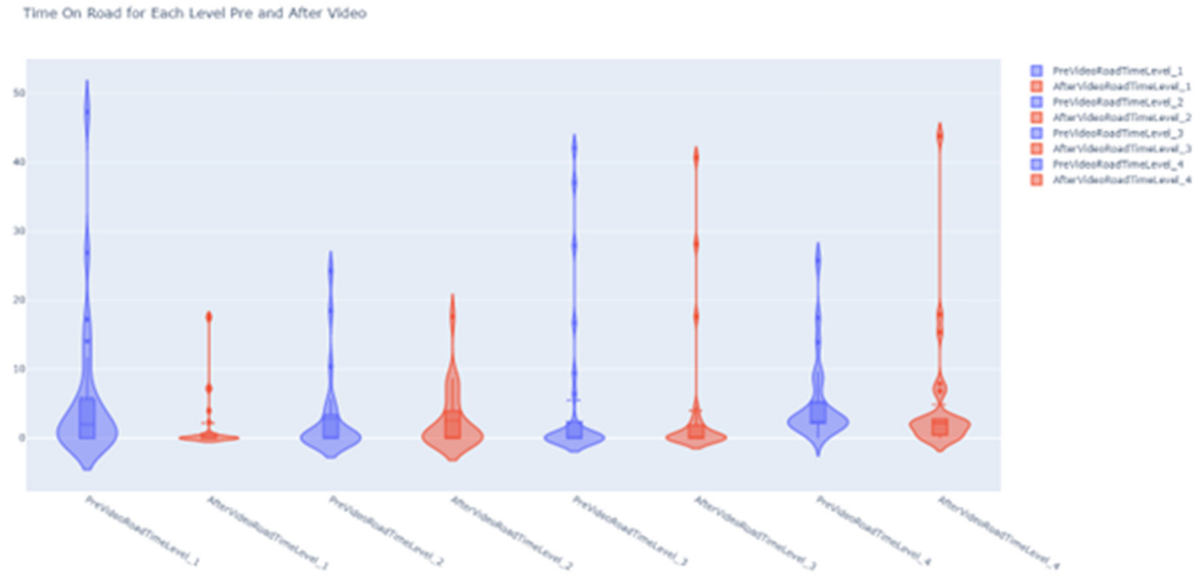


Other information

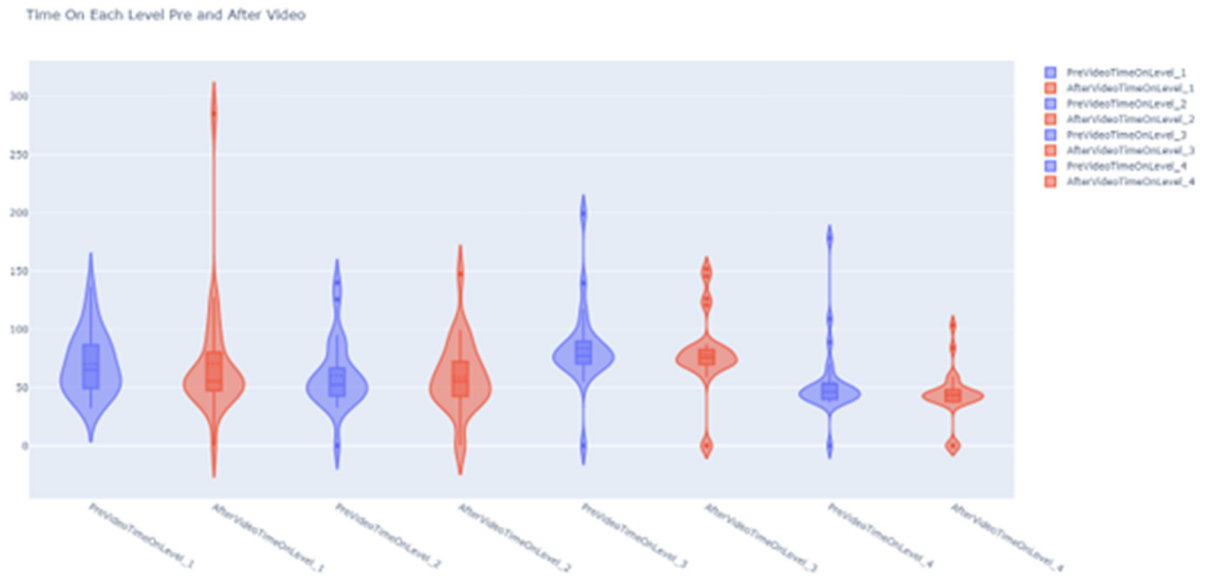
Appendix J – Kids 4 Safe Routes VR Game Results



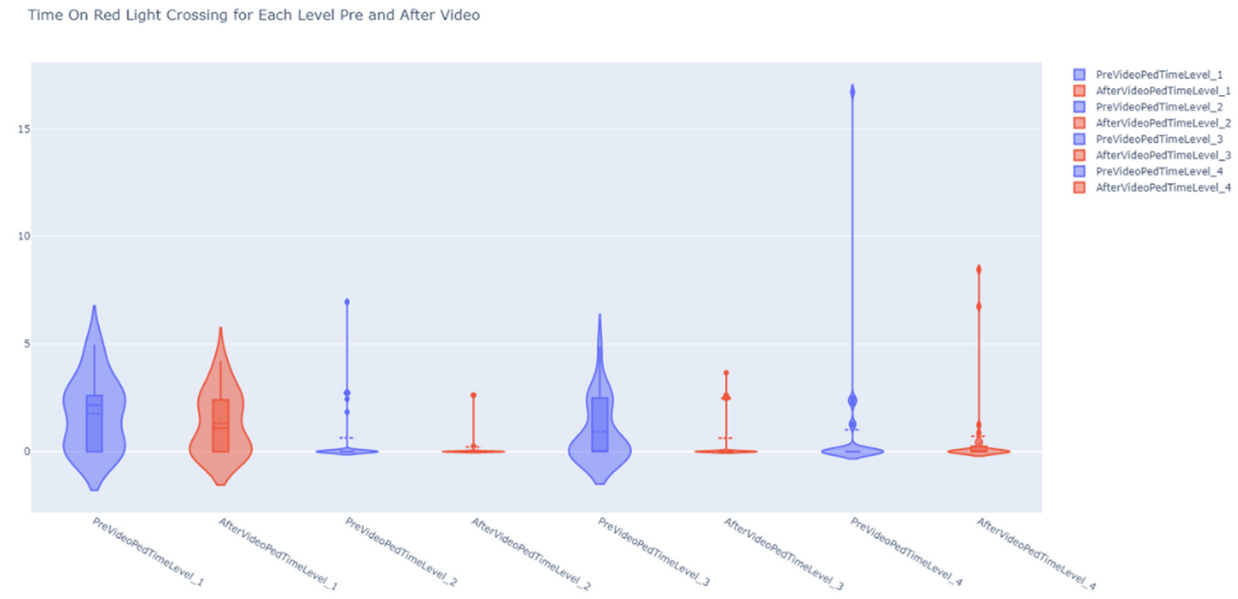
Cars stopped for each level pre- and after educational videos



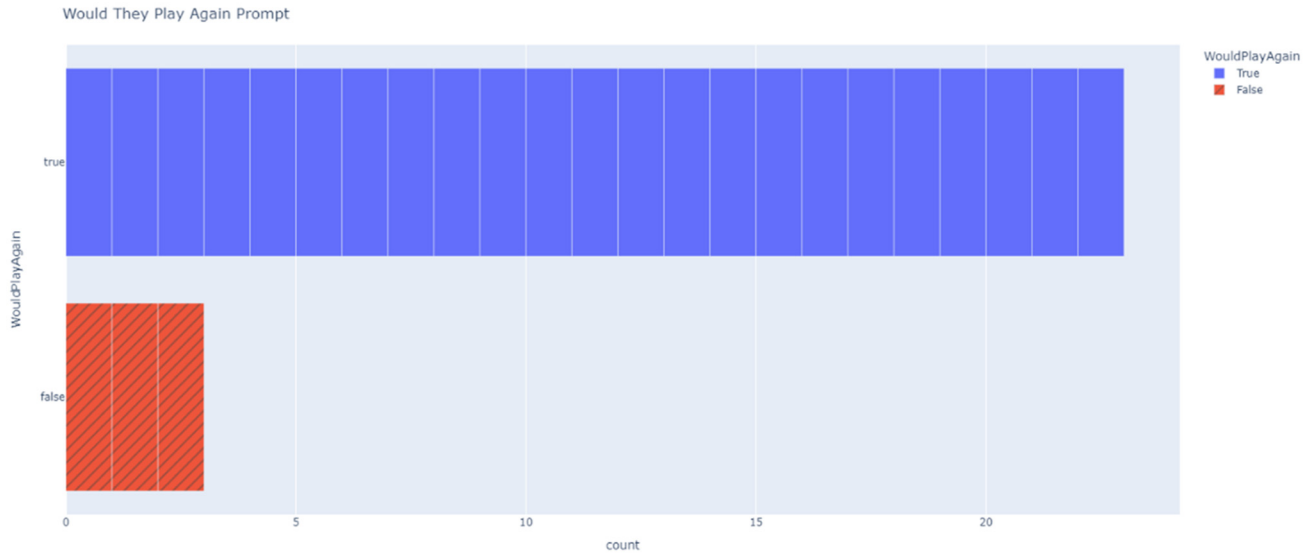
Time on road for each level pre- and after video



Time on each level pre- and after video



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



Would you play again?

Kids 4 Safe Routes VR Game

Appendix K – Kids 4 Safe Routes VR Game: A How to Guide to VR Tools

How To Guide for Anyone Interested in VR Games in Education

Prepared by Andrick Mercado

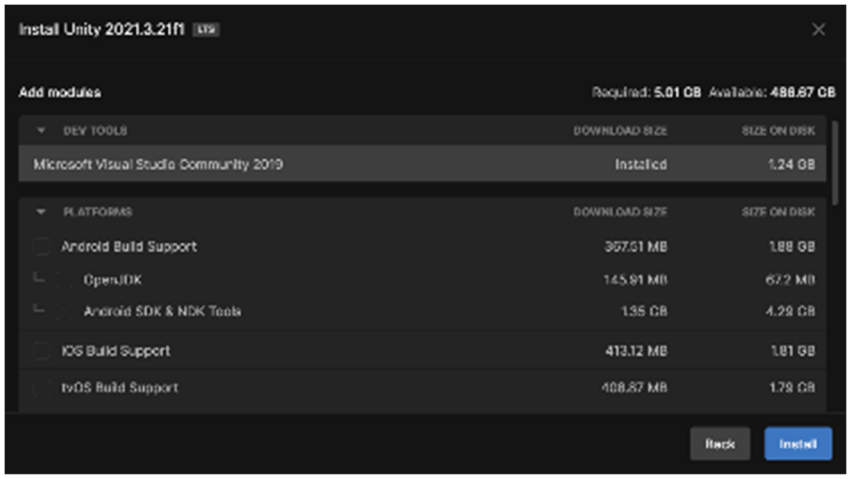
Overview and Purpose

This is a quick overview of the How To Guide. First, we download the Unity game engine, and for the VR part we are going to make use of Google Cardboard for Unity. Once we have downloaded the package in Unity, we can now test the Hello Cardboard Scene inside the Unity Editor. To test we need a phone. The minimum requirements for this to work are iOS 12 and greater and Android 7.0 'Nougat' (API level 24) for Android devices. As well, a gyroscope, accelerometer, and magnetometer are needed to make use of VR with the Google Cardboard API. Before we start creating, we want to know if we want to collect our user's performance data. If this is the case, we can make use of Firebase Realtime Database, a service by Google, to set up and check the section with this name. Finally, we just want to tighten everything together with code, and since we are using Unity, we must use C#.

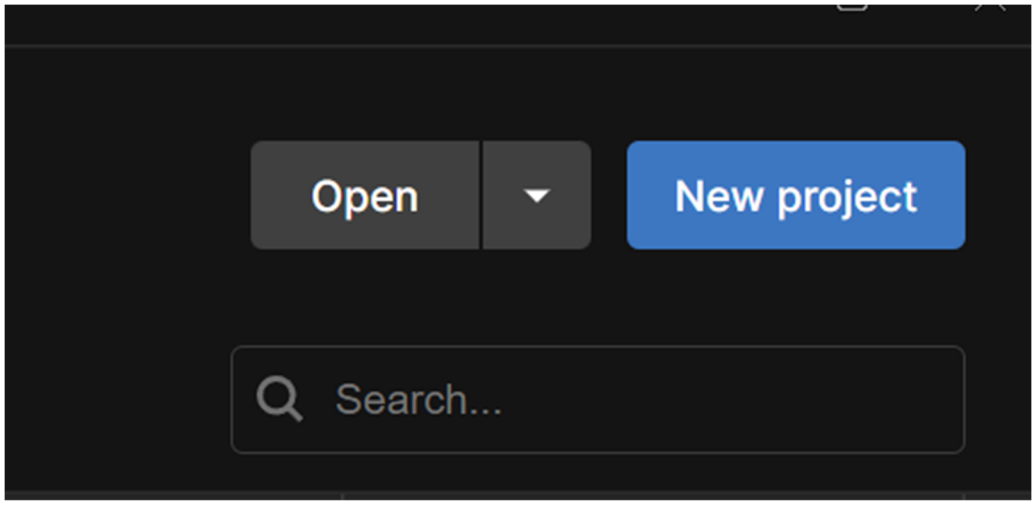
Unity

Unity is the game engine we picked for this How To, as it has fewer barriers to entry than other game engines. With this said, it is completely free given your game doesn't make more than $100K in 12 months (Unity Forum); we will pick the Personal license. Note since we are using Google Cardboard, we need to use Unity 2020.3.36f1 and above versions.

1. Visit Here and download the Unity Hub to your computer.
2. As for what version of the Unity Editor to pick, it depends on the goals of the project. We usually pick older versions as they are more stable; they are referred to as LTS versions. Here I would recommend Unity version 2021.3.10.
3. Once you select your version, you will get a prompt like the one below. Depending on what platform you are targeting, download either Android Build Support for Android or iOS Build Support for iPhones.



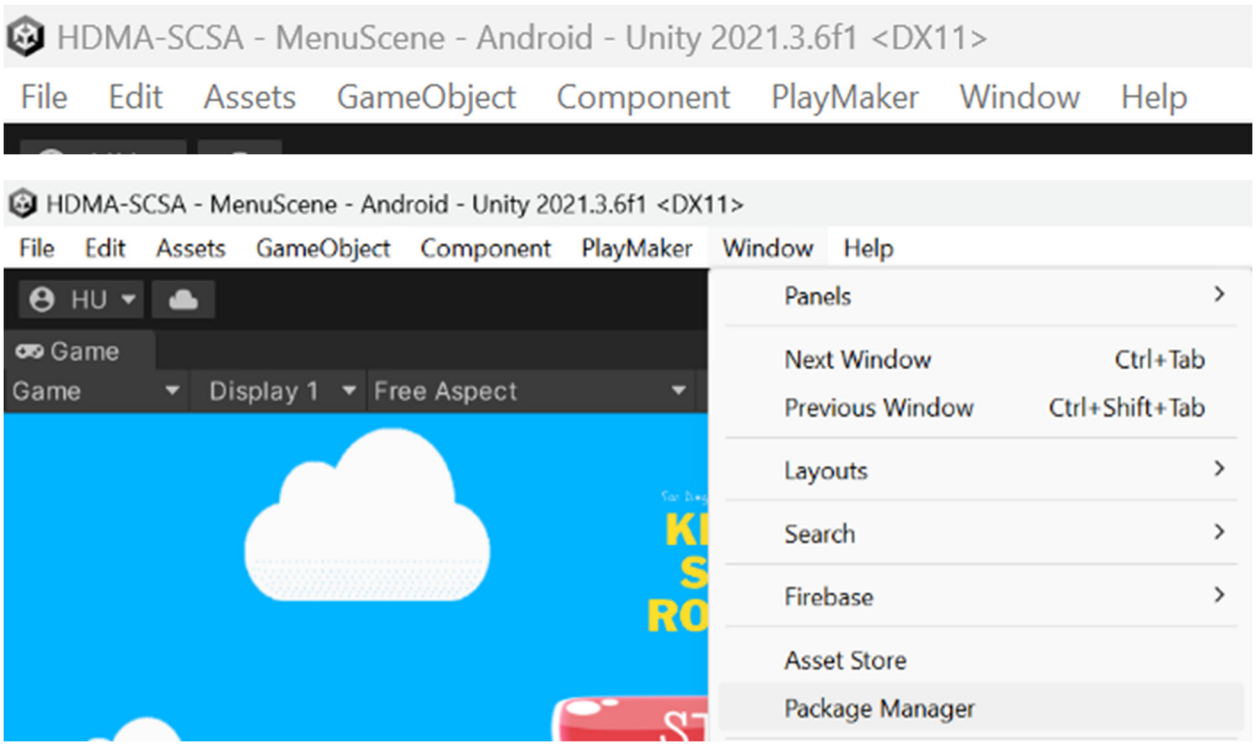
4. Before continuing, make sure you have a Unity account and sign up for a Personal license so that you can start creating your own games.
5. Now we need to create a New Project. Once we have pressed this button, we will get many templates to pick from. Just select 3D core, as this will allow us to create 3D VR games with Google Cardboard.

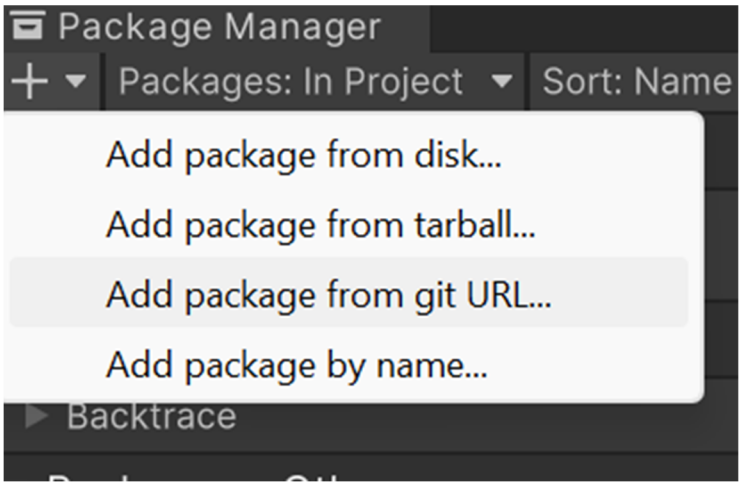


Google Cardboard

Once we have downloaded Unity and our Unity Editor is opened with the project we created, we want to add Google Cardboard to our project. Google Cardboard will allow us to create VR applications that can effectively make use of the Cardboard VR lens.

1. Now that we have the Unity Editor open on our project, we want to open the Window menu, and select Package Manager. Once pressed, we press the + symbol and select Add package from the git URL and type this: https://github.com/googlevr/cardboard-xr-plugin.git





2. Now, just press download and you will now have Google Cardboard in your cardboard. This will allow for the use of the cardboard lenses API.
3. For clarification on setup, visit here.

Firebase Realtime Database

If we want to store our player's data, we want to use a database. For this How To, I will make use of Firebase Realtime Database owned by Google.

1. For the setup of Firebase, I highly recommend this VIDEO as it explains everything very clearly.
2. Once we have set up our database and initialized it as shown in the video, we want to

save our data via JSON and send it to the database.

```
FirebaseDatabase.DefaultInstance.RootReference.
    Child("users").
        Child(schoolGrade).
            Child(sex).
                Child(SystemInfo.deviceUniqueIdentifier+PlayerPrefs.GetInt("AlternativePlayer",0)).
    SetRawJsonValueAsync(JsonUtility.ToJson(data));
```

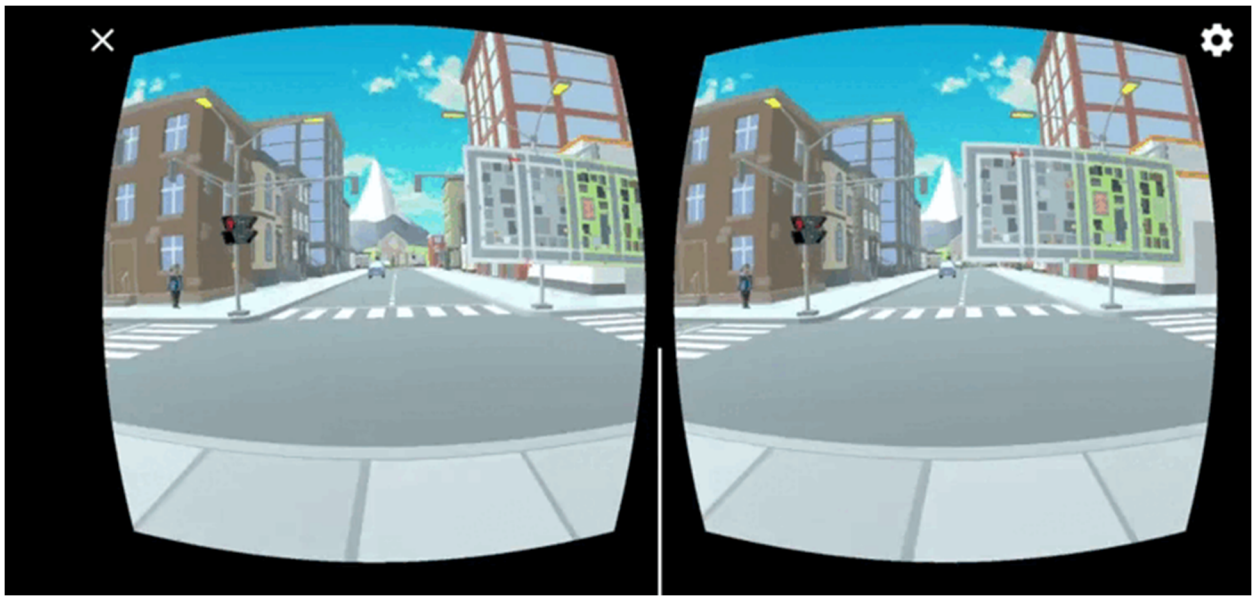
Coding (Tighten Everything Together)

Now, to make everything work together, we make use of C# since we have already installed the Unity Editor, which makes us download visual studio code by default. With this we can code and thus change how our different tools behave.

Art (The In-game Art)

Now that we have all our tools, we can either skip this step until we have a version of our game that is polished or we can acquire the art before finishing the core mechanics of our game.

1. There are many sites for acquiring free or paid 3D and or 2D artwork on the internet. I will list a few here: Unity Asset Store, Skecthfab, and OpenGameArt.
2. Here we can find diverse types of art. I would highly recommend sticking with the Unity Asset Store, as all packages you get are compatible with Unity. Just make sure they are compatible with your version as well.



Appendix L – Kids 4 Safe Routes VR Game Data Specification

PreVideoRoadTimeLevel_X (double)

- The amount of time in seconds player is on the in-game road, with "X" indicating the level, collected prior to showing them educational video on "X" level.

AfterVideoRoadTimeLevel_X (double)

- The amount of time in seconds player is on the in-game road, with "X" indicating the level, collected after showing them educational video on "X" level.

PreVideoCarsStoppedLevel_X (int)

- The number of cars stopped by the player on the in-game road, with "X" indicating the level, collected prior to showing them educational video on "X" level.

AfterVideoCarsStoppedLevel_X (int)

- The number of cars stopped by player on the in-game road, with "X" indicating the level, collected after showing them educational video on "X" level.

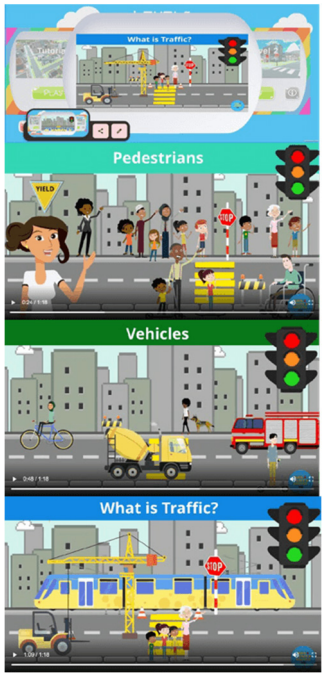
PreVideoPedTimeLevel_X (double)

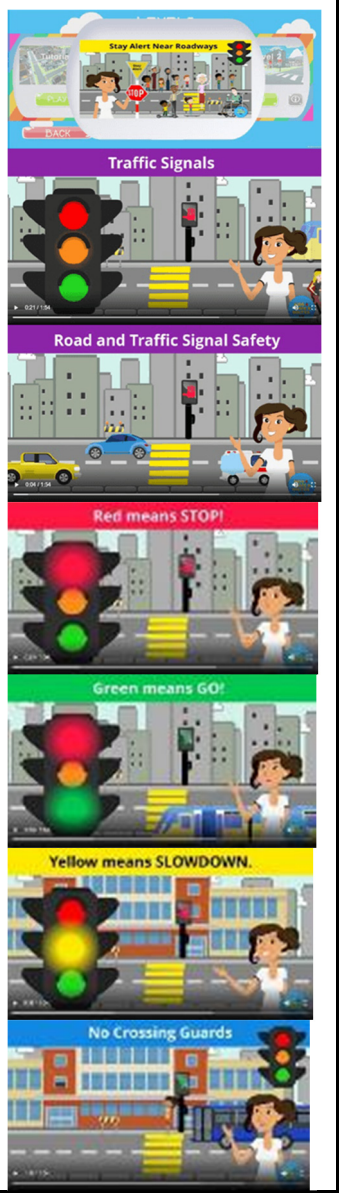
- The amount of time in seconds player is on the in-game pedestrian crossing while light is red, with "X" indicating the level, collected prior to showing them educational video on "X" level.

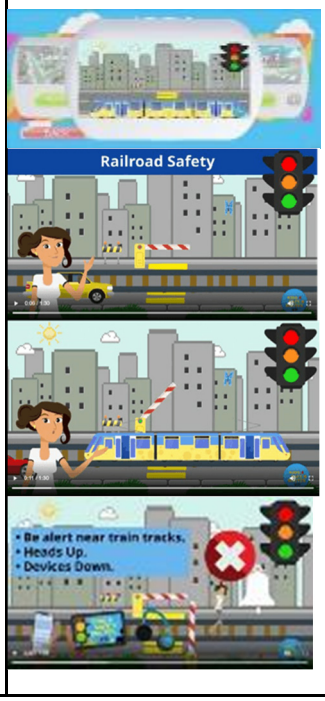
AfterVideoPedTimeLevel_X (double)

- The amount of time in seconds player is on the in-game pedestrian crossing while light is red, with "X" indicating the level, collected after showing them educational video on "X" level.

Appendix M – Kids 4 Safe Routes VR Game: Educational Animated Videos Using Powtoon

Level	**Videos** *Keywords in bold*	**Description** *Ella the instructor provides transit safety guidance throughout 4 educational videos shown below. Voice credit: Ella Camarena (9 years old)*	**Preview/ snapshots** To view videos, click here
1	Pedestrian and Vehicle Safety	Provides pedestrian and vehicle safety feedback: **What is a pedestrian**? What is a vehicle? Vehicles are machines that transport people from one place to another. Name vehicle types? Together we share a roadway. **What is traffic?** Traffic is the movement of pedestrians. **Stay alert near roadways.**	

2	Road and Traffic Signal Safety	Provides **road and traffic signal safety** feedback: Road safety is the protection and prevention of traffic incidents by using all road safety measures. It's important to learn about traffic signals. **Red means stop. Green means Go. Yellow means slow down.** Who are **crossing guards?** Direct traffic. A crossing guard gives you a signal to cross which means you are allowed to cross. **When there is no crossing guard, find a safe place to cross**. **What makes a place safe to cross?** Corners are best if it's dark, look for a place with streetlights. Look and listen. Listen for traffic and be sure to look both ways before crossing the street. **Look left, right, and left again. When there is a large gap between cars you are safe to cross. Always remember to make eye contact with the driver. Wait for vehicles to Stop. Watch for vehicles turning right. Always walk when crossing the street**. Be safe and have fun.	

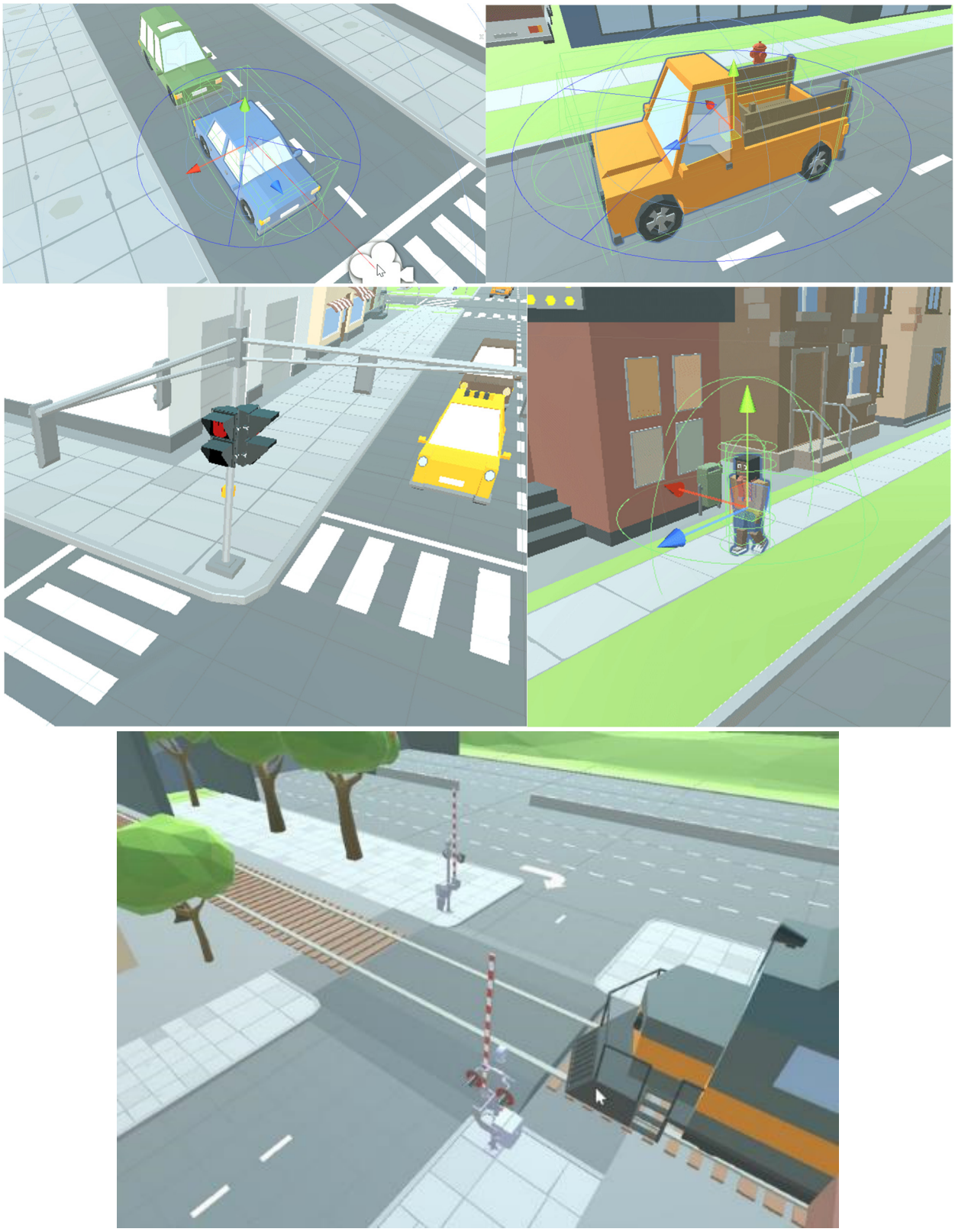
3	Crosswalk Safety	Provides **crosswalk safety** feedback: how to cross the street, no playing, no pushing, no running, always be alert, **put all distractions and devices down when crossing the street**. Designated crosswalks, where you should start crossing, finish crossing. Three types of crosswalks: pedestrian crossing, signal crosswalk, and intersection. Where should you cross? **Look left, right, and left again**. Always make eye contact with the driver. What is a countdown? Stop, look, listen, and think. Remember, stop at the curb, look left, look right, then left again, **listen for traffic**, and **think about your safety**.	
4	Railroad Safety	Provides guidance on railroad safety. Do you know how to cross railroad tracks? Only cross tracks at a street crossing. Always stay alert near train tracks. Be alert near train tracks. Heads up. Devices Down. Wait for the gates to open before crossing the street. Stay clear of tracks. When there are no sidewalks. The best place to walk is the sidewalk, but if one is not available, walk on the side of the road facing traffic.	

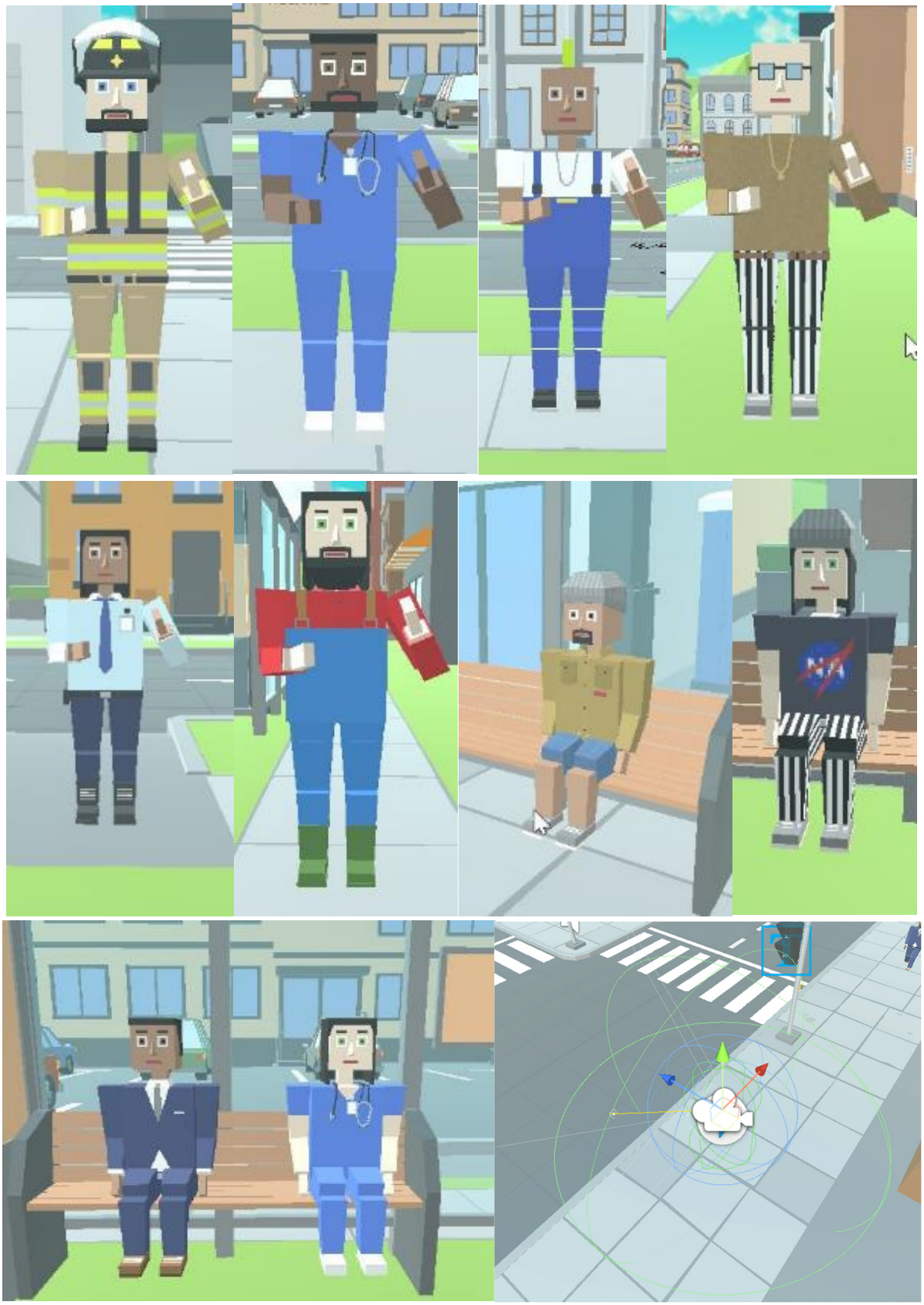
Appendix N – Kids 4 Safe Routes VR Game: Levels, Description, and Grading Scheme

ID	Levels	Description	Grading Scheme	Preview
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	Four-corner intersection with white pedestrian zebra crosswalk and traffic lights with button with sound and pedestrian sign countdown of 12 seconds.	1. Cars stopped 2. Time on road 3. Time crossing when pedestrian 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 pedestrian light is red	
3	Level 3: Go to your friend's house	School crossing intersection with button to request stop, with yellow pedestrian zebra crossing.	1. Cars stopped 2. Time on road 3. Time crossing when pedestrian 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 pedestrian light is red	

Appendix O – Kids 4 Safe Routes VR Game Assets





Appendix P – Institutional Review Board Parent English and Spanish Consent Form for Child to Participate in VR Game Study

(English)

Transit Safety Virtual Reality Game Intervention

Parent Consent Form for Child to Participate in Research Study [Detail Version]

San Diego State University
Date: January 10, 2023

NOTE: To participate in the VR game intervention on transit safety research study developed by researchers at San Diego State University. We ask that each parent and child complete the following forms before February 03, 2023, and return the forms to the participant's teacher: 1) "Transit Safety Virtual Reality Game Intervention Assent Form for Child to Participate in Research Study" and 2) Transit Safety Virtual Reality Game Intervention Parent Consent Form for Child to Participate in Research Study." Your responses will be kept confidential and neither your name nor your child's name will be associated with any results. After you have completed the two forms, please send them back to the school with your child or give them to your child's teacher.

TITLE: Transit Safety Virtual Reality Game Intervention

RESEARCHER(S):

Principal Investigator: **Dr. Gabriela Fernandez**, San Diego State University, Department: Department of Geography, Center for Human Dynamics in the Mobile Age (HDMA) Address: 5500 Campanile Dr., San Diego, California 92182. Email: gfernandez2@sdsu.edu.

Co-Investigator(s): **Dr. Ming-Hsiang Tsou**, Department of Geography, Director, Center for Human Dynamics in the Mobile Age (HDMA), San Diego State University, San Diego, California, at mtsou@sdsu.edu. **Dr. Arash Jahangiri**, Department of Civil, Construction, and Environmental Engineering at ajahangiri@sdsu.edu; **Dr. Sahar Ghanipoor-Machiani**, Department of Civil, Construction, and Environmental Engineering San Diego State University, San Diego, California, at sghanipoor@sdsu.edu.
SDSU Graduate Students: **Bita Etaati and Andrick Mercado**

STUDY FUNDED: Safe-D

IMPORTANT THINGS TO KNOW ABOUT THIS STUDY.

The importance of road safety education is widely acknowledged, however, there is a lack of consistency in road safety interventions currently being used in San Diego County schools. Furthermore, the majority of road safety educational programs use knowledge-based methods, which do not necessarily translate to improved behavior in real traffic environments. The use of virtual reality is starting to emerge as a viable option, as it allows for repeated risk-free practice. This study aimed to test the efficacy and playability of a virtual reality road crossing VR-based game with children aged 11 to 14 years. The VR game has 5 levels with different real-life scenarios. Participants will be asked to navigate to a target using a magic portal into the virtual world (the VR Google Cardboard and pointer position matching the direction of travel). Anonymous in-game data will be collected while participants play before and after an educational transit safety tutorial. Overall, the VR-based game will allow children to practice road crossing in an immersive environment, without risk and could provide a useful, evidence-based addition to current road safety education in San Diego County schools.

The study is developed by researchers from the Department of Geography and Department of Civil, Construction, and Environmental Engineering at San Diego State University (SDSU) and Safe-D.

WE ARE INVITING YOU TO JOIN THIS RESEARCH STUDY.
Your child's school wants to test your child's transit safety knowledge using VR game technologies. We would like to invite your child to take part in our National Safe Routes to School Program research study intervention. The study allows us to better understand current transit safety behaviors developed by 7th and 8th graders, ages 11 to 14 years of age. We are looking to increase our mark of volunteers to participate in our VR game intervention to 200 participants to provide a significant snapshot of participants' behaviors. The resulting data from this VR game intervention may offer important insights to fight pedestrian and bicyclist deaths/accidents. The study may be

used for academic research on transit safety in order to help urban planners, school administrators, citizens, NGO's, health specialists, and policymakers recommend effective policy measures over transit safety near K-12 schools. Please note that this information will be kept strictly confidential.

Many governments are currently implementing policy measures such as the federal funded program Safe Routes to School to help contain bicyclist and pedestrian accidents and deaths near K-12 schools. This VR game intervention will provide an aggregated view of how children perceive transit safety near K-12 schools. So far there has been no updated assessment of how children perceive transit safety near K-12 schools in Chula Vista, California.

WHY ARE WE DOING THIS STUDY?

There has been no updated VR game assessment of how individuals perceive transit safety in K-12 in the City of Chula Vista, California. Nationally, 10% to 14% of car trips during morning rush hour are for school travel. As part of the National Safe Routes to School Program, our research promotes safe walking and bicycling to school to enhance children's health and wellbeing, ease traffic congestion near schools, and improve air quality and community members' overall quality of life by making it easier and safer for families to choose active modes of transportation when traveling to and from school.

WHAT IS THE TIME COMMITMENT IF I JOIN THIS RESEARCH STUDY?

You are being asked to allow your child to participate in a VR game intervention which involves levels about transit safety, crosswalk safety, signal safety, railroad safety, and traffic safety. The intervention should take about 15 minutes to complete. Participants must have a sign parent permission form "Transit Safety Virtual Reality Game Intervention Parent Consent Form for Child to Participate in Research Study" and agreed to participate in the study by filling out the "Transit Safety Virtual Reality Game Intervention Assent Form for Child to Participate in Research Study" form. For participants to participate the two mentioned forms must be collected. This will demonstrate full consent to participation.

WHAT WILL I BE ASKED TO DO IN THIS RESEARCH STUDY?

The purpose of this study is to help researchers understand if virtual reality games among 7th and 8th graders are helpful to educate children about transportation safety when walking to/from school. This information may help us to learn strategies to help other kids' learn about transportation safety and develop policy transit recommendations. The resulting data from this study may offer important insights to fight pedestrian and bicyclist deaths/accidents and be used for academic research in order to help urban planners, school administrators, citizens, NGO's, health specialists, and policymakers recommend effective policy legislative measures over transit safety near K-12 schools. Participation is free at no cost. The data will be used for research, and not for commercial purposes.

RECRUITMENT

K-12 school administrators in the City of Chula Vista, CA will be involved with the delivery of the recruitment process by sending out an email to participants through social media, newsletter announcements, events, and school administration. VR game intervention score data will be collected through the Unity platform. Participants will be notified of the research study and be provided with details of procedures and deadlines.

WHAT SHOULD I KNOW ABOUT THE RESEARCH STUDY?

- Whether or not you take part is up to you.
- Your participation is completely voluntary.
- You can choose not to take part.
- You can agree to take part and later change your mind.
- Your decision will not be held against you.
- Your refusal to participate will not result in any consequences or any loss of benefits that you are otherwise entitled to receive.
- You can ask all the questions you want before you decide.

WHAT ARE THE RISKS OR DISCOMFORTS INVOLVED IN THE RESEARCH?

We believe there is very little chance that bad things will happen as a result of being in this study. It is possible that your child might feel motion sickness using the virtual reality google cardboards. They might also experience virtual reality side effects, which can include but are not limited to, blurry vision, eye strain, headaches, dizziness, fatigue, or nausea.

ARE THERE ANY BENEFITS TO PARTICIPATION?

The information your child provides will be used to protect and promote transit safety education. In addition, by joining this research study, you child is helping to provide information which may help engineers, urban planners, educators, and society promote transit safety legislation. Possible benefits might be that your child may gain skills playing the game. Your child might have fun playing with electronics using this new technology to learn about transit safety. We might also learn something that could help others.

WILL MY INFORMATION BE PRIVATE OR ANONYMOUS?

Minimal risk data will be recorded and collected in a separate storage away from the original data for security reasons. Specifically, data on the participant's VR game performance that is collected during the 5 levels game intervention concerning transit safety. More specifically, how to cross the street safely in intersections, crosswalks, junctions, understanding of signage, and transit safety behaviors will be collected. We will analyze the collected data in a confidential and professional manner.

The VR game intervention contains limited identifiers. Thus, we will collect information that will identify participants' before and after scores will be collected as part of this research study dataset and will not be used or distributed for future research studies. You can refuse to stop the VR game intervention at any given time. Records will be stored in a locked secured cloud and will only be accessible to research staff listed on this consent form document.

To further protect your information, data stored by the researcher will be password protected and/or encrypted. Only researchers' named in this study will have access to the data as collected. Any future publications will include collective information (i.e., aggregate data), which can be accessed by you for results. Your child's individual test scores response (i.e., raw data) will not be shared with anyone outside of the research team. The researchers will keep the data for 5 years after the end of the study (after data has been downloaded). The data will be permanently erased afterwards. The VR game intervention score responses will be deleted from the VTTI Dataverse Repository right after the data has been downloaded onto a secure storage device.

This consent applies to all participants. In the case where participants want to withdraw their individual score data from the system, participants are protected through the "right to be forgotten" clause. For more information to withdraw from the VR game intervention (participant's individual data) please contact Principal Investigator, Dr. Gabriela Fernandez at gfernandez2@sdsu.edu.

DO I HAVE TO JOIN THIS STUDY?
No, your child does not have to join this research study. Even if you agree to allow your child to participate, you can decide later that you do not want your child to be in the research. If you choose to not let your child join the study, there is no penalty or loss of benefits to which you are otherwise entitled.

WILL I BE TOLD ABOUT THE RESEARCH RESULTS?
We will not contact you with the results of this study after this study is completed, unless email is provided. However, we will share the research results in our website at:

Project website: https://storymaps.arcgis.com/stories/9b51cd43c22f4868be64c1ae74e458f8,
Safe-D website: https://safed.vtti.vt.edu/diversity-equity-and-inclusion-in-transportation/.

WILL IT COST ME ANYTHING IF I JOIN THE RESEARCH?

No.

YOUR RIGHTS AS A RESEARCH PARTICIPANT?
Participation in research is completely voluntary and your child can withdraw your consent at any point during the VR game intervention. However, once the child has played the VR Game and submitted its score at the end of the game the researchers will not be able to determine which score answers belong to your child so your information cannot be withdrawn after that point.

Please note that by signing the parent consent form you are providing your consent for participation. By consenting to participate, you are not waiving any of your legal rights as a research participant. The data cannot be withdrawn after the child has played the VR and responses have been submitted, as participant responses are anonymous. Contacting the researchers will result in a loss of anonymity (but that participant identities will remain confidential and in a safe database).

WILL I BE PAID IF I JOIN THE RESEARCH?
Participation is voluntary. Your child will not be paid for taking part in this study. However, your child's participation may help us learn strategies to help other kids' learn about transportation safety using VR. Thus, develop effective transit policy recommendations to policymakers and city managers.

WHOM DO I CONTACT IF I HAVE QUESTIONS OR CONCERNS?
If you or your child have questions, concerns, or complaints, (a person may withdraw participation at any time for any reason) please contact the Principal Investigator, **Dr. Gabriela Fernandez**, Department of Geography, Director, Metabolism of Cities Living Lab, Center for Human Dynamics in the Mobile Age (HDMA), San Diego State University, San Diego, California, at

gfernandez2@sdsu.edu. Co-Investigator(s): **Dr. Ming-Hsiang Tsou**, Department of Geography, Director, Center for Human Dynamics in the Mobile Age (HDMA), San Diego State University, San Diego, California, at mtsou@sdsu.edu; **Dr. Arash Jahangiri**, Department of Civil, Construction, and Environmental Engineering at ajahangiri@sdsu.edu; and **Dr. Sahar Ghanipoor-Machiani**, Department of Civil, Construction, and Environmental Engineering San Diego State University, San Diego, California at sghanipoor@sdsu.edu.

If you have any questions about your rights as a research participant, you may contact the Division of Research Affairs at San Diego State University (Telephone: +01(619) 594-6622; email: irb@sdsu.edu). At any time during the research, you can contact the IRB for questions about research rights, to discuss problems, concerns, give suggestions, or to offer input.

REFERENCES List of references to support research.

Using Virtual Reality to Train Children Safe Street Crossing Skills
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2829738/

Teaching Children Road Safety Using a Simulated Environment
https://files.eric.ed.gov/fulltext/EJ1259913.pdf

Safe-D Program
https://safed.vtti.vt.edu/

Federal Government Guidelines
https://www.transportation.gov/mission/health/Safe-Routes-to-School-Programs#:~:text=Safe%20Routes%20to%20School%20(SRTS,hour%20are%20for%20school%20travel

(English)

Transit Safety Virtual Reality Game Intervention
Parent Consent Form for Child to Participate in Research Study

Key Information About This Study

The following is a short summary of this study to help you decide whether to allow your child to participate in an interactive research activity. Your child has been selected to participate and help improve a national program. Your child's participation will help improve the national Safe Routes to School program.

The purpose of this study is to help researchers understand if virtual reality games among 7th and 8th graders are helpful to educate children about transportation safety when walking to/from school. This information may help us to learn strategies to help other kids' learn about transportation safety and develop policy transit recommendations. The resulting data from this study may offer important insights to fight pedestrian and bicyclist deaths/accidents and be used for academic research in order to help urban planners, school administrators, citizens, NGO's, health specialists, and policymakers recommend effective policy legislative measures over transit safety near K-12 schools. Participation is free at no cost.

Study Participation
Your child will play a virtual reality game "**KIDS 4 SAFE ROUTES VR**" during intervention. Intervention play will total a minimum of 15 minutes. This will take place at Feaster Charter Elementary School on February 03, 2023, during school hours.
Note: Please return the form to the school teacher.

Dear Parent/Guardian,

We invite your child to be in this global research study because we are **testing the feasibility and effectiveness of virtual reality games to help educate children about transportation safety when walking to/from school**. Findings from this study will help us know how to develop more effective transit safety interventions.

Participation is voluntary. Using this form as a guide, we will explain the study to you. If you have any questions about the study, please ask. Once you understand this study, we will ask you to decide whether you would like your child to participate. The data collected will be confidential and protected.

WHAT ARE THE RISKS OF BEING IN THIS STUDY?
We believe there is very little chance that bad things will happen as a result of being in this study.
It is possible that your child might feel motion sickness using the virtual reality google cardboards. They might also experience virtual reality side effects, which can include but are not limited to, blurry vision, eye strain, headaches, dizziness, fatigue, or nausea.

WHOM SHOULD I CONTACT IF I HAVE QUESTIONS?
If you are worried about anything or if you have further questions please contact the Principal Investigator Dr. Gabriela Fernandez at gfernandez2@sdsu.edu.

ARE THERE BENEFITS TO TAKING PART IN THIS STUDY?
Possible benefits might be that your child may gain skills playing the game. Your child might have fun playing with electronics using this new technology to learn about transit safety. We might also learn something that could help others.

SIGNATURE BLOCK FOR CHILDREN

By signing this form, you agree to allow your child to be in this study. Your signature documents your permission for the named child to take part in this research. Data will be confidential.

[ ] Yes, I agree to participate.
[ ] No, I do not agree to participate.

_____
Printed name of child

_____
Signature of Parent/Guardian legally authorized to consent to the child.

_____
Date

(Spanish)

Intervención de juego de realidad virtual de seguridad de tránsito

Formulario de consentimiento de los padres para que el niño participe en un estudio de investigación [Versión detallada]

Universidad Estatal de San Diego
Fecha: 10 de enero de 2023

NOTA: Para participar en el estudio de investigación de intervención de juegos de realidad virtual sobre seguridad en el tránsito desarrollado por investigadores de la Universidad Estatal de San Diego. Pedimos que cada padre e hijo completan los siguientes formularios antes del 3 de Febrero de 2023 y los devuelvan al maestro del participante: 1) "Formulario de consentimiento de intervención del juego de realidad virtual de seguridad en el tránsito para que el niño participe en un estudio de investigación" y 2) Seguridad en el tránsito virtual Reality Game Intervention Formulario de consentimiento de los padres para que el niño participe en el estudio de investigación". Sus respuestas se mantendrán confidenciales y ni su nombre ni el de su hijo se asocian con ningún resultado. Una vez que haya completado los dos formularios, envíalos a la escuela con su hijo o entréguese los maestro de su hijo.

TÍTULO: Intervención de juegos de realidad virtual de seguridad en el tránsito

INVESTIGADORES):

Principal Investigator: **Dr. Gabriela Fernandez**, San Diego State University, Department: Department of Geography, Center for Human Dynamics in the Mobile Age (HDMA) Address: 5500 Campanile Dr., San Diego, California 92182. Email: gfernandez2@sdsu.edu.

Co-Investigator(s): **Dr. Ming-Hsiang Tsou**, Department of Geography, Director, Center for Human Dynamics in the Mobile Age (HDMA), San Diego State University, San Diego, California, at mtsou@sdsu.edu. **Dr. Arash Jahangiri**, Department of Civil, Construction, and Environmental Engineering at ajahangiri@sdsu.edu; **Dr. Sahar Ghanipoor-Machiani**, Department of Civil, Construction, and Environmental Engineering San Diego State University, San Diego, California, at sghanipoor@sdsu.edu.
SDSU Graduate Students: **Bita Etaati and Andrick Mercado**

ESTUDIO FINANCIADO: Safe-D

COSAS IMPORTANTES A SABER SOBRE ESTE ESTUDIO.
La importancia de la educación vial es ampliamente reconocida, sin embargo, existe una falta de coherencia en las intervenciones de seguridad vial que se utilizan actualmente en las escuelas del condado de San Diego.

Además, la mayoría de los programas educativos de seguridad vial utilizan métodos basados en el conocimiento, que no necesariamente se traducen en una mejora del comportamiento en entornos reales de tráfico. El uso de la realidad virtual empieza a despuntar como una opción viable, ya que permite una práctica reiterada y sin riesgos. Este estudio tuvo como objetivo probar la eficacia y la jugabilidad de un juego basado en VR de cruce de carreteras de realidad virtual con

Niños de 11 a 14 años. El juego de realidad virtual tiene 5 niveles con diferentes escenarios de la vida real. Se les pedirá a los participantes que naveguen hacia un objetivo utilizando un portal mágico en el mundo virtual (el cartón de Google VR y la posición del puntero que coincida con la dirección del viaje). Se recopilaron datos anónimos en el juego mientras los participantes juegan antes y después de un tutorial educativo sobre seguridad en el tránsito. En general, el juego basado en realidad virtual permitirá a los niños practicar el cruce de carreteras en un entorno inmersivo, sin riesgo y podría proporcionar una adición útil basada en evidencia a la educación actual sobre seguridad vial en las escuelas del condado de San Diego.
El estudio fue desarrollado por investigadores del Departamento de Geografía y del Departamento de Ingeniería Civil, de Construcción y Ambiental de la Universidad Estatal de San Diego (SDSU) y Safe-D.

Lo/a invitamos a unirse a este estudio de investigación.
La escuela de su hijo quiere evaluar el conocimiento de seguridad del tránsito de su hijo utilizando tecnologías de juegos de realidad virtual. Nos gustaría invitar a su hijo a participar en nuestra intervención de estudio de investigación del Programa Nacional de Rutas Seguras a la Escuela. El estudio nos permite comprender mejor los comportamientos actuales de seguridad en el tránsito desarrollados por estudiantes de 7.° y 8.° grado, de 11 a 14 años de edad. Estamos buscando aumentar nuestra marca de voluntarios para participar en nuestra intervención de juegos de realidad virtual a 200 participantes para proporcionar una instantánea significativa de los comportamientos de los participantes. Los datos resultantes de esta intervención del juego VR pueden ofrecer información importante para combatir las muertes/accidentes de peatones y ciclistas. El estudio puede utilizarse para la investigación académica sobre la seguridad del tránsito con el fin de ayudar a los planificadores urbanos, administradores escolares, ciudadanos, ONG, especialistas en salud y legisladores a recomendar medidas de políticas efectivas sobre la seguridad del

tránsito cerca de las escuelas K-12. Tenga en cuenta que esta información se mantendrá estrictamente confidencial.

Muchos gobiernos están implementando actualmente medidas políticas como el programa financiado por el gobierno federal Rutas seguras a la escuela para ayudar a contener los accidentes y muertes de ciclistas y peatones cerca de las escuelas K-12. Esta intervención de juego de realidad virtual proporcionará una vista agregada de cómo los niños perciben la seguridad del tránsito cerca de las escuelas K-12. Hasta el momento no ha habido una evaluación actualizada de cómo los niños perciben la seguridad del tránsito cerca de las escuelas K-12 en Chula Vista, California.

¿POR QUÉ HACEMOS ESTE ESTUDIO?
No ha habido una evaluación actualizada del juego de realidad virtual sobre cómo las personas perciben la seguridad del tránsito en K-12 en la ciudad de Chula Vista, California. A nivel nacional, del 10% al 14% de los viajes en automóvil durante la hora pico de la mañana son para viajes escolares. Como parte del Programa Nacional de Rutas Seguras a la Escuela, nuestra investigación promueve caminar y andar en bicicleta de manera segura a la escuela para mejorar la salud y el bienestar de los niños, aliviar la congestión del tráfico cerca de las escuelas y mejorar la calidad del aire y la calidad de vida general de los miembros de la comunidad al hacer que sea más fácil y más seguro para las familias elegir modos activos de transporte cuando viajan hacia y desde la escuela.

¿CUÁL ES EL COMPROMISO DE TIEMPO SI PARTICIPO EN ESTE ESTUDIO DE INVESTIGACIÓN?
Se le pide que permita que su hijo participe en una intervención de juego de realidad virtual que implica niveles de seguridad en el tránsito, seguridad en los cruces peatonales, seguridad en las señales, seguridad en los ferrocarriles y seguridad en el tránsito. La intervención debería tardar unos 15 minutos en completarse. Los participantes deben tener un formulario de permiso de los padres firmado "Formulario de consentimiento de los padres para la intervención del juego de realidad virtual de seguridad en el tránsito para que el niño participe en el estudio de investigación" y aceptar participar en el estudio completando el "Formulario de consentimiento de intervención del juego de realidad virtual para la seguridad en el tránsito para que el niño participe en el formulario de Estudio de Investigación". Para que los participantes puedan participar se deberán recoger los dos formularios mencionados. Esto demostrará el pleno consentimiento a la participación.

¿QUÉ ME PEDIRÁN HACER EN ESTE ESTUDIO DE INVESTIGACIÓN?
El propósito de este estudio es ayudar a los investigadores a comprender si los juegos de realidad virtual entre los estudiantes de 7.º y 8.º grado son útiles para educar a los niños sobre la seguridad en el transporte cuando caminan hacia y desde la escuela. Esta información puede ayudarnos a aprender estrategias para ayudar a otros niños a aprender sobre la seguridad en el transporte y desarrollar recomendaciones de políticas de tránsito. Los datos resultantes de este estudio pueden ofrecer información importante para combatir las muertes/accidentes de peatones y ciclistas y ser utilizados para la investigación académica con el fin de ayudar a los planificadores urbanos, administradores escolares, ciudadanos, ONG, especialistas en salud y legisladores a recomendar medidas legislativas de políticas efectivas sobre el tránsito. seguridad cerca de las escuelas K-12. La participación es gratuita sin costo alguno. Los datos se utilizarán con fines de investigación y no con fines comerciales.

RECLUTAMIENTO
Los administradores de escuelas K-12 en la ciudad de Chula Vista, CA, participarán en la entrega del proceso de reclutamiento enviando un correo electrónico a los participantes a través de las redes sociales, anuncios de boletines, eventos y administración escolar. Los datos de puntaje de intervención del juego VR se recopilaron a través de la plataforma Unity. Los participantes serán notificados del estudio de investigación y se les proporcionarán detalles de los procedimientos y plazos.

¿QUÉ DEBO SABER SOBRE EL ESTUDIO DE INVESTIGACIÓN?

- Si participar o no, depende de ti.
- Su participación es completamente voluntaria.
- Puede optar por no participar.
- Puede aceptar participar y luego cambiar de opinión.
- Su decisión no se tomará en su contra.
- Su negativa a participar no dará lugar a ninguna consecuencia ni a la pérdida de los beneficios a los que tiene derecho a recibir.
- Puedes hacer todas las preguntas que quieras antes de decidir.

¿CUÁLES SON LOS RIESGOS O MOLESTIAS INVOLUCRADAS EN LA INVESTIGACIÓN?
Creemos que hay muy pocas posibilidades de que sucedan cosas malas como resultado de estar en este estudio.

Es posible que su hijo sienta mareos al usar los cartones de Google de realidad virtual. También pueden experimentar efectos secundarios de la realidad virtual, que pueden incluir, entre otros, visión borrosa, fatiga visual, dolores de cabeza, mareos, fatiga o náuseas.

¿HAY ALGÚN BENEFICIO EN LA PARTICIPACIÓN?
La información que proporcione su hijo se utilizará para proteger y promover la educación sobre seguridad en el tránsito. Además, al unirse a este estudio de investigación, su hijo está ayudando a brindar información que puede ayudar a los ingenieros, planificadores urbanos, educadores y la sociedad a promover la legislación sobre seguridad en el tránsito. Los posibles beneficios podrían ser que su hijo pueda adquirir habilidades jugando el juego. Es posible que su hijo se divierta jugando con dispositivos electrónicos usando esta nueva tecnología para aprender sobre la seguridad en el tránsito. También podríamos aprender algo que podría ayudar a otros.

¿MI INFORMACIÓN SERÁ PRIVADA O ANÓNIMA?
Los datos de riesgo mínimo se registran y recopilan en un almacenamiento separado de los datos originales por razones de seguridad. Específicamente, los datos sobre el rendimiento del juego de realidad virtual del participante que se recopilan durante la intervención del juego de 5 niveles en relación con la seguridad del tránsito. Más específicamente, se recuperará cómo cruzar la calle con seguridad en intersecciones, cruces peatonales, cruces, comprensión de la señalización y comportamientos de seguridad en el tránsito. Analizaremos los datos recopilados de manera confidencial y profesional.
La intervención del juego VR contiene identificadores limitados. Por lo tanto, recopilaremos información que identificará los puntajes de antes y después de los participantes como parte de este conjunto de datos de estudio de investigación y no se usará ni distribuirá para futuros estudios de investigación. Puede negarse a detener la intervención del juego VR en cualquier momento. Los registros se almacenarán en una nube segura bloqueada y solo serán accesibles para el personal de investigación que figura en este documento de formulario de consentimiento.

Para proteger aún más su información, los datos almacenados por el investigador estarán protegidos con contraseña y/o encriptados. Solo los investigadores nombrados en este estudio tendrán acceso a los datos recopilados. Cualquier publicación futura incluirá información colectiva (es decir, datos agregados), a la que puede acceder para obtener los resultados finales. La respuesta de los puntajes de las pruebas individuales de su hijo (es decir, datos sin procesar) no se compartirá con nadie fuera del equipo de investigación. Los investigadores conservarán los datos durante 5 años después del final del estudio (después de que se hayan descargado los datos). Los datos se borrarán permanentemente después. Las respuestas de puntuación de la intervención del juego de realidad virtual se eliminarán del repositorio de

VTTI Dataverse inmediatamente después de que los datos se hayan descargado en un dispositivo de almacenamiento seguro.
Este consentimiento se aplica a todos los participantes. En el caso de que los participantes deseen retirar sus datos de puntuación individual del sistema, los participantes están protegidos a través de la cláusula de "derecho al olvido". Para obtener más información sobre cómo retirarse de la intervención del juego de realidad virtual (datos individuales del participante), comuníquese con la investigadora principal, la Dra. Gabriela Fernandez en gfernandez2@sdsu.edu.

¿TENGO QUE UNIRME A ESTE ESTUDIO?

No, su hijo no tiene que participar en este estudio de investigación. Incluso si acepta permitir que su hijo participe, puede decidir más adelante que no desea que su hijo participe en la investigación. Si elige no permitir que su hijo participe en el estudio, no hay penalización ni pérdida de los beneficios a los que tiene derecho.

¿SE ME INFORMARÁ SOBRE LOS RESULTADOS DE LA INVESTIGACIÓN?

No nos pondremos en contacto con usted con los resultados de este estudio después de que se complete este estudio, a menos que proporcione un correo electrónico. Sin embargo, compartiremos los resultados de la investigación en nuestro sitio web en:

Sitio web del proyecto: https://storymaps.arcgis.com/stories/9b51cd43c22f4868be64c1ae74e458f8,

Sitio web de Safe-D: https://safed.vtti.vt.edu/diversity-equity-and-inclusion-in-transportation/.

¿COSTARÁ ALGO SI PARTICIPÓ EN LA INVESTIGACIÓN?

No.

¿SUS DERECHOS COMO PARTICIPANTE DE LA INVESTIGACIÓN?

La participación en la investigación es completamente voluntaria y su hijo puede retirar su consentimiento en cualquier momento durante la intervención del juego de realidad virtual. Sin embargo, una vez que el niño haya jugado el juego de realidad virtual y haya enviado su puntaje al final del juego, los investigadores no podrán determinar qué respuestas de puntaje pertenecen a su hijo, por lo que su información no se puede retirar después de ese punto.
Tenga en cuenta que al firmar el formulario de consentimiento de los padres, está dando su consentimiento para participar. Al dar su consentimiento para participar, no renuncia a ninguno de sus derechos legales como participante de la investigación. Los datos no se pueden retirar después de que el niño haya jugado la RV y se hayan enviado las respuestas, ya que las respuestas de los participantes son anónimas. Contactar a los investigadores resultará en una pérdida de anonimato (pero las identidades de los participantes permanecerán confidenciales y en una base de datos segura).

¿ME PAGARÁN SI PARTICIPÓ EN LA INVESTIGACIÓN?
La participación es voluntaria. A su hijo no se le pagará por participar en este estudio. Sin embargo, la participación de su hijo puede ayudarnos a aprender estrategias para ayudar a otros niños a aprender sobre la seguridad en el transporte utilizando la realidad virtual. Por lo tanto, desarrollar recomendaciones de políticas de tránsito efectivas para los encargados de formular políticas y los administradores de la ciudad.

¿A QUIÉN ME CONTACTO SI TENGO PREGUNTAS O INQUIETUDES?

Si usted o su hijo tienen preguntas, inquietudes o quejas (una persona puede retirar su participación en cualquier momento y por cualquier motivo), comuníquese con la Investigadora Principal, Dra. Gabriela Fernández, Departamento de Geografía, Directora, Metabolism of Cities Living Lab, Center para Human Dynamics in the Mobile Age (HDMA), Universidad Estatal de San Diego, San Diego, California, en gfernandez2@sdsu.edu. Co-investigador(es): Dr. Ming-Hsiang Tsou, Departamento de Geografía, Director, Centro para la Dinámica Humana en la Era Móvil (HDMA), Universidad Estatal de San Diego, San Diego, California, en mtsou@sdsu.edu; Dr. Arash Jahangiri, Departamento de Ingeniería Civil, de Construcción y Ambiental en ajahangiri@sdsu.edu; y la Dra. Sahar Ghanipoor-Machiani, Departamento de Ingeniería Civil, de Construcción y Ambiental de la Universidad Estatal de San Diego, San Diego, California, en sghanipoor@sdsu.edu.

Si tiene alguna pregunta sobre sus derechos como participante de la investigación, puede comunicarse con la División de Asuntos de Investigación de la Universidad Estatal de San Diego (Teléfono: +01(619) 594-6622; correo electrónico: irb@sdsu.edu). En cualquier momento durante la investigación, puede comunicarse con el IRB si tiene preguntas sobre los derechos de investigación, para discutir problemas, inquietudes, dar sugerencias u ofrecer comentarios.

REFERENCIAS

Lista de referencias para apoyar la investigación.

Uso de la realidad virtual para capacitar a los niños en habilidades para cruzar calles de forma segura

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2829738/

Enseñar a los niños la seguridad vial utilizando un entorno simulado

https://files.eric.ed.gov/fulltext/EJ1259913.pdf

Programa Safe-D

https://safed.vtti.vt.edu/

Pautas del gobierno federal

https://www.transportation.gov/mission/health/Safe-Routes-to-School-Programs#:~:text=Safe%20Routes%20to%20School%20(SRTS,hour%20are%20for%20school%20travel

(Spanish)

Intervención de juego de realidad virtual de seguridad de tránsito
Formulario de consentimiento de los padres para que el niño participe en un estudio de investigación

Información clave sobre este estudio

El siguiente es un breve resumen de este estudio para ayudarlo a decidir si permite o no que su hijo participe en una actividad de investigación interactiva. Su hijo ha sido seleccionado para participar y ayudar a mejorar un programa nacional. La participación de su hijo ayudará a mejorar el programa nacional Rutas seguras a la escuela.

El propósito de este estudio es ayudar a los investigadores a comprender si los juegos de realidad virtual entre los estudiantes de 7 y 8 grado son útiles para educar a los niños sobre la seguridad en el transporte cuando caminan hacia y desde la escuela. Esta información puede ayudarnos a aprender estrategias para ayudar a otros niños a aprender sobre la seguridad en el transporte y desarrollar recomendaciones de políticas de tránsito. Los datos resultantes de este estudio pueden ofrecer información importante para combatir las muertes/accidentes de peatones y ciclistas y ser utilizados para la investigación académica con el fin de ayudar a los planificadores urbanos, administradores escolares, ciudadanos, ONG, especialistas en salud y legisladores a recomendar medidas legislativas de políticas efectivas sobre el tránsito. seguridad cerca de las escuelas K-12. La participación es gratuita sin costo alguno.

Participación en el estudio
Su hijo jugará un juego de realidad virtual "KIDS 4 SAFE ROUTES VR" durante la intervención. El juego de intervención utilizará un mínimo de 15 minutos. Esto tendrá lugar en la escuela primaria Feaster Charter el 3 de febrero de 2023 durante el horario escolar.
Nota: Por favor devuelva el formulario al maestro de la escuela.

Estimado Padre / Tutor,

Invitamos a su hijo a participar en este estudio de investigación global porque estamos probando la viabilidad y eficacia de los juegos de realidad virtual para ayudar a educar a los niños sobre la seguridad en el transporte cuando caminan hacia y desde la escuela. Los hallazgos de este estudio nos ayudarán a saber cómo desarrollar intervenciones de seguridad de tránsito más efectivas.

La participación es voluntaria. Usando este formulario como guía, le explicaremos el estudio. Si tiene alguna pregunta sobre el estudio, por favor pregunte. Una vez que comprenda este estudio, le pediremos que decida si desea que su hijo participe. Los datos recabados serán confidenciales y protegidos.

¿CUÁLES SON LOS RIESGOS DE ESTAR EN ESTE ESTUDIO?
Creemos que hay muy pocas posibilidades de que sucedan cosas malas como resultado de estar en este estudio.
Es posible que su hijo sienta mareos al usar los cartones de Google de realidad virtual. También pueden experimentar efectos secundarios de la realidad virtual, que pueden incluir, entre otros, visión borrosa, fatiga visual, dolores de cabeza, mareos, fatiga o náuseas.

¿A QUIÉN DEBO CONTACTAR SI TENGO PREGUNTAS?
Si está preocupado por algo o si tiene más preguntas, comuníquese con la Investigadora Principal Dra. Gabriela Fernandez en gfernandez2@sdsu.edu.

¿HAY BENEFICIOS POR PARTICIPAR EN ESTE ESTUDIO?
Los posibles beneficios podrían ser que su hijo pueda adquirir habilidades jugando el juego. Es posible que su hijo se divierta jugando con dispositivos electrónicos usando esta nueva tecnología para aprender sobre la seguridad en el tránsito. También podríamos aprender algo que podría ayudar a otros.
BLOQUE DE FIRMAS PARA NIÑOS
Al firmar este formulario, acepta permitir que su hijo participe en este estudio. Su firma documenta su permiso para que el niño mencionado participe en esta investigación. Los datos serán confidenciales.
[ ] Sí, acepto participar.

[ ] No, no acepto participar.

_____

Nombre impreso del niño/a

_____

Firma del padre/tutor legalmente autorizado para dar consentimiento al niño

_____

Fecha

Appendix Q – Institutional Review Board Parent Survey About Walking and Biking to School English and Spanish Consent Form

(English)

Parent Consent Form

Parent Survey About Walking and Biking to School

San Diego State University

Date: January 10, 2023

NOTE: We ask that each family complete only one "Parent Survey About Walking and Biking to School" survey if your child is in 7th and 8th grade. Your response will be kept confidential and neither your name nor your child's name will be associated with any results. If the survey was filled out in hard copy, after you have completed the survey, send it back to the school with your child or give it to your child's teacher. See further information about the survey below.

TITLE: Parent Survey About Walking and Biking to School

RESEARCHER(S):

Principal Investigator: **Dr. Gabriela Fernandez**, San Diego State University, Department: Department of Geography, Center for Human Dynamics in the Mobile Age (HDMA) Address: 5500 Campanile Dr., San Diego, California 92182. Email: gfernandez2@sdsu.edu.

Co-Investigator(s): **Dr. Ming-Hsiang Tsou**, Department of Geography, Director, Center for Human Dynamics in the Mobile Age (HDMA), San Diego State University, San Diego, California, at mtsou@sdsu.edu. **Dr. Arash Jahangiri**, Department of Civil, Construction, and Environmental Engineering at ajahangiri@sdsu.edu; **Dr. Sahar Ghanipoor-Machiani**, Department of Civil, Construction, and Environmental Engineering San Diego State University, San Diego, California, at sghanipoor@sdsu.edu.

SDSU Graduate Students: **Bita Etaati and Andrick Mercado**

STUDY FUNDED: Safe-D

IMPORTANT THINGS TO KNOW ABOUT THIS STUDY.

Your child's school wants to learn your thoughts about children walking and biking to school. I would like to invite you to take part in our National Safe Routes to School Program research study, which concerns understanding transit safety behavior near K-12 schools. More specifically, your thoughts about children walking and bicycling to/from school. We are looking to increase our mark of volunteers to participate in our survey to 120 participants to provide a significant snapshot of participants at the local level (San Diego County community). The purpose of this survey is to investigate beliefs, perceptions, and behaviors in response to transit safety near K-12 schools in the City of Chula Vista, California.

The resulting data from this survey may offer important insights to fight pedestrian and bicyclist deaths/accidents and be used for academic research in order to help urban planners, school administrators, citizens, NGO's, health specialists, and policymakers recommend effective policy measures over transit safety near K-12 schools. Please note that this information will be kept strictly confidential.

The study is developed by researchers from the Department of Geography and Department of Civil, Construction, and Environmental Engineering at San Diego State University (SDSU) and Safe-D.

WE ARE INVITING YOU TO JOIN THIS RESEARCH STUDY.

Many governments are currently implementing policy measures such as the federal funded program Safe Routes to School to help contain bicyclist and pedestrian accidents and deaths near K-12 schools. This survey provides an aggregated view of how people perceive transit safety near K-12 schools. Specifically, learning your thoughts about children walking and biking to/from school. So far there has been no updated assessment of how individuals perceive transit safety near K-12 schools in Chula Vista, California. The purpose of this research is to investigate

beliefs, attitudes, perceptions, and behaviors in response to transit safety and identifying safe routes to school.

WHY ARE WE DOING THIS STUDY?

There has been no updated assessment of how individuals perceive transit safety in K-12 in the City of Chula Vista, California. Nationally, 10% to 14% of car trips during morning rush hour are for school travel. As part of the National Safe Routes to School Program, our research promotes safe walking and bicycling to school to enhance children's health and wellbeing, ease traffic congestion near schools, and improve air quality and community members' overall quality of life by making it easier and safer for families to choose active modes of transportation when traveling to and from school.

WHAT IS THE TIME COMMITMENT IF I JOIN THIS RESEARCH STUDY?

You are being asked to voluntarily complete this on-line survey. The survey involves questions about transit safety behaviors and perceptions when dropping/picking up your child from school and should take about 5-10 minutes to complete. Participants must be 18 years and older to voluntarily complete an online survey. In order for all answers to be collected, participants must go to the end of the survey and click 'submit.' This will demonstrate full consent to participation.

WHAT WILL I BE ASKED TO DO IN THIS RESEARCH STUDY?

Participants will be asked to take a survey and indicate their travel behaviors when dropping off/picking up their child from school, walking or bicycling perception, mode of transport when traveling to/from school, weather conditions, distance acceptance from home to/from school, issues affecting their decision to allow, or not allow, a child to walk or bike to/from school, or personal opinions concerning safe routes to school.

The data will be used for research, and not for commercial purposes.

RECRUITMENT

K-12 school administrators in the City of Chula Vista, CA will be involved with the delivery of the recruitment process by sending out an email to participants through social media, newsletter announcements, events, and school administration. Survey data will be collected through the ESRI Online Survey 123 online platform. Participants will be notified of the research study and be provided with details of procedures and deadlines.

WHAT SHOULD I KNOW ABOUT THE RESEARCH STUDY?

- Whether or not you take part is up to you.
- Your participation is completely voluntary.
- You can choose not to take part.
- You can agree to take part and later change your mind.

- Your decision will not be held against you.
- Your refusal to participate will not result in any consequences or any loss of benefits that you are otherwise entitled to receive.
- You can ask all the questions you want before you decide.

WHAT ARE THE RISKS OR DISCOMFORTS INVOLVED IN THE RESEARCH?

Because we ask personal questions about transportation behaviors, you might remember unpleasant things when we ask you questions. You can refuse to answer any questions that you don't want to answer. You also can decide if you want to stop participating. Some of the survey questions may make you uncomfortable or upset or you may simply wish not to answer some questions. You are free to decline to answer any questions you do not wish to answer or stop participating at any time by closing your browser. If you close your browser before getting to the end of the survey and do not confirm your consent to participate at the end of the survey by clicking the 'submit' button your information will not be collected.

ARE THERE ANY BENEFITS TO PARTICIPATION?

There are no direct benefits to you if you take part in this survey, but the information you provide will be used to protect and promote transit safety education. In addition, by joining this research study, you are helping to provide information which may help engineers, urban planners, educators, and society promote transit safety legislation.

WILL MY INFORMATION BE PRIVATE OR ANONYMOUS?

Minimal risk data will be recorded and collected in a separate storage away from the original data for security reasons. Specifically, data on the street intersections nearest to your home (geographic subdivision smaller than a state) will be collected. We will analyze the collected data in a confidential and professional manner.

The survey contains limited identifiers (i.e street intersection nearest to your home). Thus, we will collect information that will identify participants' geo coordinates such as the street intersection nearest to your home will be collected as part of this research study dataset and will not be used or distributed for future research studies. You can refuse to stop the survey at any given time. Records will be stored in a locked secured cloud and will only be accessible to research staff listed on this consent form document.

This survey uses Survey123 ArcGIS which is a United States of American (USA) company. Consequently, USA authorities under the provisions of the Freedom Act may access the survey data. If you would rather participate with an email or paper-based survey, please contact the researchers. Please note email or paper-based surveys may allow your identity to be known to the researchers but if you select this option, your information will be kept confidential.

To further protect your information, data stored by the researcher will be password protected and/or encrypted. Only researchers' named in this study will have access to the data as collected. Any future publications will include collective information (i.e. aggregate data), which can be accessed by you for final results. Your individual response (i.e. raw data) will not be shared with anyone outside of the research team. The researchers will keep the data for 3 years after the end of the study (after data has been downloaded). The data will be permanently erased afterwards. The survey responses will be deleted from Survey123 for ArcGIS right after the data has been downloaded onto a secure storage device.

This consent applies to all participants. In the case where participants want to withdraw their individual data from the system, participants are protected through the "right to be forgotten" clause. For more information to withdraw from the survey (participant's individual data) please contact Principal Investigator, Dr. Gabriela Fernandez at gfernandez2@sdsu.edu.

DO I HAVE TO JOIN THIS STUDY?

No, you do not have to join this research study. Even if you agree to join, you can decide later that you do not want to be in the research. If you choose not to join or later decide that you do not want to be in the study, there is no penalty or loss of benefits to which you are otherwise entitled.

WILL I BE TOLD ABOUT THE RESEARCH RESULTS?

We will not contact you with the results of this study after this study is completed, unless email is provided. However, we will share the research results in our website at:

Project website: https://storymaps.arcgis.com/stories/9b51cd43c22f4868be64c1ae74e458f8,

Safe-D website: https://safed.vtti.vt.edu/diversity-equity-and-inclusion-in-transportation/.

WILL IT COST ME ANYTHING IF I JOIN THE RESEARCH?

No.

YOUR RIGHTS AS A RESEARCH PARTICIPANT?

Participation in research is completely voluntary and you can withdraw your consent at any point up to clicking the submit button at the end of the survey. However, once you click the submit button at the end of the survey the researchers will not be able to determine which survey answers belong to you so your information cannot be withdrawn after that point.

Please note that by clicking submit at the end of the study you are providing your consent for participation. By consenting to participate, you are not waiving any of your legal rights as a research participant. The data cannot be withdrawn after survey responses have been submitted, as participant responses are anonymous. Contacting the researchers will result in a loss of

anonymity (but that participant identities will remain confidential and in a safe database).

WILL I BE PAID IF I JOIN THE RESEARCH?

Participation is voluntary. You will not be paid for taking part in this study. However, your participation may help us learn strategies to help other kids learn about transportation safety. Thus, develop effective transit policy recommendations to policymakers and city managers.

WHOM DO I CONTACT IF I HAVE QUESTIONS OR CONCERNS?

If you have questions, concerns, or complaints, or think the research has hurt you, or want to withdraw from the survey (a person may withdraw participation at any time for any reason) please contact the Principal Investigator, **Dr. Gabriela Fernandez**, Department of Geography, Director, Metabolism of Cities Living Lab, Center for Human Dynamics in the Mobile Age (HDMA), San Diego State University, San Diego, California, at gfernandez2@sdsu.edu. Co-Investigator(s): **Dr. Ming-Hsiang Tsou**, Department of Geography, Director, Center for Human Dynamics in the Mobile Age (HDMA), San Diego State University, San Diego, California, at mtsou@sdsu.edu; **Dr. Arash Jahangiri**, Department of Civil, Construction, and Environmental Engineering at ajahangiri@sdsu.edu; and **Dr. Sahar Ghanipoor-Machiani**, Department of Civil, Construction, and Environmental Engineering San Diego State University, San Diego, California at sghanipoor@sdsu.edu.

PARENT SURVEY ELECTRONIC LINK: Survey

REFERENCES List of references to support research.

Safe-D Program

https://safed.vtti.vt.edu/

San Diego Regional Safe Routes to School Strategic Plan, SANDAG and County of San Diego

https://www.google.com/url?sa=t&source=web&rct=j&url=https://www.sandag.org/uploads/publicationid/publicationid_1665_14448.pdf&ved=2ahUKEwiU74OgpMrzAhUjuqQKHc_ICMMQFnoECAoQAQ&usg=AOvVaw1TWfd1eUL7-2zbNij38LrL

Federal Government Guidelines

https://www.transportation.gov/mission/health/Safe-Routes-to-School-Programs#:~:text=Safe%20Routes%20to%20School%20(SRTS,hour%20are%20for%20school%20travel

(Spanish)

Formulario de consentimiento de los padres
Encuesta para padres sobre caminar y andar en bicicleta a la escuela

Universidad Estatal de San Diego
Fecha: Enero 10, 2023

NOTA: Pedimos que cada familia complete solo una encuesta de "Encuesta para padres sobre caminar y andar en bicicleta a la escuela" si su hijo está en 7 y 8 grado. Su respuesta se mantendrá confidencial y ni su nombre ni el de su hijo se asocian con ningún resultado. Si la encuesta se llenó en forma impresa, después de completarla, envíala de vuelta a la escuela con su hijo o entréguese al maestro de su hijo. Consulte más información sobre la encuesta a continuación.

TÍTULO: Encuesta para padres sobre caminar y andar en bicicleta a la escuela

INVESTIGADOR(ES):
Investigador principal: **Dra. Gabriela Fernández**, Universidad Estatal de San Diego, Departamento: Departamento de Geografía, Center for Human Dynamics in the Mobile Age (HDMA) Dirección: 5500 Campanile Dr., San Diego, California 92182. Correo electrónico: gfernandez2@sdsu.edu .Co-investigador(es): Dr. Ming-Hsiang Tsou, Departamento de Geografía, Director, Center for Human Dynamics in the Mobile Age (HDMA), Universidad Estatal de San Diego, San Diego, California, en mtsou@sdsu.edu. **Dr. Arash Jahangiri**, Departamento de Ingeniería Civil, de Construcción y Ambiental en ajahangiri@sdsu.edu; **Dra. Sahar Ghanipoor-Machiani**, Departamento de Ingeniería Civil, de Construcción y Ambiental de la Universidad Estatal de San Diego, San Diego, California, en sghanipoor@sdsu.edu. Estudiantes de posgrado de SDSU: **Bita Etaati** y **Andrick Mercado**

ESTUDIO FINANCIADO: Safe-D

COSAS IMPORTANTES A SABER SOBRE ESTE ESTUDIO.
La escuela de su hijo quiere conocer sus pensamientos acerca de los niños que caminan o van en bicicleta a la escuela. Me gustaría invitarlo a participar en nuestro estudio de investigación del Programa Nacional de Rutas Escolares Seguras, que se refiere a comprender el comportamiento de seguridad del tránsito cerca de las escuelas K-12. Más específicamente, sus pensamientos sobre los niños que caminan y andan en bicicleta hacia y desde la escuela. Estamos buscando aumentar nuestra marca de voluntarios para participar en nuestra encuesta a 120 participantes para brindar una instantánea significativa de los participantes a nivel local (comunidad del condado de San Diego). El propósito de esta encuesta es investigar creencias, percepciones y comportamientos en respuesta a la seguridad del tránsito cerca de las escuelas K-12 en la ciudad de Chula Vista, California.

Los datos resultantes de esta encuesta pueden ofrecer información importante para luchar contra las muertes/accidentes de peatones y ciclistas y utilizarse para investigaciones académicas con el fin de ayudar a los planificadores urbanos, administradores escolares, ciudadanos, ONG, especialistas en salud y legisladores a recomendar medidas de política efectivas sobre la seguridad del tránsito. cerca de las escuelas K-12. Tenga en cuenta que esta información se mantendrá estrictamente confidencial.

El estudio fue desarrollado por investigadores del Departamento de Geografía y del Departamento de Ingeniería Civil, de Construcción y Ambiental de la Universidad Estatal de San Diego (SDSU) y Safe-D.

LO INVITAMOS A SUMARSE A ESTE ESTUDIO DE INVESTIGACIÓN.
Muchos gobiernos están implementando actualmente medidas políticas como el programa financiado por el gobierno federal Rutas seguras a la escuela para ayudar a contener los accidentes y muertes de ciclistas y peatones cerca de las escuelas K-12. Esta encuesta proporciona una visión agregada de cómo las personas perciben la seguridad del tránsito cerca de las escuelas K-12. Específicamente, conocer sus pensamientos acerca de los niños que caminan y andan en bicicleta hacia y desde la escuela. Hasta el momento no ha habido una evaluación actualizada de cómo las personas perciben la seguridad del tránsito cerca de las escuelas K-12 en Chula Vista, California. El propósito de esta investigación es investigar creencias, actitudes, percepciones y comportamientos en respuesta a la seguridad del tránsito e identificar rutas seguras a la escuela.

¿POR QUÉ HACEMOS ESTE ESTUDIO?
No ha habido una evaluación actualizada de cómo las personas perciben la seguridad del tránsito en K-12 en la ciudad de Chula Vista, California. A nivel nacional, del 10% al 14% de los viajes en automóvil durante la hora pico de la mañana son para viajes escolares. Como parte del Programa Nacional de Rutas Seguras a la Escuela, nuestra investigación promueve caminar y andar en bicicleta de manera segura a la escuela para mejorar la salud y el bienestar de los niños, aliviar la congestión del tráfico cerca de las escuelas y mejorar la calidad del aire y la calidad de vida general de los miembros de la comunidad al hacer que sea más fácil y más seguro para las familias elegir modos activos de transporte cuando viajan hacia y desde la escuela.

¿CUÁL ES EL COMPROMISO DE TIEMPO SI PARTICIPO EN ESTE ESTUDIO DE INVESTIGACIÓN?

Se le pide que complete voluntariamente esta encuesta en línea. La encuesta incluye preguntas sobre comportamientos y percepciones de seguridad en el tránsito al dejar/recoger a su hijo de la escuela y debe tomar entre 5 y 10 minutos para completarla. Los participantes deben tener 18 años o más para completar voluntariamente una encuesta en línea. Para recopilar todas las respuestas, los participantes deben ir al final de la encuesta y hacer clic en "enviar". Esto demostrará su pleno consentimiento para participar.

¿QUÉ ME PEDIRÁN HACER EN ESTE ESTUDIO DE INVESTIGACIÓN?

Se les pedirá a los participantes que respondan una encuesta e indiquen sus comportamientos de viaje cuando dejan o recogen a su hijo de la escuela, la percepción de caminar o andar en bicicleta, el modo de transporte cuando viajan hacia o desde la escuela, las condiciones climáticas, la distancia aceptada desde el hogar hasta la escuela o desde ella. , cuestiones que afectan su decisión de permitir o no permitir que un niño camine o vaya en bicicleta a/desde la escuela, u opiniones personales sobre rutas seguras a la escuela.

Los datos se utilizarán con fines de investigación y no con fines comerciales.

RECLUTAMIENTO

Los administradores de escuelas K-12 en la ciudad de Chula Vista, CA, participarán en la entrega del proceso de reclutamiento enviando un correo electrónico a los participantes a través de las redes sociales, anuncios de boletines, eventos y administración escolar. Los datos de la encuesta se recopilaron a través de la plataforma en línea ESRI Online Survey 123. Los participantes serán notificados del estudio de investigación y se les proporcionarán detalles de los procedimientos y plazos.

¿QUÉ DEBO SABER SOBRE EL ESTUDIO DE INVESTIGACIÓN?

- Si participar o no, depende de ti.
- Tu participación es completamente voluntaria.
- Puede optar por no participar.
- Puede aceptar participar y luego cambiar de opinión.
- Su decisión no se tomará en su contra.
- Su negativa a participar no dará lugar a ninguna consecuencia o pérdida de los beneficios que de otro modo tiene derecho a recibir.
- Puedes hacer todas las preguntas que quieras antes de decidirte.

¿CUÁLES SON LOS RIESGOS O MOLESTIAS INVOLUCRADAS EN LA INVESTIGACIÓN?

Debido a que hacemos preguntas personales sobre comportamientos de transporte, es posible que recuerde cosas desagradables cuando le hacemos preguntas. Puede negarse a responder cualquier pregunta que no desee responder. También puede decidir si quiere dejar de participar. Algunas de las preguntas de la encuesta pueden hacerle sentir incómodo o molesto, o simplemente puede desear no responder algunas preguntas. Puede negarse a responder cualquier pregunta que no desee responder o dejar de participar en cualquier momento cerrando su navegador. Si cierra su navegador antes de llegar al final de la encuesta y no confirma su consentimiento para participar al final de la encuesta haciendo clic en el botón "enviar", no se recopilan su información.

¿HAY ALGÚN BENEFICIO EN LA PARTICIPACIÓN?
No hay beneficios directos para usted si participa en esta encuesta, pero la información que proporcione se utilizará para proteger y promover la educación sobre seguridad en el tránsito. Además, al unirse a este estudio de investigación, está ayudando a proporcionar información que puede ayudar a los ingenieros, urbanistas, educadores y la sociedad a promover la legislación sobre seguridad en el tránsito.

¿MI INFORMACIÓN SERÁ PRIVADA O ANÓNIMA?
Los datos de riesgo mínimo se registran y recopilan en un almacenamiento separado de los datos originales por razones de seguridad. Específicamente, se recopilaron datos sobre las intersecciones de calles más cercanas a su hogar (subdivisión geográfica más pequeña que un estado). Analizaremos los datos recopilados de manera confidencial y profesional.

La encuesta contiene identificadores limitados (es decir, la intersección de calles más cercana a su casa). Por lo tanto, recopilaremos información que identificará las coordenadas geográficas de los participantes, como la intersección de calles más cercana a su hogar, que se recopilará como parte de este conjunto de datos de estudio de investigación y no se usará ni distribuirá para futuros estudios de investigación. Puede negarse a detener la encuesta en cualquier momento. Los registros se almacenarán en una nube segura bloqueada y solo serán accesibles para el personal de investigación que figura en este documento de formulario de consentimiento.

Esta encuesta utiliza Survey123 ArcGIS, que es una empresa de los Estados Unidos de América (EE. UU.). En consecuencia, las autoridades de EE. UU. bajo las disposiciones de la Ley de Libertad pueden acceder a los datos de la encuesta. Si prefiere participar con una encuesta por correo electrónico o en papel, comuníquese con los investigadores. Tenga en cuenta que las encuestas por correo electrónico o en papel pueden permitir que los investigadores conozcan su identidad, pero si selecciona esta opción, su información se mantendrá confidencial.

Para proteger aún más su información, los datos almacenados por el investigador estarán protegidos con contraseña y/o encriptados. Solo los investigadores nombrados en este estudio tendrán acceso a los datos recopilados. Cualquier publicación futura incluirá información colectiva (es decir, datos agregados), a la que puede acceder para obtener los resultados finales. Su respuesta individual (es decir, datos sin procesar) no se compartirá con nadie fuera del equipo de investigación. Los investigadores conservarán los datos durante 3 años después del final del estudio (después de que se hayan descargado los datos). Los datos se borrarán permanentemente después. Las respuestas de la encuesta se eliminarán de Survey123 for ArcGIS justo después de que los datos se hayan descargado en un dispositivo de almacenamiento seguro.

Este consentimiento se aplica a todos los participantes. En el caso de que los participantes deseen retirar sus datos personales del sistema, los participantes están protegidos a través de la cláusula de "derecho al olvido". Para obtener más información para retirarse de la encuesta (datos individuales del participante), comuníquese con la Investigadora Principal, Dra. Gabriela Fernandez en gfernandez2@sdsu.edu.

¿TENGO QUE UNIRME A ESTE ESTUDIO?
No, no es necesario que participe en este estudio de investigación. Incluso si acepta unirse, puede decidir más adelante que no desea participar en la investigación. Si elige no participar o más tarde decide que no quiere participar en el estudio, no hay penalización ni pérdida de los beneficios a los que tiene derecho.

¿SE ME INFORMARÁ SOBRE LOS RESULTADOS DE LA INVESTIGACIÓN?
No nos pondremos en contacto con usted con los resultados de este estudio después de que se complete este estudio, a menos que proporcione un correo electrónico. Sin embargo, compartiremos los resultados de la investigación en nuestro sitio web en:

Sitio web del proyecto:
https://storymaps.arcgis.com/stories/9b51cd43c22f4868be64c1ae74e458f8

Sitio web de Safe-D:
https://safed.vtti.vt.edu/diversity-equity-and-inclusion-in-transportation/.

¿COSTARÁ ALGO SI PARTICIPÓ EN LA INVESTIGACIÓN?
No.

¿SUS DERECHOS COMO PARTICIPANTE DE LA INVESTIGACIÓN?
La participación en la investigación es completamente voluntaria y puede retirar su consentimiento en cualquier momento hasta hacer clic en el botón Enviar al final de la encuesta. Sin embargo, una vez que haga clic en el botón Enviar al final de la encuesta, los investigadores no podrán determinar qué respuestas de la encuesta le pertenecen, por lo que su información no se puede retirar después de ese punto.

Tenga en cuenta que al hacer clic en enviar al final del estudio, está dando su consentimiento para participar. Al dar su consentimiento para participar, no renuncia a ninguno de sus derechos legales como participante de la investigación. Los datos no se pueden retirar después de que se hayan enviado las respuestas de la encuesta, ya que las respuestas de los participantes son anónimas. Contactar a los investigadores resultará en una pérdida de anonimato (pero las identidades de los participantes permanecerán confidenciales y en una base de datos segura).

¿ME PAGARÁN SI PARTICIPÓ EN LA INVESTIGACIÓN?
La participación es voluntaria. No se le pagará por participar en este estudio. Sin embargo, su participación puede ayudarnos a aprender estrategias para ayudar a otros niños a aprender sobre la seguridad en el transporte. Por lo tanto, desarrollar recomendaciones de políticas de tránsito efectivas para los encargados de formular políticas y los administradores de la ciudad.

¿A QUIÉN ME CONTACTO SI TENGO PREGUNTAS O INQUIETUDES?
Si tiene preguntas, inquietudes o quejas, o cree que la investigación lo ha lastimado, o desea retirarse de la encuesta (una persona puede retirarse de la participación en cualquier momento y por cualquier motivo), comuníquese con la Investigadora Principal, Dra. Gabriela Fernández, Departamento de Geografía, Director, Metabolism of Cities Living Lab, Center for Human Dynamics in the Mobile Age (HDMA), Universidad Estatal de San Diego, San Diego, California,

en gfernandez2@sdsu.edu. Co-investigador(es): Dr. Ming-Hsiang Tsou, Departamento de Geografía, Director, Center for Human Dynamics in the Mobile Age (HDMA), Universidad Estatal de San Diego, San Diego, California, en mtsou@sdsu.edu; Dr. Arash Jahangiri, Departamento de Ingeniería Civil, de Construcción y Ambiental en ajahangiri@sdsu.edu; y la Dra. Sahar Ghanipoor-Machiani, Departamento de Ingeniería Civil, de Construcción y Ambiental de la Universidad Estatal de San Diego, San Diego, California, en sghanipoor@sdsu.edu.

Si tiene alguna pregunta sobre sus derechos como participante de la investigación, puede comunicarse con la División de Asuntos de Investigación de la Universidad Estatal de San Diego (Teléfono: +01(619) 594-6622; correo electrónico: irb@sdsu.edu). En cualquier momento durante la investigación, puede comunicarse con el IRB si tiene preguntas sobre los derechos de investigación, para discutir problemas, inquietudes, dar sugerencias u ofrecer comentarios.
ENCUESTA PARA PADRES ENLACE ELECTRÓNICO:
Encuesta
REFERENCIAS Lista de referencias para apoyar la investigación.

Programa Safe-D

https://safed.vtti.vt.edu/

Plan Estratégico Regional de Rutas Seguras a la Escuela de San Diego, SANDAG y el Condado de San Diego

https://www.google.com/url?sa=t&source=web&rct=j&url=https://www.sandag.org/uploads/publicationid/publicationid_1665_14448.pdf&ved=2ahUKEwiU74OgpMrzAhUjuqQKHc_ICMMQFnoECAoQAQ&usg=AOvVaw1TWfd1eUL7-2zbNij38LrL

Pautas del gobierno federal
https://www.transportation.gov/mission/health/Safe-Routes-to-School-Programs#:~:text=Safe%20Routes%20to%20School%20(SRTS,hour%20are%20for%20school%20travel

SAN DIEGO STATE UNIVERSITY

Research Support Services
Research and Innovation San Diego State University 5500 Campanile Drive San Diego, CA 92182-1933
Phone 619-594-6622 irb@sdsu.edu

Exempt Verification

03-Feb-2023

Principal Investigator:	**Gabriela Fernandez**
Department:	**Geography**
Protocol Number:	**HS-2023-0014**

Title: Transit Safety Virtual Reality Game Intervention

Dear Gabriela,

The proposal or proposed study amendment was reviewed and verified as exempt in accordance with SDSU's Assurance and federal requirements pertaining to human subjects protections within the Code of Federal Regulations (45 CFR 46.104). This review applies to the conditions and procedures described in your protocol or amendment. The determination of exemption is final and continuing review (Progress Reports) are not required for this study. However, **if any changes to your study are proposed**, you must submit an amendment and receive IRB cerification that the study still meets exemption criteria (per 45 CFR 46.104). Additionally, CITI training must be kept current in order to maintain compliance. Finally, please notify the Human Research Protection Program office at 619-594-6622 or at irb@sdsu.edu if your status as an SDSU-affiliate changes while conducting this research study (you are no longer a SDSU faculty member).

Sincerely,

Rick Julizio

Asst. Vice President
Research Support Services
Research and Innovation

SAN DIEGO STATE UNIVERSITY

Research Support Services
Research and Innovation San Diego State University 5500 Campanile Drive San Diego, CA 92182-1933
Phone 619-594-6622 irb@sdsu.edu

Not Subject to IRB Review Determination

11-Jan-2023

Principal Investigator: **Gabriela Fernandez**
Department: **Geography**
Protocol Number: **HS-2022-0060**
Title: Evaluating the Safe Routes to School (SR2S) transportation program in socially vulnerable communities in San Diego County, California

Study Status: Not Subject to IRB Review
Dear Gabriela,

Thank you for your submission to the Institutional Review Board (IRB). An SDSU IRB Member has screened the submitted proposal titled: *Evaluating the Safe Routes to School (SR2S) transportation program in socially vulnerable communities in San Diego County, California*. Based on the information provided in the submission, the proposal, while an important systematic inquiry that may include interactions with people, is not subject to IRB Review. Please note that while the proposed activity is not subject to IRB review, it may be subject to privacy regulations, professional standards, and ethical obligations.

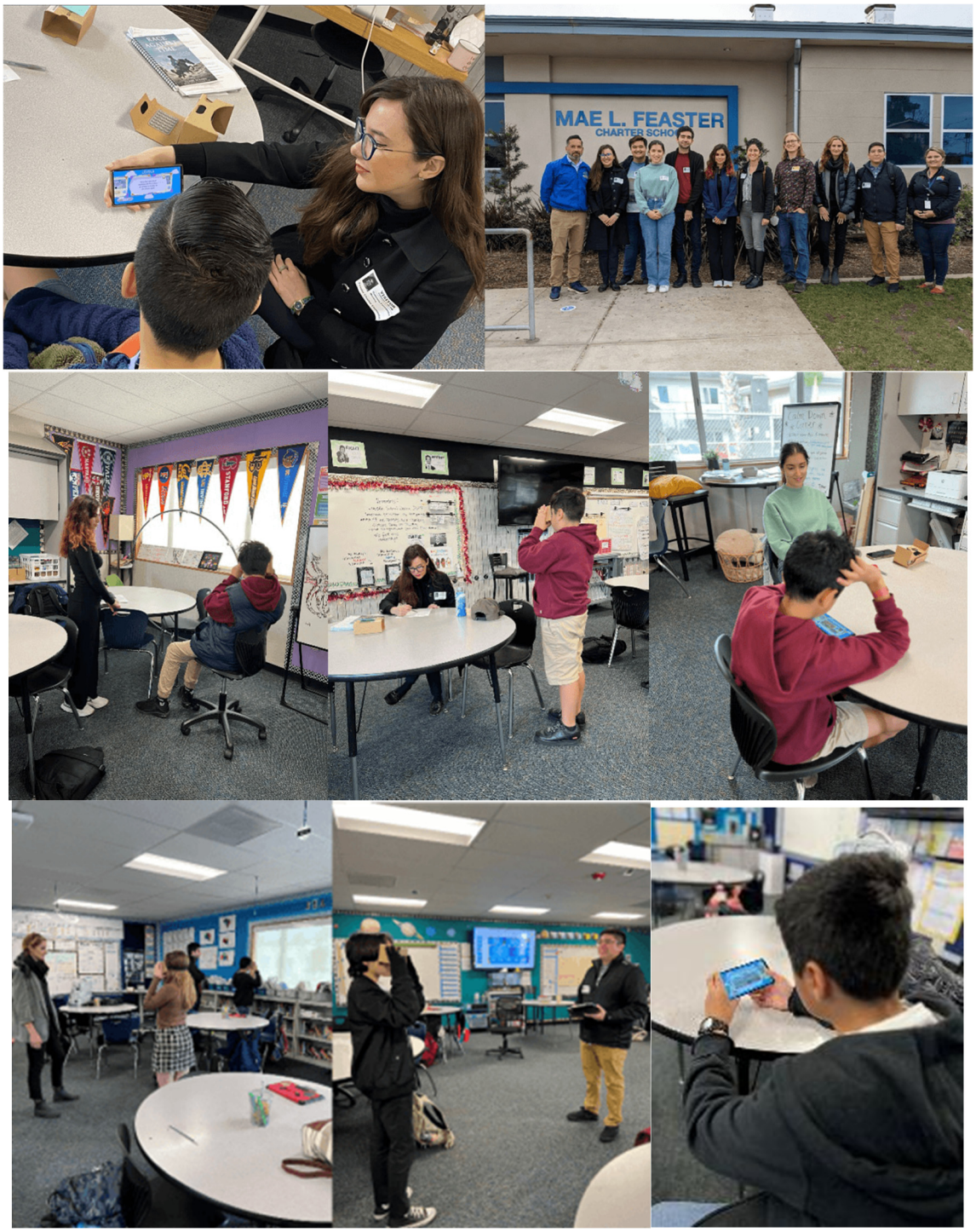
If you have any questions regarding the use of human subjects in research, please call our office at 619-594-6622. To access relevant policies and guidelines related to the involvement of human subjects in research, visit the IRB web site here.

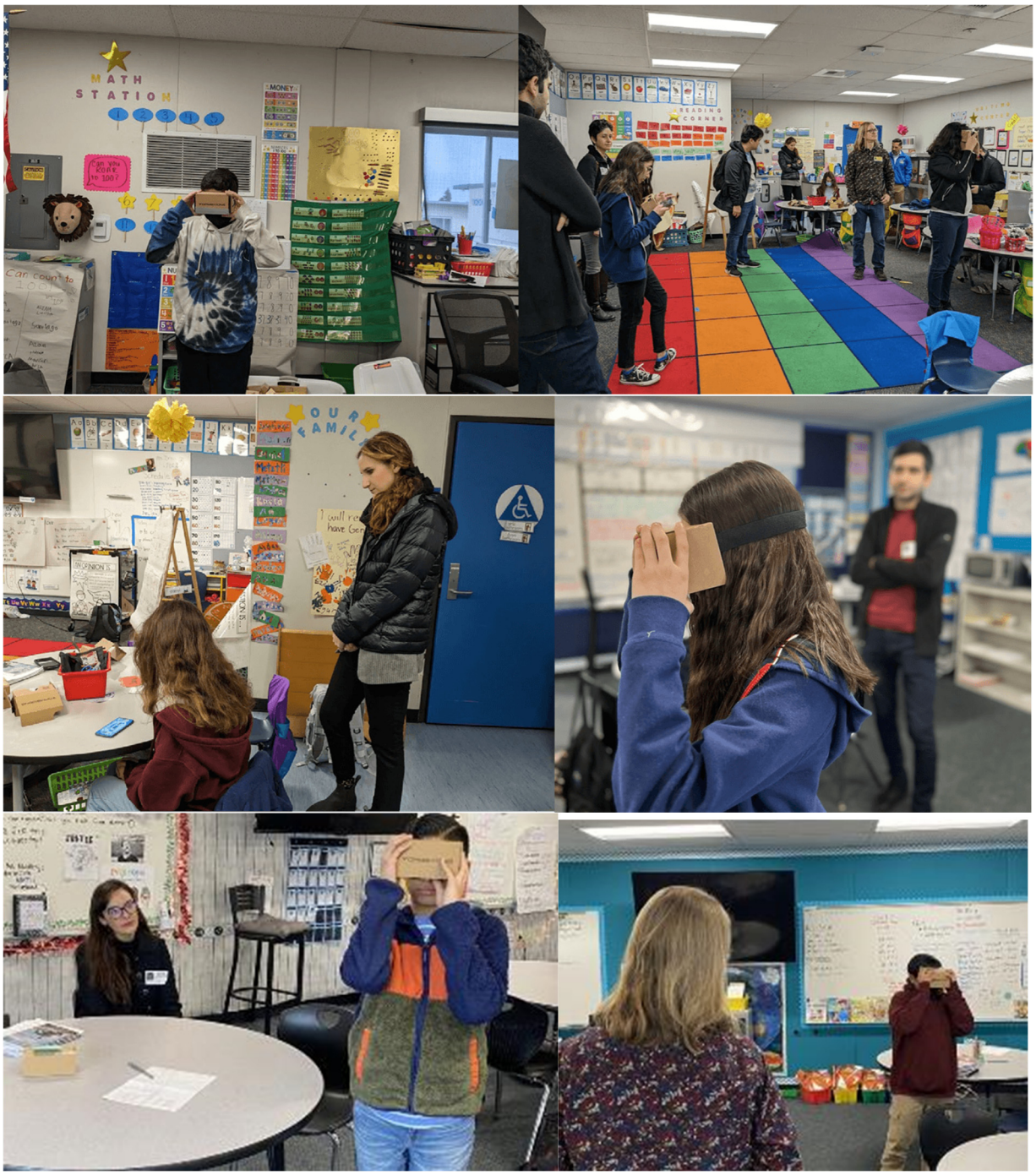
Sincerely,

Rick Julizzo

Asst. Vice President
Research Support Services
Research and Innovation

Appendix R –Feaster Charter Elementary School VR Game Intervention Photos




MATH
STATION
MONEY
READING
CORNER

Appendix S –Project Logo

Appendix T –Feaster Charter Elementary School VR Game Intervention Project Poster

MAE L. Feaster Charter Elementary School Kids 4 Safe Routes VR Game Intervention

Chula Vista, CA on February 9, 2023

(Left to Right: Rosario Villareal, Dr. Gabriela Fernandez, Kyle Fontelera, Bita Etaati, Amir Sadeghi, Nell Ahangarfabrik, Dr. Sahar Machiani, Chris Swindell, Carol Maione, Andrick Mercado, and Meagan Ramirez)