Zero Heroes Unite: Fighting the Fight against Air Pollution in Croydon

An Interactive Qualifying Project Report submitted to the faculty of

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Abstract

Greater London suffers from serious air pollution caused by road traffic. This project created, implemented, and evaluated the “Zero Heroes” program—initiated by the Croydon Council—to teach primary school children about causes and effects of air pollution and methods to reduce it. The program comprises a day of walking to school, plus lesson plans, group activities, and competitions for schools selected. Pre- and post-testing suggests that the program instills pollution-related knowledge and behavioral change, and can be replicated and sustained in other schools in the future.

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3.1.4 How Far Have You Walked	Gabrielle Bitzas	Katherine Longhurst
3.1.5 Peppered Moth Activity	Tim Theriot	Katherine Longhurst
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3.2.5 Conducting the Event	Tim Theriot	Katherine Longhurst
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3.3.4 Future Sustainability	Equal Contribution	Katherine Longhurst
3.4 Summary	Tim Theriot	Katherine Longhurst
4.1 Analysis and Results Intro	Austin Brais	Katherine Longhurst
4.2 School Reception	Tim Theriot	Katherine Longhurst
4.3 Case-Control Study Results	Gabrielle Bitzas	Katherine Longhurst
4.4 Daily Survey Results	Austin Brais	Katherine Longhurst
4.5 The Weeks Walking Distribution	Austin Brais	Katherine Longhurst
4.6 Zero Heroes Day	Austin Brais	Katherine Longhurst
4.7 Pre-Test vs. Post-Results for Test Schools	Austin Brais	Katherine Longhurst
4.8 London Air Quality Network Data	Tim Theriot	Equal Contribution
4.9 Drawing Contest	Katherine Longhurst	Katherine Longhurst
4.10 Participation Contest	Katherine Longhurst	Katherine Longhurst
4.11 How Far Have You Walked	Tim Theriot	Katherine Longhurst
4.12 Plant Experiment	Tim Theriot	Katherine Longhurst
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Appendix II	Katherine Longhurst	Katherine Longhurst
Appendix III	Gabrielle Bitzas	Katherine Longhurst
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Appendix V	Katherine Longhurst	Katherine Longhurst
Appendix VI	Austin Brais	Austin Brais
Appendix VII	Katherine Longhurst	Katherine Longhurst
Appendix VIII		
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Art Contest Certificate	Katherine Longhurst	N/A
Participation Competition Hand Out	Austin Brais	Katherine Longhurst
Surveys	Austin Brais	Katherine Longhurst + Gabrielle Bitzas + Austin Brais

Table of Contents

List of Figures

Chapter 1: Introduction

Every day high levels of traffic exhaust enter the environment. These poisonous fumes contribute to a layer of harmful air pollutants that threaten millions of lives, especially the lives of young children. Air pollution from vehicle exhaust fumes is at its highest level in metropolises around the world, where vehicle traffic is most prevalent. London, one of the world's most active and populated cities, has been vigorously fighting to lower air pollution levels for the past forty years (London Air, 2013). Despite the country's efforts, air pollution still breaches safety limits and requires further attention.

London commonly breaks the allowance set by the European Union for annual air pollution (Black, 2011). In such conditions, the local population is at risk of irritating any existing medical conditions and developing life-threatening illnesses (Lawrence Berkeley National Laboratory). Children are at a significantly greater health risk than adults owing to their underdeveloped respiratory systems (Schwartz, 2004). Children, of course, spend much of their time at school. As such, improving the air quality around schools can help reduce the health risks to children associated with air pollution.

As travel to and from schools is a principal source of local traffic congestion and thus air pollution, the London Borough of Croydon has received funds from Transport for London to run a number of programs to help address the school-related traffic. The environmental branch of the city council has implemented various strategies such as Cleaner Air for Schools and Eco Schools that aims to change the behavior of children and parents to reduce pollution (Croydon Council, 2012). Recently, the council has created Zero Heroes, a program that encourages children to walk to school. The purpose of the Zero Heroes program is to provide schools with compact, intensive curricular support that results in successful and ongoing promotion of environmental awareness among both children and their parents.

While the London Borough of Croydon is largely successful in working with schools to implement environmentally friendly systems, the Zero Heroes program is still in development and has yet to reach full impact. The program ran for the first time last year, with only one school participating. This year, however, we expanded the program to four schools, holding a

week of fun and educational activities to encourage walking to school and environmental awareness.

Our project aimed to reduce air pollution by working with the London Borough of Croydon to create and implement a successful Zero Heroes walk-to-school program in four primary schools. We designed a week of informed educational activities for primary school students that increase awareness and knowledge of air pollution as well as strategies to reduce air pollution. We evaluated the effect of the events on knowledge, attitudes, values, and behaviors in relation to air pollution reduction, as well as the direct impact of the week-long activities on air quality around the schools. Finally, we made recommendations on how to improve these events for additional impact in subsequent efforts and on how to establish an annual Zero Heroes program. Our project was designed to educate as well as actively engage students in reducing air pollution to create a safer and sustainable environment.

Chapter 2: Background

The Borough of Croydon is the fifth largest borough of London, covering 87 km^2 (33.6 mi^2), occupying the southern tip of London (see Figure 1). It is one of the most populous boroughs of London with 363,000 residents, leading eight other boroughs of over 300,000 (GLAIntelligence Unit, 2012). Croydon is a very diverse community, comprising primarily three distinct sections – North, South, and Central. Residents in Croydon's north section generally have a lower income, and are ethnically diverse, while residents in the south have a higher economic status and are mostly of British heritage. Central Croydon tends to be a mix of lower and upper class citizens. More than 130 different languages are spoken throughout the borough (Greater London Authority, 2010).

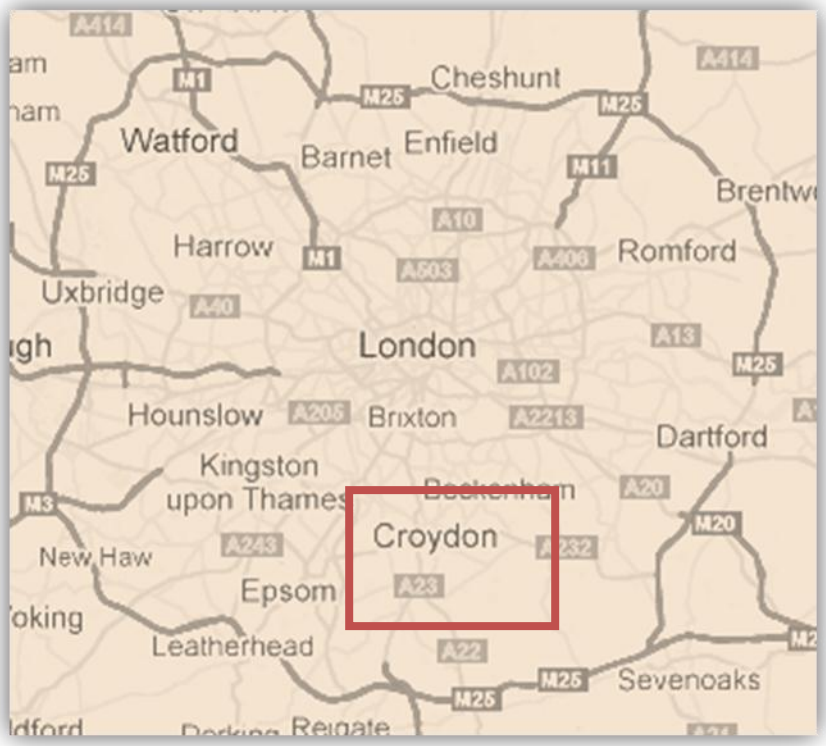


Figure 1: A map of London (Croydon outlined in red), Source: Google Maps, 2013

Croydon is one of the largest commercial centers in the area, easily accessible by train or bus and heavily trafficked by commercial vehicles. While the economy is dominated by the retail industry and enterprise, the borough has sought in recent years to reduce the impact of

its business and residents on the environment and bring additional greenery to its cityscape. As of June 2010, £43 million had been spent on 'Environmental services' or about 7% of the Borough's total expenditure (Greater London Authority, 2010).

Croydon is working to implement an air quality assessment that would require companies to complete an air pollution assessment when submitting new development proposals. Such a strategy aims to measure whether air quality objectives are being or are likely to be met, and put policies in place that will meet quality objectives (Local Air Quality Management, 2012). The council's latest policy, the Air Quality Action Plan 2012-2017, seeks to reduce the impact of emission from road traffic, industry, and homes, building on previous action plans (2012). The plan also seeks to ensure that communication is maintained with the community and partners to actively provide information on air quality and the actions everyone can take to reduce pollution or minimize its effects.

The environmental branch of the London Borough of Croydon has developed many notable policies that work directly with community members. When levels of nitrogen dioxide breached air quality objective levels, the council designated the whole borough an air quality management area (Local Air Quality Management, 2012). An Environment and Climate Change Strategy is in place, which aims for a 34% reduction in Carbon Dioxide ($C0_2$) emissions by 2025 by reducing reliance on fossil fuels, including petroleum for vehicles.

The borough has also created a policy called Cleaner Air 4 Schools in which they aim to reduce emissions from school buildings and to change both children's and parents' behaviors to reduce pollution (Local Air Quality Management, 2012). Eco Schools, an international program run by the British campaign Keep Britain Tidy, supports schools in their efforts to become more sustainable. Over 70 schools in the borough of Croydon have signed up to participate (2012). The Air Quality Campaign Days project aims to reduce the air pollution in London through behavior change (2012). Our project aims to assist the London Borough of Croydon to continue their work with schools by promoting active and sustainable travel of students through a successful walk-to-school program.

2.1 London Traffic

2.1.1 Air Pollution

London, a teeming metropolis of Western Europe, is naturally strained by high levels of traffic. With over three million active motor vehicles releasing pollutants daily in the greater London area (Beevers, Carslaw, & Fuller, 2001), the surrounding air quality suffers. Despite a steady decline in vehicular use spurred by factors such as the rise in price in petroleum and a push for a green movement, London's pollution levels remain higher than other European cities of comparable size, and frequently breaches the legal limit set by the European Union on allowable annual air pollution (Black, 2011). Even with new government-mandated standards on pollution levels from small vehicles, private cars are still the largest contributors to air pollution, particularly nitrogen dioxide (NO_2) and PM10 (any pollution particulate matter smaller than 10 microns) (See Figure 2 and Figure 3) (Atkinson et al., 2009). The London Assembly Environment Committee found that 67% of PM10 and 41% of NO2 released in the London area can be traced back to vehicles (London Assembly Environment Commitee, 2009).

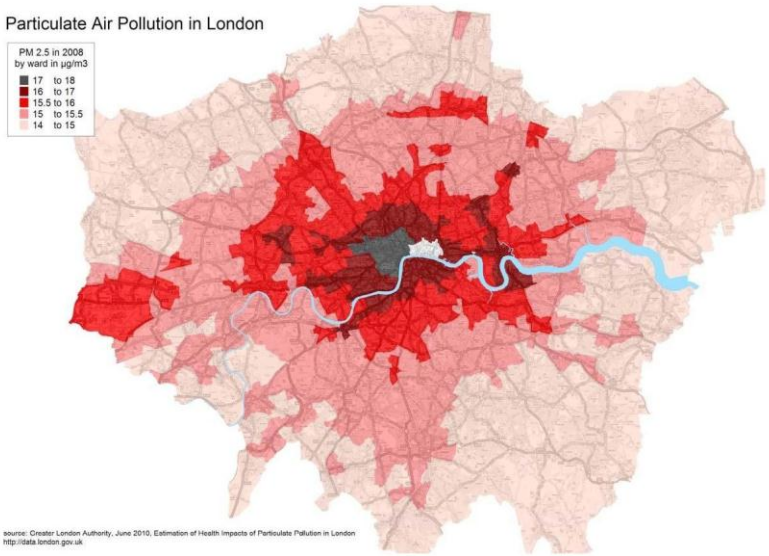


Figure 2: Map of Air Pollution in London, Source: Greater London Authority, 2010

In a study conducted in 2009 in which approximately 400 Londoners were asked how local pollution personally affects their life, over 50% reported being negatively affected by the poor air quality in their urban environment (MacKerron & Mourato, 2009), presenting

symptoms ranging from increased coughing to life-threatening conditions such as asthma. Another study conducted in 2009 in which various cardio-respiratory hospital admissions were monitored over a four-year period across small areas, found that there was a notable increase in number of patients admitted to hospitals in the London areas of greater pollution levels, specifically nitrogen oxides (Tonne et al., 2010). Reducing the daily number of personal car traffic on London's major roads could result in a significant decrease in both the environmental and public health hazard caused by vehicle-related air pollution.

Air pollution caused from traffic poses a much more dangerous threat to children than to adults. Joel Schwartz, a pediatric scholar, states that adolescents are at higher risk than adults to suffer respiratory symptoms because on average children spend more time outside and because they have underdeveloped immune systems (Schwartz, 2004). Children who live most of their lives in urban environments, which tend to have more concentrated road traffic, are overall 20% more likely to develop lung cancer than residents of rural communities (Turner & Kewski, 2011). As children spend most of their days in school, it is important to keep the air around these areas clean. If traffic and vehicular use can be dramatically reduced around primary schools, the air quality will improve, reducing the health hazard imposed on children.

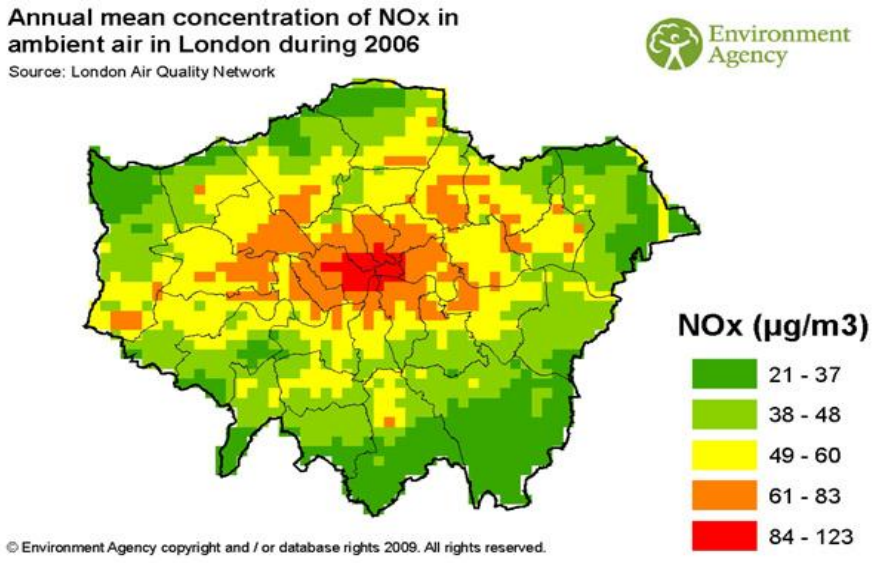


Figure 3: Map of concentration of Oxides of Nitrogen in London, Source: London Air Quality Network, 2009

2.1.2 Road Safety

The high levels of traffic straining the transportation infrastructure of London not only place the environment at risk but also cause hazardous road conditions that endanger local residents. This poses a danger for those trying to reduce air pollution by walking instead of driving. The London Borough of Croydon actively lobbies to decrease vehicular use to keep its citizens safe (Transport for London, 2012b). Although this borough has already been successful in decreasing traffic levels, with a 10% decrease in average traffic volume from 1999 to 2010 (Transport for London, 2012b), the road conditions are still hazardous. In 2011, over 24,000 collisions involving personal injuries were reported, with 2,800 people being fatally or seriously injured (Transport for London, 2012a). Of these casualties, 18.6% were pedestrians (Transport for London, 2012a). The traffic environment of the borough of Croydon is proving perilous to pedestrians.

Children walking to school in London face dangerous road conditions caused by congested traffic. Congestion of personal vehicles is found to be at its highest and thus most dangerous during early morning school drop-off and mid-afternoon school pick-up times. Even the conditions in front of the schools themselves are extremely dangerous, especially in or near the parking lots. A study researching road hazards around schools in Croydon involving the observation of parental drop-offs witnessed one-third of parents violating traffic rules in front of primary schools, thus creating an unsafe walking environment for their own children (Mortensen et al., 2012). During this study, parents were witnessed swerving through walking zones. Christian Mortensen, one of the four researchers, described the situation as “Absolute madness, I never expected to see that amount of negligence while driving in a school zone” (Iamartino & Mortensen, personal communication, April 4, 2013).

Reducing the congested area surrounding schools by having more children walk to school can generate a safer environment at pick-up and drop-off zones. However, this raises the concern for safety of the route students take to school. According to a survey sent to parents of primary school students in 2011, the most commonly mentioned concern was that of the safety of children on their passage to school (Edwards, 2011). If a safe travel route were

created for children to walk to school, parents would have more opportunity for their children to walk and thus to lower dangerous traffic levels.

2.2 Child Education

Before teaching children in primary schools the concepts related to the danger traffic poses so that they make walk to school safely, it is necessary to understand the underlying theories and strategies of child education. Perceptions and learning abilities of children are significantly different from those of adults, given natural brain development. Consequently, educating and interacting with children requires unique approaches. While these approaches can take many forms, the primary theories relating to child education, developmental pathways, cognitive learning types, and the roles of educators and parents, remain consistent.

Children require critical developmental pathways in order to learn academically, argues James P. Comer (1989), a professor of child psychiatry. These pathways include what he calls the social interactive pathway, pyscho-emotional pathway, moral pathway, linguistic pathway, and cognitive thinking pathway. For example, the social interactive pathway is the development of how a child interacts with others in a social manner and whether or not the child can understand the different backgrounds and situations of other children. The progress of each developmental pathway determines how integrated each child becomes as a student in an academic community.

Teachers play a crucial role in the advancement of their student's cognitive development. Comer states, "regardless of family background, most children will begin to do reasonably well in a school environment where the teachers are caring and supportive" (1989). Teachers therefore, provide crucial guidance for children that may not be provided by the parents. If the teacher fails to provide what the parent lacks, the child has a harder time properly learning and integrating into his or her environment. Consequently, teachers must be engaged in any educational activity that aims to teach children new attitudes and related behaviors towards reducing air pollution.

Of course, not all children have the same learning styles, and successful educational interventions must address each learning style for maximum effect. Children can be classified

into one of three different learning types: audio, visual, and action (Bjork, McDaniel, Pashler, & Rohrer, 2008). Audio learners respond best to new knowledge by hearing it. Similarly, visual learners respond best to new knowledge by seeing it. Finally, action learners absorb more knowledge when acting out something that relates to the lesson. After understanding all of these learning types, all forms of education can be covered by executing the lesson in many different styles. For instance, a lesson about air pollution in which the children are educated by being spoken to, shown posters and other visual displays, and brought out to walk and help take air quality measurements, appeals to all three learning types. This not only includes each of the most beneficial learning styles, ensuring any lesson taught stays with the child, but also enhances the child's learning by helping him or her understand a single concept in different ways. A fundamental understanding of audio, visual, and action learning is necessary to properly teach and present new topics of understanding to children.

Arguably the most vital role in the education of a child is played by the parent. When working with children at young ages, teachers are subject to dealing with the requests and daily styles of the parents. Ultimately, it will be the parents' decision to engage the child in any activities the school has to offer, especially if it is in accordance with their own beliefs or priorities. According to Ali Kemal Tekin, a professor of Early Childhood education, "Parents' involvement is motivated by two major belief systems: role construction for involvement and self-efficacy for helping the children succeed in school" (2010). This excerpt lays out the fundamentals of a parents' involvement with their child. Here, "role construction" is defined as what the parent believes should be done for the child's education, while "self-efficacy" refers to the parents' belief that helping the child succeed will positively affect their child's education. Tapping into both of these concepts is necessary for a teacher to persuade the parents to involve themselves in a school program to influence their children. The influence a teacher has on a student is largely dependent on convincing the parents to become involved and therefore must speak to the parents' belief systems. For the Zero Heroes activities to achieve maximum success, we had to engage with parents not only to obtain consent for student participation, but also to ensure the learning objectives remain consistent between school and home.

Previous walk-to-school programs have had mixed but overall positive feedback from the children's parents (McDonald & Aalborg, 2009). Researchers from Walking School Bus (WBS) programs in the United Kingdom, New Zealand, Australia, and the United States asked mothers and fathers for opinions on the programs. General feedback indicated that the parents enjoyed spending time with their children and believed the children's sense of navigation dramatically increased (McDonald & Aalborg, 2009). It was also shown that many students who originally were driven to school joined the program on their own after seeing it run on a daily basis (McDonald & Aalborg, 2009). The study provides us with supportive research that may offer valuable assets for convincing parents to allow their children to walk to school rather than be driven. As primary school children are not able to make many of their own decision, especially how they intend to commute to and from school, parental buy-in is essential for WSB-type programs. Eva Pomerantz (2007), a child development specialist, asserts that by becoming involved in their child's life, parents can learn what the child is learning in the school and help the child fully develop cognitive skills. Parents are also able to recognize the child's abilities in and out of the classroom, as well as teach the child to learn from practice and instruction during parental home-based involvement (Pomerantz, 2007). Showing a genuine interest in the child's well-being can also be noticed by the teacher, an additional benefit to the student-teacher relationship (Pomerantz, 2007). Children with involved parents tend to strive harder and become more involved in activities in and out of the classroom. A study researching the effects of parental involvement and expectations involving 780 primary school students in Hong Kong, China, verified that children with highly involved parents, who set high expectations for their children, tested substantially higher on IQ tests and were much more involved in classroom activities (Phillipson & Phillipson, 2012). If the overall education and cognitive learning abilities are not reason enough for parental involvement, the health and environmental concerns stated in previous sections are further reasons for involvement. By setting a positive example for a child, they will likely lead and follow in the footsteps of their parents. As time progresses and the activities become more prevalent, attitudes and behaviors will slowly change throughout the community. Although this concept is important, parental involvement is extremely hard to gain due to of the variety of outside circumstances that

parents must deal with on a daily basis. Giving parents an idea of the positive benefits of their children walking to school will be the extent of outreach the project team will partake in. In a best-case scenario, parents will recognize the benefits for their children in reducing air pollution, and subsequently begin to change on their own.

By tapping into developmental pathways, cognitive learning types, and role of parents in a child's behavioral as well as educational growth, we understood how and why strategies to educate children were effective. As all children are unique and have different needs and background, one has to adapt to changing conditions and attempt to be as flexible as possible in education. By incorporating the theories of child education and directly involving parents in the process, we aimed to better influence and educate the children of Croydon about sustainable reductions in air pollution.

2.4 Successful Means of Approaching Children

Other walk-to-school programs identify useful methods of gaining student popularity and maintaining active engagement, crucial components to the success of our project. Walk Once a Week (Wavehill Consulting, 2009), Sustrans Heroes (Sustrans, n.d.), and Cleaner Air 4 Schools (Local Air Quality Management, 2012) identify advertising, incentives, and competition as key aspects that keep students' interested and involved.

2.4.1 Incentives

Incentives are a very effective method for gaining the involvement of children because they often associate the behavior they conduct with a reward (Greig, Taylor, & Mackay, 2007). An incentive is defined as "that which influences or encourages to action; motive; spur; stimulus" (Mckenchnie, 1976). Incentives range from tangible goods, such as cash payments, to intangible rewards, such as altruistic feelings (Rice & Broom, 2004). With children, incentives that offer long-lasting rewards tend to be the most effective reasoning for recruitment (Mackett, Lucas, Paskins, & Turbin, 2005). A long-lasting incentive gives a child reason to engage in certain activities and convinces a child to remain active.

Programs that promote walking to school, such as Walk Once a Week (WoW) and Walking Bus, use incentives to effectively gain child involvement. Walking Bus uses intangible incentives, such as the satisfaction of walking and keeping the air clean. Given that Walking Bus involvement is continuously declining, these intangible incentives seem to be ineffective with children (Mackett et al., 2005). Walk Once a Week, however, uses tangible rewards such as badges. These tangible methods appear to more effectively gain students' interest and greatly increased students' involvement (Wavehill Consulting, 2009). Both tangible and intangible incentives are an essential component to keep our project running through Zero Heroes week and in the future.

2.4.2 Advertising

Advertising is also a vital component to successful and sustainable programs. Advertising can be done in many ways, including newspaper ads, bulletin boards, posters, and school announcements. Design of advertisements aimed at children is far less complicated than advertising to any other group of the general public (Calvert, 2008). The impact that the choice of color, words, and layout make on a child is crucial to ensure a concept or idea is assimilated without any misinterpretations induced by complex wording, puns, or such literary devices (Calvert, 2008). Advertising to children requires the ability to fully present a concept in a brief and appealing way (Calvert, 2008).

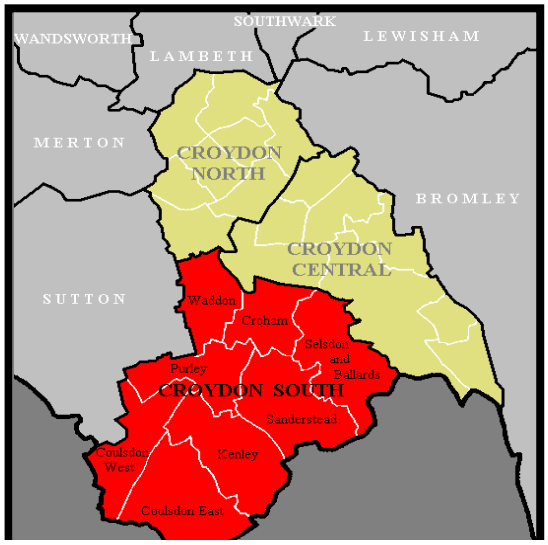
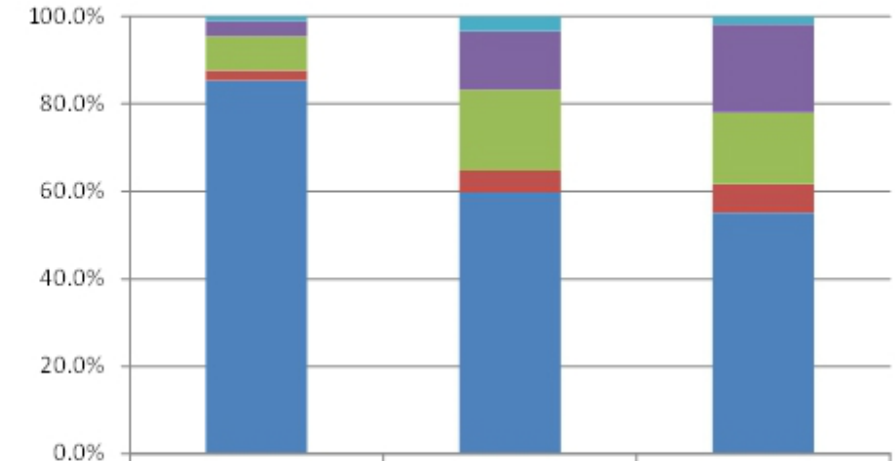


Figure 4: A map of Croydon distinguishing the north from the south, Source: East Coulsdon Residents' Association, 2012

One challenge presented in Croydon is that English may not be the first language of some primary school students. In particular, Croydon North is a diverse community where upwards of 70% of school students do not speak English as their first language (see Figures 4 and 5). Advertising to children whose first language is not English requires the use of universally understood symbols to get a message across. One universally effective way of capturing a child's attention that is not restricted by a language barrier is the use of cartoon characters

(Calvert, 2008). Research suggests that advertising containing such characters has a greater ability to change consumer's ideas and preferences as compared to ads without cartoon characters (Ogilvy & Raphaelson, 1982). Characters begin to assume human traits in the minds of consumers, generating feelings of trust or respect (Callcott & Phillips, 1996).

As discussed earlier, it was also pertinent for us to advertise to the parents of the children. These adverts will differ from those aimed at the students because the parent looks for different objectives to be addressed. For the parent, the importance of the decisions that their child makes is based not upon factors of fun, but upon how the decisions affects the child's well-being. Advertising to the parent must address their concerns. For our project, we must implement universally understood advertising to appeal to both child and parent to ensure participation.



	England	London	Croydon
Other %	1.0%	3.4%	1.8%
Black %	3.5%	13.3%	20.2%
Asian %	7.8%	18.5%	16.4%
Mixed %	2.3%	5.0%	6.6%
White %	85.4%	59.8%	55.1%

Figure 5: Census of England, London, and Croydon, Source: ONS census release, 2012

2.4.3 Competition

Competition is the final identified mean to keeping children actively engaged and involved. Evidence suggests that children are more willing to engage in educational work if it is presented to them in the form of friendly competition with their peers. One 2012 study, in

which math comprehension scores of students in a normal classroom environment versus students engaging in an educational game in mathematics were compared, found that when replacing a normal math curriculum with a competitive game, comprehension scores increased over seven weeks for the experimental group (Pareto, Haake, Lindstrom, Sjoden, & Gulz, 2012). This study suggests the competitive atmosphere motivated the students to do better. A different study published in 2010 in which students and teachers were examined in various teaching environments found that competition between students in school can be made constructive, provided that the right conditions are met in the classroom environment. These conditions include the teacher focusing their attention on the general knowledge level of the group rather than personal successes or failures and the students recognizing on some level that "winning" the competition is achieving long-term knowledge (Williams & Sheridan, 2010). Competition keeps children more engaged in lessons and will be used in our project as another means of motivating students.

2.5 Sustainability

Our final goal in this project was to achieve sustainability so that the activities may be implemented annually. Researchers from McGill University, Pluye, Potvin, Denis, and Pelletier (2004), investigating program sustainability with a focus on organizational routines by studying health centers in Quebec, discovered that organizational routines are key components in a successful and sustainable program. The researchers narrowed down four focal components within organizational routines: memory, adaptation, values, and rules. Memory is defined as the common principles of past experiences that can be recollected for current events and programs (Pluye et al., 2004). Memory is divided into sub-sections that include social networks, paper-based manuals, and computerized memory. Adaptation refers to the change in the routinized activities over the period of time in which they will be in place. It is important that the adaptations put in place are constantly updated to avoid a misinterpretation of program. All sustainable programs express communal values and beliefs that ultimately define the goals and objectives that our program hopes to attain each year, as well as a set of rules that need to be enacted and governed by elected or volunteer coordinators (Pluye et al., 2004).

In addition to understanding and incorporating memory, adaption, values, and rules as a way to keep a program sustainable, the researchers discovered that follow-up activities must be conducted to ensure that permanence. Routinized activities also have an enormous impact on the improvement and length of any organizational programs (Pluye et al., 2004). According to the study, the centers that conducted a follow-up activity as well as organized routine activities met with large success, while those that did not largely failed. The discussed techniques provide insight into what makes and keeps a program sustainable and will be important for implementing our Zero Hero program annually.

2.6 Summary

Previous studies have shown that the high levels of traffic in London greatly contribute to the local air pollution, harming the environment and threatening the health of residents. While the country has made great attempts to reduce the release of contaminants in the air, in many areas pollution continues to be prevalent. This is particularly true in front of primary schools where most parents drop off their children. An effective, sustainable walk-to-school program needs to be established to reduce vehicular use and educate children on pollution reduction to change their attitudes towards vehicle use.

Chapter 3: Methodology

The goal of this project was to assist the London Borough of Croydon to improve air quality by promoting active and sustainable travel of students through a successful walk-to-school program. To accomplish this we:

1. Designed informed educational activities for primary school students that increase awareness and knowledge of air pollution and possible strategies to reduce air pollution
2. Evaluated the positive effect of the Zero Hero lessons and worksheets on knowledge, attitudes, values and behaviors in relation to air pollution reduction as well as improving air quality
3. Offered recommendations on improvements to the events for additional impact in subsequent efforts and implement methods to establish an annual Zero Heroes program

Our methodology was divided into the following chronological phases to best address each objective (see Figure 6).

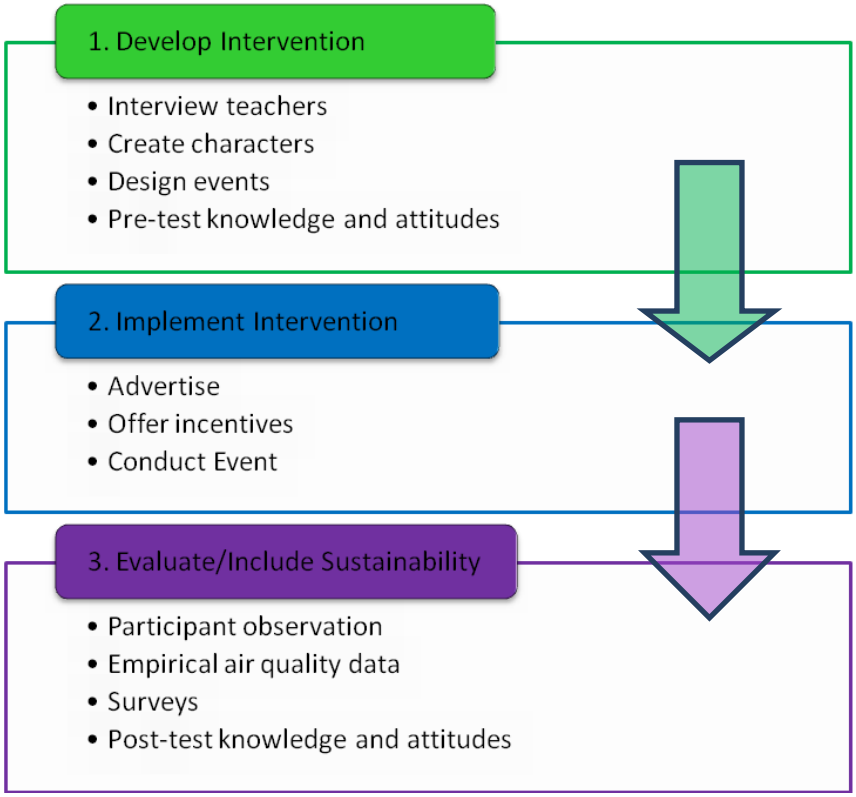


Figure 6: Table of Methodology

3.1 Develop Interventions

To develop and form educational activities, we first sought guidance from expert teachers. Based on the data collected from conversations with teachers and the background research we conducted on how to educate a child, we designed and implemented a week of events promoting the prevention of air pollution that will be fun and educational for children attending four primary schools in Croydon.

3.1.1 Interviews

We conducted a set of unstructured interviews with two groups of students who have conducted walk-to-school programs in London, five teachers in Massachusetts, and one principal in the Worcester area before we left for London. This helped us obtain expert advice on what elements we should consider when developing our interactive activities. This sample of interviews was large enough to obtain a range of ideas while allowing us to have significantly in-depth conversations within a limited time period. By interviewing teachers, we formulated activities both before and shortly after arrival in London that were adapted to the Croydon context.

Teachers informed us about parental involvement, student engagement, teacher communication, and past experiences in developing or running similar activities (See Appendices I-VII). By conducting an unstructured interview with topics instead of direct questions, we allowed the experienced interviewees to discuss anything they deemed most relevant to our project. Conducting unstructured interviews with primary school teachers brought to light strategies for working with young children that helped set the foundation for our program prepared us for possible issues that could occurred.

3.1.2 Characters and possible activities

In order to both effectively advertise and offer incentives to children, we developed cartoon characters, mascots for our project. Our team developed a league of five Zero Heroes that appear on various advertisements and are associated with each lesson. When the week of activities began, the students were shown the first hero, Nicola (see Figure 7). It was

announced by the teachers that Nicola arrived to eliminate local air pollution, but that she needed the help of her fellow heroes. Nicola then appeared on any worksheets or related materials for that day, and the students were told that they can help her friends arrive by working hard to learn about pollution and taking action to prevent it. Each day afterwards, a new hero was unveiled who appeared on all related materials for that day (see Figure 8-11). In total, five heroes were revealed, one for each day of events. The aim of this approach was to motivate students to take part in each lesson plan because they will associate their effort with the arrival of each hero.

In addition to the development of our own characters, we raised interest and involvement by asking the children to draw and submit their own Zero Heroes for an art competition. There were two competitions in each school, one for the younger children and one for the older ones. The winning design was chosen by the project coordinator of the school and was awarded to the drawing that exemplifies the most artistic skill, creativity, and effort. The first place prize included a certificate with the student's hero standing amongst the Zero Heroes and the drawing being displayed in the school. All other entries were displayed on a banner that will be hung in the main entrance of the school on the final day of the week of events. The art contest encouraged competitiveness and therefore more participation among the students.

We also conducted a participation competition in which the child who was most involved in the program received a hand-drawn poster of him or herself as a Zero Hero standing among the other Zero Heroes. As in the art contest, there was two competitions per school divided by the age group of the children. This poster was sent home with the child to be hung up in his or her household. To determine which student participated the most, each teacher near the end of Zero Heroes week was prompted to recommend two students from his or her classroom that most exemplified a Zero Hero based on factors such as how far the student walked each day, how often the student walked, how involved was the student during each lesson plan. The teacher was asked to write a short paragraph explaining why the student should be considered, and those sheets were collected and read by the project coordinators of

each school. The schools decided the winning student based on information gained from this process.

Figure 7: Our group's first original Zero Hero, Nicola

Figure 9: Zero Hero, Anu

Figure 10: Zero Hero, Sonya

Figure 8: Zero Hero, Klaus

Figure 11: Zero Hero, Rin

3.1.3 Experiment

The purpose of this experiment was to give students first-hand knowledge of the effect of air pollution through a more tangible method. The experiment consisted of a closed environment in which two plants were brought to each school, one grown in a healthy environment and one introduced to pollutants. During the week, while the first plant was watered and cared for, the polluted plant slowly withered from pollutants. In order to simplify things, the "pollutants" introduced, unbeknownst to the students, were simple weed killers and herbicides. Seeing a plant wither from the effects of air pollution gave the students a more personal feel for the negative effects pollution has on the environment. By allowing children to observe this interactive experiment, our lesson reached them on a personal level and stressed the need to take action against air pollution.

3.1.4 How Far Have You Walked

In order to create positive enthusiasm about walking to school every day during the week of activities, the "How Far Have You Walked" competition was designed and implemented. This competition was both to encourage students to walk to school and a means to gather information on how many kids are actually walking to school each day. All of the schools were set to compete with the each other to see which walks the farthest. A poster board of Europe was set up in a public viewing area for each school and a marker was used to represent each of the teams. The poster board had each Zero Hero character standing in separate countries, with a backdrop of a dotted path flowing through Europe. The path was approximately the correct distance that the children as a school would walk in five days. The marker was moved each morning a certain distance depending on how many students walked on the previous day. Who actually walked was documented by giving out a survey sheet with a simple question of whether the student walked to school or not. This sheet was completed each morning and passed in to the teacher. The data received from this competition came back to us so that we could determine the proportion of students that walked to school out of the entire school population for each team.

3.1.5 Peppered Moth Activity

The peppered moth has been used for quite some time, to demonstrate an example of natural selection as well as evolution. Pre-industrial revolution around 200 years ago, peppered moths were very light in color, practically white. As time went on and the air grew increasingly smoggy, moths started to evolve and change to a darker, almost black color. Recently, the moths have begun slowly changing back to their original shade because of slight reductions in air pollution around the area. To mimic this process, during the "Peppered Moth Activity" each class created a dark-colored paper moth, then posted it in the classroom. Each time a student walked to school, they gained a white sticker, which they could place on the moth, making the moth lighter and representing their contribution to reducing air pollution. This activity has a two-fold encouragement factor: it provides a set of prizes that the class can win, but also shows the importance of each individual's contribution in helping the environment.

3.2 Implement Interventions

After developing our activities, we implemented them in four primary schools: Atwood, Hayes, Forestdale, and Norbury Manor. Implementation required extensive communication and collaborations with school administration, faculty, staff, volunteers and students. We needed to encourage maximum participation. We did this through a variety of methods, including incentives, advertising, and competition.

3.2.1 Applying Incentives

Incentives were offered to both children and adult participants. We gave parents of the students the incentive of increasing the health of their child by informing them of the research we have done on the potential health risks to children associated with growing up in environments with high pollution. For the children, we offered tangible incentives during the preparation lesson plan as well as on the day of Zero Heroes. In one school, each student received a sticker sheet with silhouettes of a Zero Hero character under each day of the week.

We set up a lesson plan that involved the children demonstrating their knowledge of the science of air pollution, as well as fun and creative activities such as the Zero Hero design contest. This set up the incentive of receiving first-place prizes. Finally, a breakfast was funded for every child who walked to school on Zero Heroes day. Incentives encouraged both parents and students to engage in our project.

3.2.2 Applying Advertisements

We developed advertisements to encourage both children and adult participation. Advertisements, such as the parent email and the walk to school banner (Appendix VIII) made the students and parents aware of the activities we conducted and the incentives that we used through the use of advertisement campaigns. We wrote templates for each school to send a parent email to inform the parents on Zero Heroes week and where the drop-off zones were. For our student advertising, the main focus of our ads included our group's original Zero Hero designs. We decorated the schools with images of the characters in posters and a banner reminding children of the upcoming event and giving reasons to become involved. We also assigned the students activities to do with their parents in order to get parents engaged in the lessons and get maximum participation in the program.

3.2.3 Lesson Plan

During the week of events, we ensured that the students were gaining knowledge about air pollution and how their efforts are affecting their environment. We created a short lesson plan of discussion for each day to give to the teachers. On these lesson plans, we specified the topics for discussion and some facts for the students to learn. We also created PowerPoint slides that follow each lesson plan for the teachers to use. We created a coloring sheet for each day relating to the lesson plan that asks the students to draw and color various scenes from their imagination. For instance, as the first day's lesson plan aims to clarify what exactly air pollution is, the sheet (featuring one of the Zero Heroes) prompted students to draw in a window what air pollution looks like. Finally, we gave the teachers group discussion questions for their students to work in groups to answer.

3.2.4 Assemblies/ Class Visits

Before the week of events began we visited each participating school to give two assemblies, one for the younger half of the school and one for the older half. During these assemblies we prompted the students with various questions about the program and provided them with our own short lessons. This was our opportunity to personally inform the students on various lessons with more depth and to begin to gauge the impact the program was making.

In addition to each assembly, during Zero Heroes week we visited individual classrooms with one group member dressed as a Zero Hero. When children are in a large group such as an assembly, it becomes easier for them to become disengaged and lose their attention. By visiting classrooms individually, we interacted with the students on a more personal level and conducted more accurate observations, unhindered by the excitement of an assembly. These observations were used to determine the effectiveness of our program by gauging factors such as number of hands raised and number of smiles to determine level of involvement.

3.2.5 Conducting the Event

There are a number of logistical concerns with increasing the number of children walking to school. Since it is possible that many parents will not be able to walk to the school with their children, we organized volunteer and staff escorts to help the children through the streets of Croydon. We took as many precautions as possible to allow these activities to run smoothly and ensure the safety of the children participating.

3.3 Evaluate the Activities and Build Sustainability

We concluded our project by evaluating our success and implementing methods to establish an annual Zero Heroes program. The success of our project was determined by measuring the positive effects the knowledge, values, and behaviors of students involved, as well as the impact on the air quality. We also recorded and offered recommendations on improvements to the events for future use.

3.3.1 Participant Observation

Participant observation was an efficient way of evaluating the overall experience of students and parents. The observational study was a tool to determine the effects of the activities. Observation was determined as to whether the school's community actually enjoyed the event and had a valuable learning experience. Teachers were given observational sheets that they completed during each day's activity for us to analyze.

Monitoring and evaluation was a vital component to ensure the program is maintained in the future. By giving teachers the capabilities to conduct the observations on their own, the program will be able to thrive in years to come. The evaluation sheets provided information to evaluate a multitude of observations qualitatively and ultimately determine the success of the project. The evaluation sheet included demographics of the participants in each activity such as age, gender, parent, and child. It also recorded a multitude of attitudes and behaviors, while the activity is taking place. A rating scale from 1 to 5, with 5 being the highest, was used to judge the attitudes and behaviors of the participants.

3.3.2 Surveys

Surveys were conducted once the week of activities was over. The goal of these surveys was to help provide information that showed how much participation occurred, as well as to offer recommendations for impact in subsequent efforts. Given that there were around 1,200 participants in the student category (roughly 400 per school); we gave surveys to each teacher from each school to pass out to all of their students. Only students from older grades (grades 4-6) were surveyed because of the lack of writing and reading skills in the younger years. For the younger years, we personally came in and asked them questions, using our observation sheets to collect data. Once the older students filled out the survey, they were collected. Surveys were short and concise, no more than ten multiple choice or matching questions. At the bottom of the survey was an additional box to write comments and criticism of the overall program. All surveys were handed out at the last event and collected, to ensure that each participant had the possibility of a full week of exposure to the interventions and activities. All multiple-choice

data was entered into an Excel spreadsheet and illustrated using graphing tools. These surveys gave us hard data on the success of our project.

3.3.3 Pre-Post Testing in a Case-Control Evaluation Design

Pre-Post testing was used to assess the effectiveness of the Zero Heroes Program over the time elapsed during the project. By administering a base test before the week of activities and following up with a post test administered after all activities and interventions were implemented, we have been able to determine the impact of the week-long event. The test did not just analyze the knowledge of the student participants, but also gave us an idea of the change in attitudes, behaviors, and values that students have developed through their experience.

Within the first two weeks of the project we split up into teams of two and went to six different schools within the borough of Croydon. Four of the schools were selected to participate in the events. The two additional schools, the David Livingston Academy and Smitham Primary School, were selected as the control schools based upon similarities in demographics and activities related to walking to school. The control schools did not engage in the Zero Hero activities. However, we collected pre-post data from the control schools to compare against the four other schools, adding another level of analysis upon which to determine if the week-long event was a success. Classes from each of the six schools received the pre- and post-tests. Each class comprised approximately 30 students. Every class in the test schools received a pre- and post-test, whereas in the control school only a random number of selected classrooms received the pre- and post-tests. Classes were selected from the 1-3-year bracket and from the 4-6-year bracket. They were so categorized because of the varying changes in maturity level of the children of younger ages.

Children in the year bracket 1-3 were given a group evaluation as the pre and post-test. Their evaluation was conducted by two group members. The questions were asked in the classroom and were very basic because of the age of the children (see Appendix B). They were asked many questions that were the same for both the pre- and post-tests to determine if they had a valuable learning experience during the program and if they retained any of the information taught to them through the experience.

The older children, years 4-6, received a different testing technique. Because of their ability to answer questions and take tests more efficiently than the lower years, we created a test to evaluate their knowledge of pollution and the benefits of walking to school while also recording how often they walked to school (see list of questions in Appendix C). By having both tests comprise the same questions, we were able to evaluate differences in knowledge from before the week of activities to after for both the control and test schools. The only difference is that the post-test had a final question on matching the heroes as a fun activity for the children.

Considering that all the schools tested were located in the borough of Croydon, there was a possibility that our data could be skewed if students from the control schools mingled with students from the test schools. We attempted to recognize any contamination of data by asking the children from the control groups where or if they received any information from students in neighboring schools, in regards to the Zeroes Heroes Program. Bias was also a concern because of the large environmental movement going on in the London area. Programs like Walk on Wednesday and the Walking School Bus Program have already or are currently being implemented in the London area and could account for another source of intervention bias.

3.3.4 Future Sustainability

Since one of the ultimate goals of the Zero Heroes program was to allow the easy repeated use of the program in subsequent years and at an increasing number of schools, we had to consider alternative methods of delivering the teaching material that is more cost effective. We designed our program's lesson plan to be delivered to the schools all on paper in order to accommodate any schools that are not technologically equipped enough to receive it in any other form. However, after witnessing the technology resources that our schools have to work with firsthand, we deduced that enough schools have the resources to make our project digital. The largest expense that we encountered was for printing and distributing the teaching materials. Our initial estimate for the price of printing the materials was several thousand pounds. We managed to reduce that figure significantly, but it will still be a major hindrance in

expanding the program beyond four schools. In future years, we recommend setting up all the daily worksheets and surveys online and accessing them in the classroom via computers. The only part of the lesson plan that would have to remain on hard copies is the coloring sheets. The rest of the materials would then only be printed for the schools that do not possess the technology necessary to use the digital versions of the materials.

3.4 Summary

Our plan for the Zero Heroes program consisted of three primary phases. First, we developed interventions based on research on child-education methods from both primary sources such as structured interviews with teachers and secondary sources on effective methods in incentivizing and engaging young children. Our use of characters and mascots developed out of the research as a strategy to appeal to schoolchildren. In addition, the in-class experiment studying the effects of air pollution and acid rain on plant life developed to display the harsh effects of air pollution on life, indicated by existing literature and experts as an effective strategy to engage with students. To ensure student participation, we initiated an advertising campaign focused toward both the students and parents, and offer incentives to the students to participate by engaging in creative competitions. To evaluate the effectiveness of our program, we conducted surveys and interviews asking how the program went, gathered empirical data on the air pollution levels in Croydon on the day of the event, and subjected the test and control schools on knowledge and passion for the air-pollution issue before and after the program occurred.

Chapter 4: Analysis and Results

The analysis of the results comprised two parts: how the data varied between schools and why. These schools included the control schools, David Livingstone Academy and Smitham Primary, and the test schools, Hayes Primary, Forestdale Primary, Norbury Manor Primary, and Atwood Primary. Each test school experienced unique obstacles, such as school trips, school inspectors, fire alarms ringing during assemblies, and other walk-to-school programs—all of which influenced our data. Three of the four schools completed the majority of activities including the pre/post-tests, drawing competition, participation competition, lesson plans, and surveys. Atwood Primary presented the most difficult challenge for us as they only made time for the art contest and Zero Heroes Day itself, neglecting all of the lesson plans. Although the school was not able to implement all of the materials provided, the experience of working with them proved important to our data analysis. The three other schools had very good testing results for both the educational material provided and the actual walking to school during the week and on Zero Heroes day. Both the consistencies and the inconsistencies of our data allowed us to analyze where our project succeeded and what can be done to improve it for future use.

4.2 School Reception

The four schools varied greatly in the ease and success of working with the project. Hayes, the school that explicitly took time out of their lesson plans to fit in time our Zero Heroes material, had the best results. Schools that also organized drop-off zones and assigned staff to escort the children also met with success. Issues arose due to the time of the school year when the program was attempted. For one, we asked schools to run the program near the end of their school year, when assemblies, standardized testing, and general end-of-the-school-year activities were already occurring. During the seven weeks that we spent with the schools, all four had a week-long school holiday, a few had a week devoted to standardized testing, and most conducted school trips that removed one or more grade levels during the pre- or post-testing.

When we initially approached the schools about our program, they all seemed confident in their ability to overcome these logistical programs and execute the activities as intended, and enthusiastic about taking part. When it came time to execute the program, however, some of them failed to adjust their existing curriculum to accommodate the lessons. Out of our four schools, only Hayes was able to hold the pre-program test, the week of activities, Zero Heroes day, and the post-program test in the order and time frame that we intended. Atwood and Forestdale failed to do the week of activities before the Zero Heroes day, and their surveys and test data are compromised. Norbury requested to reschedule their Zero Heroes day a week later. However, when we told them that would not be possible, they did the activities in a shorter time frame instead of over the intended five day period. We learned from these challenges that more success will be gained if, in the future, Zero Heroes week is held at an earlier time of the school year, giving the schools much longer notice to plan out the curriculum.

4.3 Case-Control Study Results

To test the program's effectiveness in teaching children the material and getting them to start changing their daily habits to walk to school, we used case-control pre- and post-testing (see Appendix VIII). In this testing phase, we worked with two other control schools who did not receive any interventions and our four test schools that received all the interventions, and compared test results. These results came from the pre-test conducted before the week of activities and the post-test that came after the week of activities. By seeing a positive change in the test-schools' results and no change in the control schools' results, we concluded that the week of activities had a significant impact on the schools' educational levels relating to air pollution and road safety. In figure 12, the pre-test results are displayed for both test and control schools, where bars indicate the percentage of students—out of 443—who got each question correct.

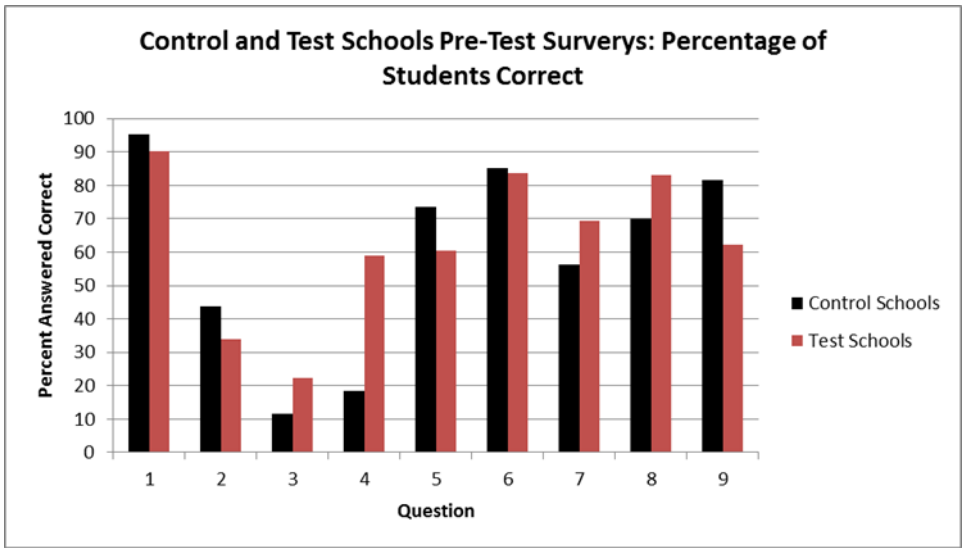


Figure 12: Comparison of Pre-test results for the control and test schools

As can be seen from Figure 12, the general percentage of student answers is about the same for both the control schools and the test schools. Some questions, like question four, are a little off balance; however, beneficial results can still be received. This is because when compared to the post-test results, an increase in percentage of correct student answers for the test schools is desired, while the control schools do not change. Figure 13 below shows the test schools increase significantly in percentage of students that answered correctly while the control schools do not change.

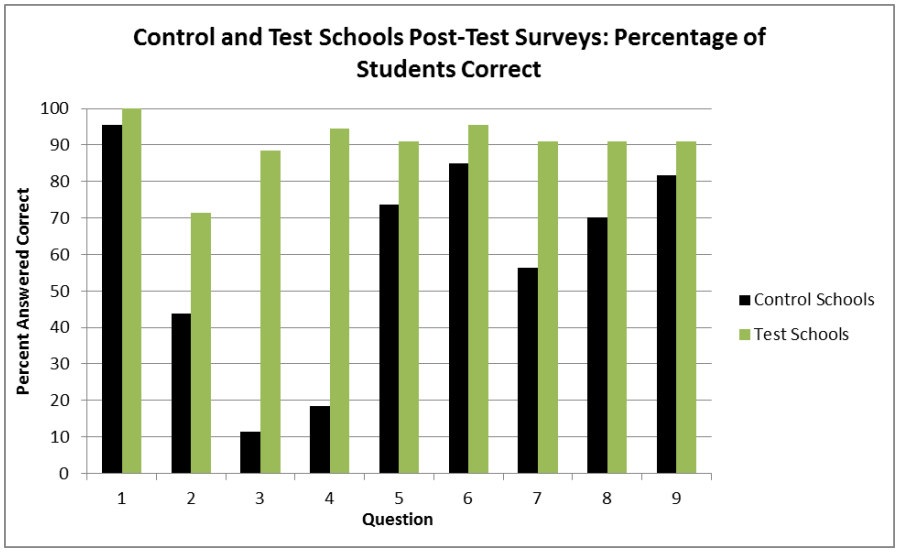


Figure 13: Comparison of Post-test results for control and test schools

These results reinforce that the week of activities taught the students about the material and that they held on to the concepts. We can conclude that the week of activities had an extremely successful outcome in teaching the students and engaging them in the activities.

A second part in evaluating comparisons between the control and test schools was the behavioral change in walking to school on a weekly basis. This was a question on the pre- and post-tests that asked how many days the students walked to school weekly. Figure 14 below shows the percentage of students who chose each distribution on the pre-test.

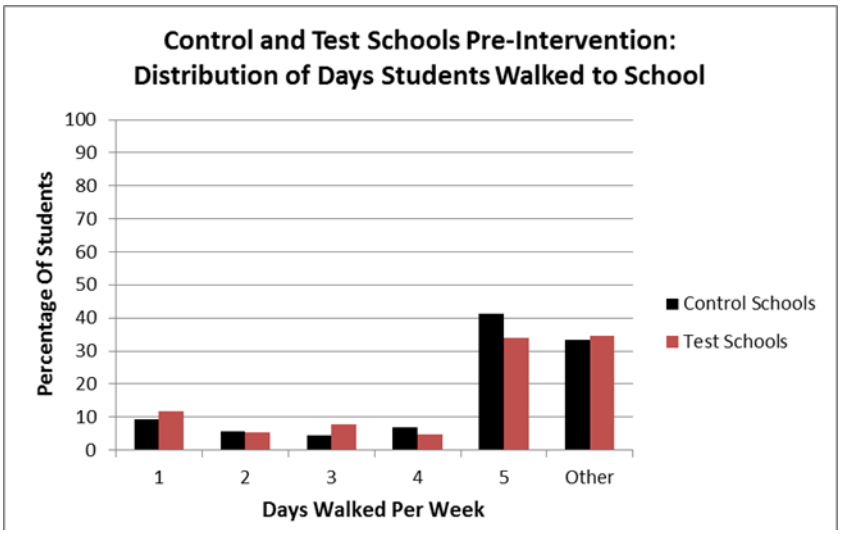


Figure 14: Comparison of distribution of student walking on the pre-test

This graph shows that during the pre-test a bit over half the students walked to school weekly while a large percentage of students responded other, which implies that they do not walk to school. Again, what should be seen in the post-test results is that more students walk to school on some kind of daily basis while the percentage of students that chose other goes down, for the test schools. The control schools once again do not change. Figure 15 shows the post-test results.

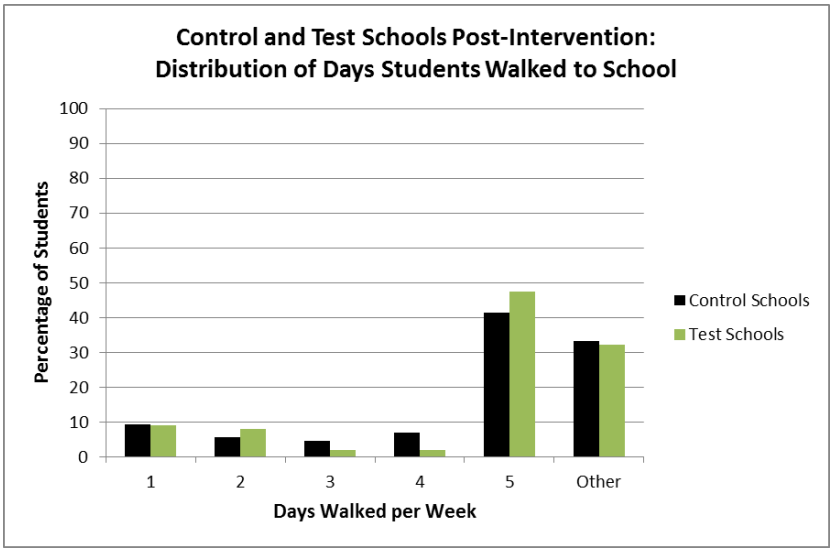


Figure 15: Comparison of distribution of students walking on the post-test

This graph shows that even though is only a small positive change in behavior of the test schools, the percentage of students who walked on a weekly basis increased while students who indicated "other" or do not walk decreased. This reinforces that the Zero Heroes week of activities and Zero Heroes day, had an impact on the behavior of children and their walking-to-school habits.

4.4 Daily Survey Results

The return rate of the daily surveys was minimal at two of the four schools. With results from both Forestdale and Hayes, the graph below indicates how the children did while tested on the material learned that day. The results were very encouraging considering that the children did not test nearly as well on the pre-test, which contained all questions from the same subject matters. Figure 16 shows the percentage of correct answers in the surveys for the educational material:

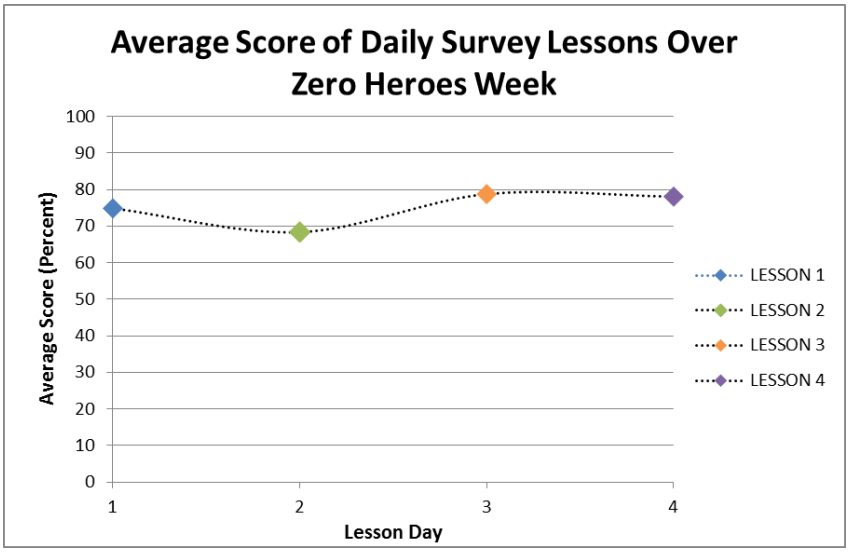


Figure 16: Overall Averages for Daily Surveys over the week

The average of correct answers for the entire week of surveys was approximately 76%. Although not extraordinarily high in percent, these results were encouraging and proved that the children were learning the material. Some possible alterations in the data could have occurred if the teachers did not go through each lesson plan for each daily survey. The data we collected demonstrates the success of the project in educating the students on air pollution.

4.5 The Weeks Walking Distribution

By using the surveys and pre/post-tests, we were able to determine how often the children walked during Zero Heroes week in comparison to how often they normally walked. As stated in previous sections, the overall goal of the week was to have all the children walk on Zero Heroes day. However, we did encourage them to make an attempt at walking to school throughout the week leading up to Zero Heroes day. The graph below shows in red the number of days the children walked previous to Zero Heroes week, and the green indicates how often the children walked during Zero Heroes week.

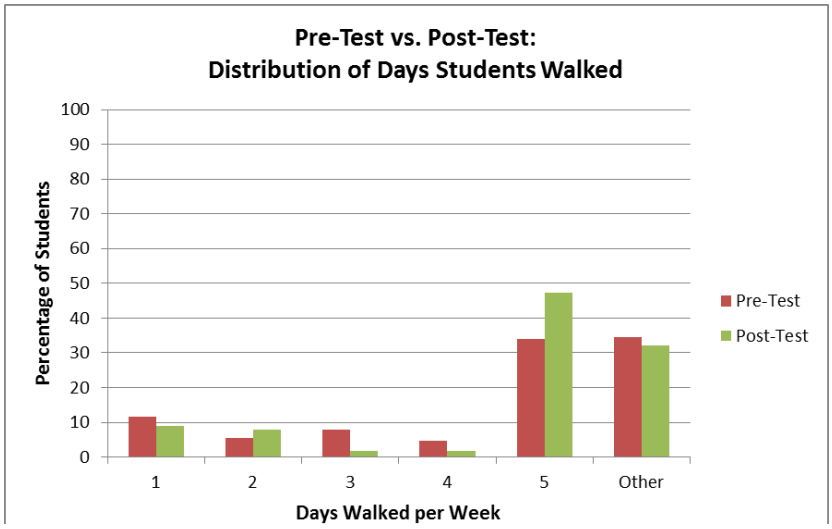


Figure 17: Comparison of Distribution between Pre- and Post- walking behavior

Again the results were very encouraging, showing an increase in children walking to school five days of the week and a decrease in 'other', the category indicating walking less than one day per week. Although this observation was not the primary focus of the program, the results speak for themselves—more than a 10% increase in children walking to school every day of Zero Heroes week. This data is a good indication that the week of interventions and competitions did play an important role leading up to Zero Heroes day.

4.6 Zero Heroes Day

The test schools that participated in nearly all of the interventions, Hayes Primary, Forestdale Primary, and Norbury Manor Primary, all had very successful Zero Heroes days. The schools together had at least 79% of their children walk to school in the morning of Zero Heroes day. Figure 18 indicates the percentages of each school that walked on Zero Heroes day:

School	Students Who Walked	Total Student Count	Walking Percentage
Hayes	301	360	83.6
Norbury	339	427	79.4
Forestdale	181	210	86.2
Atwood	144	380	37.9

Figure 18: Number of students that walked on Zero Heroes Day

Looking over the data, it is apparent that some of the schools that participated in the activities and majority of the interventions had a very successful walking ratio on the Zero Heroes day. Atwood, on the other hand, failed to participate in most of the activities and resulted in a poor walking ratio. The day also got much attention from the press. A newspaper article reported on the day and the reason the children were walking to school. This likely had an influence on the community's perception on vehicle use in regards to polluting the air. In figure 19, the team is assembled in front of the Forestdale students on Zero Heroes Day. This photo was taken by the Croydon Advertiser where they reported on the positive impacts walking-to-school programs had on the community (Croydon Advertiser, 2013).

Figure 19: Zero Heroes Day Walking with Forestdale Students, Source: (Croydon Advertiser, 2013)

4.7 Pre-Test vs. Post-Results for Test Schools

The primary means of evaluating the interventions as well as the educational material was the case-control study conducted with two separate primary schools. Another interesting comparison was the results from the pre-test paired against those of the post-test. Figure 20 shows that comparison in graphical form, with the percentage answered correctly on the y-axis and question on the x-axis.

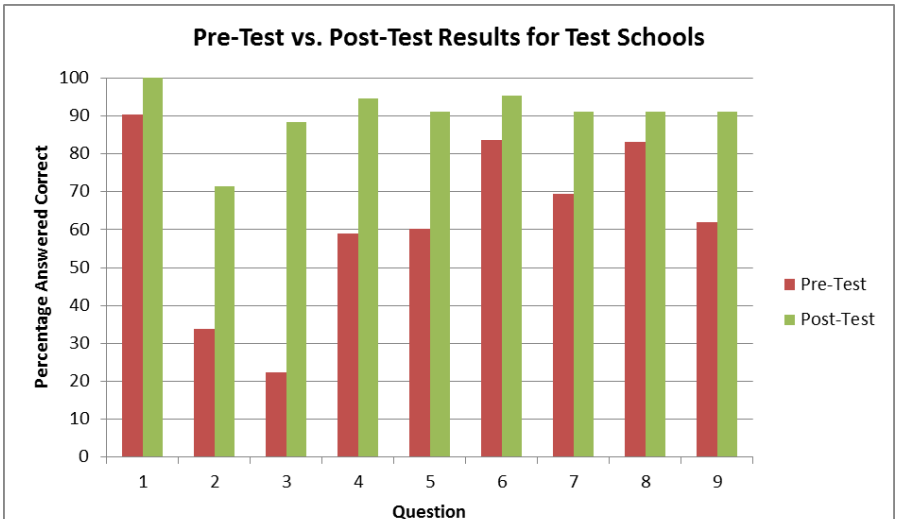


Figure 20: Comparison of Pre- and Post- test results for test schools

The red bars are the pre-test results and the green the post-test results. These results were quite astounding. Every single question had an increase in percentage of correct answers. Questions two and three, in particular, were advanced questions and as one can see they both show over a 40% increase. This data is another indication that the teaching material works in both the educational side of the program and behavioral, increasing the students walking rates during the week and on Zero Heroes day.

4.8 London Air Quality Network Data

Since the main focus of the project is to create a walking-to-school program teaching students the importance of air pollution, one point to make is if there was actually a change in air pollution during the weeks. The London Air Quality network has three stations operational in the borough of Croydon: Norbury, George Street, and Purley Way. However, due to the delays involved in processing the pollution data, only the data from the George St and Norbury are available at the time of the writing of this report, and only the Norbury station has released data from our final Zero Heroes day with Norbury Manor Primary. We retrieved the data for the daily averages for six months prior to the Zero Heroes day, and then compared it to the daily mean value for each of our Zero Heroes day, for both the level of oxides of nitrogen (NOX) in Figure 21, and the levels of PM10 particulate molecules in Figure 22.

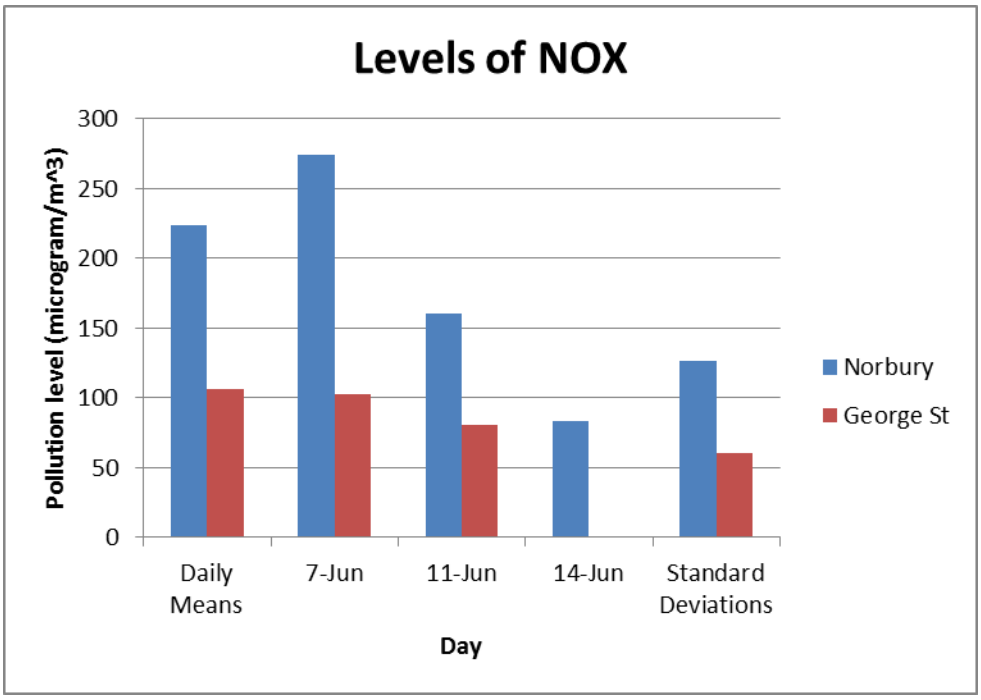


Figure 21: Comparison of the level of NOX near Norbury and George Street

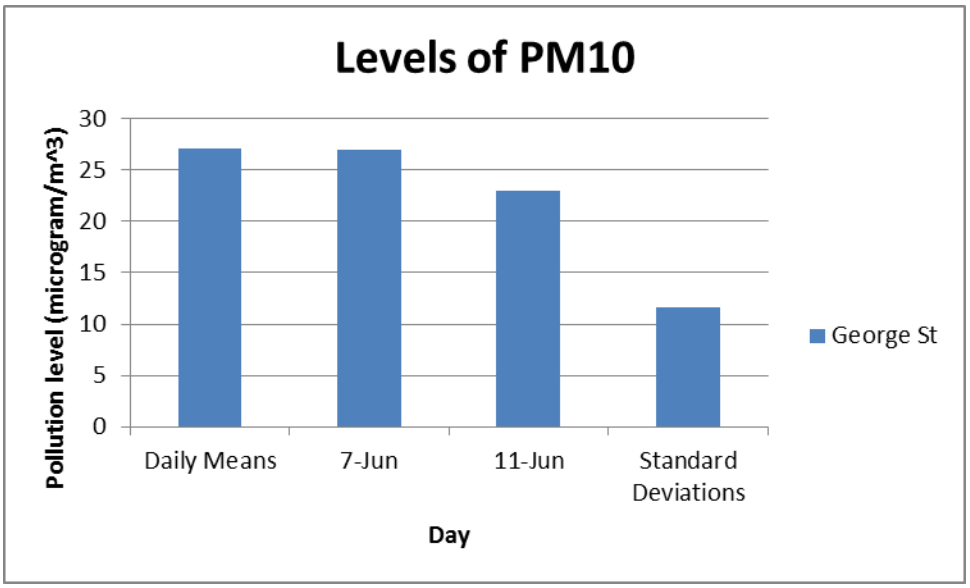


Figure 22: Levels of PM10 near George St during Zero Heroes Week

Due to weather patterns, fluctuations in vehicle use, and the few numbers of monitoring stations in Croydon, the standard deviation of all sets of data is relatively high, so any conclusions must be drawn with that in mind. Despite the low precision of the data, some

positive conclusions can be drawn. Significant drops in NOX levels occurred on 11 June, our Zero Hero day for Hayes and Atwood, and 14 June, our Zero Heroes day for Norbury Manor. The only day that did not see a drop in air pollution levels was the 7th of June, which was our Zero Heroes day for Forestdale. This might be because Forestdale is located the farthest away from either of the monitoring sites, so any effect of the program on the level of traffic or air pollution could not be detected from the greater distance. While the conclusions from this data are not irrefutable because of the high variance, any visible drop in air pollution levels just from reducing traffic to one or two schools is encouraging for the future success of this program if it is expanded to more schools in Croydon.

4.9 Drawing Contest

The drawing competition was the most appealing competition to the students and was the only contest in which all four schools participated. During the pre-Zero Heroes week assemblies, the students consistently showed the most signs of interest when the art contest was introduced. These signs included the sudden straightening of postures, loud responses to questions posed to the audience, smiles, cheers, and raised hands.

The contests sparked imaginative ways in which the students could prevent air pollution and showed their enthusiasm for keeping the environment clean. Some of the heroes used supernatural abilities to clean the air such as firing jets of clean air to blow away smog villains, but others used more down-to-earth, plausible methods such as walking and biking that the children themselves can imitate. In one instance, a child showed her enthusiasm by drawing herself as a Zero Hero with the description telling how she walks to school every day and keeps the air clean. These drawings successfully created enthusiasm for the Zero Heroes program and demonstrated the creativity and passion with which the children approached the project.

4.10 Participation Contest

The participation contest was another popular competition that sparked enthusiasm for the program. During the pre-Zero Heroes Week assemblies, the children were told that the student who participated the most in the program, not only by walking to school as much as

possible but also by taking an active role in each contest and, most importantly, encouraging his or her peers to also walk, would win a mystery reward. The idea of a surprise as a reward sparked a lot of interest. Many students would sharply intake their breath in excitement and immediately ask what the surprise was, much to the amusement of their teachers. In one instance, a couple of boys, when they realized there would be a surprise reward for a participation competition, pumped their fist in the air and shouted in glee. The students displayed clear enthusiasm for the contest and continued to ask about it as the week progressed. When the winners received their surprise drawing of themselves as a Zero Hero, they responded with much enthusiasm, smiling, and happiness. The participation contest continued to be a motivating factor for the students to get themselves involved throughout the entire week.

4.11 How Far Have You Walked

We encountered difficulty conducting our "How Far Have You Walked" activity the way we originally intended. We initially planned to have all four schools hold their Zero Heroes week at the same time. After each day, the school would tell us how many children had walked and the distance traveled, and we would instruct the schools to adjust the poster accordingly to show where their school was in relation to the others. However, we quickly discovered that due to the short notice that the schools had about the program, their already existing curriculum and planned activities forced us to hold each school's Zero Heroes day on a different day. We then had to modify the activity and gave the schools more control over it. Instead of displaying four accurate and objectively gathered figures for the distance each school had walked, we had each school estimate on their own how many students had walked that day and the distance traveled, and they would adjust the posters accordingly without any calculations from us. They were then free to show the other schools at whatever position relative to theirs that they saw fit. Though we had to sacrifice displaying accurate figures to the students, the activity still ended up serving its desired purpose of motivating the students during Zero Heroes week through a competitive atmosphere.

4.12 Plant Experiment

We also had to adjust how we conducted and presented the plant experiment activity. Originally, we intended for each school to plant two plants on school grounds, and expose one to a pollutant or toxin that would mimic the long-term effects of air pollution in a much shorter time frame. These effects can be seen in Figure 23.

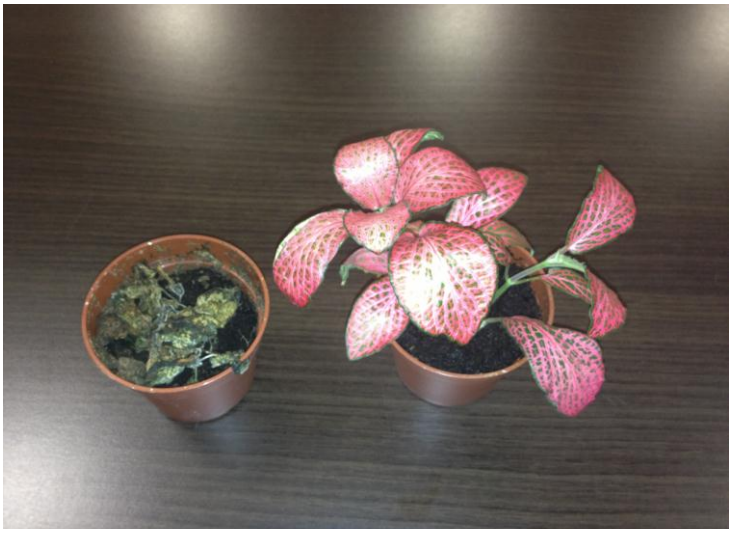


Figure 23: Plant experiment, Left: Polluted, Right: Clean

However, this approach was quickly abandoned since it required the schools to have another daily responsibility in conducting the experiment, and required a longer time frame than we had to work with. Instead, we changed it so that we would conduct the experiment ourselves, by poisoning one plant and leaving one healthy in time for each Zero Heroes day, and having them present at the breakfast event to show to any children who expressed interest on the topic. Although most of the students did not ask for the experiment to be explained to them, the extremely low cost of the activity makes it cost effective even if it reaches a small number of students.

Chapter 5: Recommendations

Although the results ultimately showed a successful project, several recommendations can be made to make this project more efficient and even more successful. These recommendations include: having more time, contact with higher officials, fewer activities, and digital formatting.

Time was a major issue in this project. The allotted seven weeks worked; however, it was a very cramped time period. In order for the project to be more organized, the schools should be contacted further in advanced so the planning can begin and an ideal time slot for the week of activities can be established with minimal interruption. Because of the nature of this project and how much time needs to be taken out of each day for a week, the school needs to be able to prepare. This will avoid complications such as the school having students out on a retreat, or just not having enough time to do the materials. More advance planning will enable the teachers to know their role more clearly and to plan their time more effectively.

Another recommendation was to get in contact with higher officials such as school governors who will help support and run the program. School governors act as a school council and are responsible for the entirety of the school and control the hiring and firing of all of the teachers and head teachers. Having a liaison with the school governors would give the program more weight in the schools, encouraging the head teachers and teachers to take the program seriously so that it can become a major event. A liaison could better advertise and promote the program in the school, such as on the school website. By doing this, parents of potential students will see that the program has the full support of the leadership and staff in their school and they will be more apt to participate.

It may also be helpful to have fewer activities. We observed that some schools had difficulty getting to every activity in a timely manner. One reason for this was insufficient planning; however, omitting activities such as the surveys and pre- and post- tests which were useful for the analysis of our pilot project may be helpful. Some of the lesson plans might also be cut. These cuts would diminish the educational portion of the project; however, the walking portion with all of its contests remains essential to the Zero Heroes Program.

Our final recommendation is to make the program completely digital. When we started the project, we did not know the level of access to computers each school had. Therefore, we printed out the materials, such as worksheets, surveys, and coloring sheets. This cost money and required a budget. The printing cost were originally 5,000 pounds (~7,500 dollars) but through reformatting and black-and-white printing the cost was cut to less than 300 pounds (~450 dollars). In order to take this a step further and make the cost of running the project virtually nothing, making the program digital is the best option. This will allow students to learn via PowerPoint and complete worksheets and coloring sheets on a computer or tablet by just formatting these materials into an Adobe format. This will conserve paper as well as printing costs, and all data collected can be easily exported. Moreover, emailing the materials to a liaison for distributing to teachers will save postage costs. Any extra costs would be for optional breakfasts or banner advertisements.

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Appendices

Appendix I: Unstructured interview with Christian Mortensen and Christian Iamartino, past IQP group to work on the Zero Heroes project at Worcester Polytechnic Institute

April 4th, 2013,

In attendance: Austin Brais, Gabrielle Bitzas, Katherine Longhurst

Interview Questions

- How prepared did you have to be prior to your intervention?
- How enjoyable did you find the project?
- What was one of the first things you did with the project after arriving?
- How did you keep the children's attention?
- What were some of your methods?
- What difficulties did you run into on site?
- As you only worked with one school, do you think it is feasible to work with four?
- How did you work with parents?
- What advice do you have about working with schools?
- How easily could we integrate our program into the curriculum?
- Could you tell us a bit about how the children walked to school?

Interview Notes

- We had to be very prepared, do not depend on anything to be set in place for you. We came to London only to find out no materials were prepared for us whatsoever and that the schools didn't even know we were coming.
- The project was incredibly enjoyable and the children were extremely fun to work with.
- One of the first things we did was visit some of the classrooms to gauge the level of maturity of the children. To our pleasure, they ended up being fun-loving and easy to work with.
- We kept the children's attention by bringing in materials for them to touch and see. In one instance we brought in an air quality measuring device and they reacted extremely enthusiastically when we turned it on.
- A couple of the methods we used were:
    - Asking the children where they lived and pinpointing them all on a map of London
    - Creating a map of a safe walking route to school
    - Using the air quality website to track changes in air quality
- After we made all the proper preparations for the program to run, there was a Teacher's Union dispute that got in the way… it was something that was out of our hands but that you shouldn't have to deal with.
- Working with four schools sounds challenging, but doable. The biggest obstacle will be figuring out a way to interact with all schools.
- Parents were incredibly hard to work with, but we attempted communication by setting up parent workshops for them to attend. Each school should already have in place a parent liaison, make sure to talk with them.
- Communication with each school is key. Remember, they don't even know you are coming. You are going to need to conduct pitches with each of them, and you will have to give them a step-by-step lesson plan. Leave no room or misinterpretation. Each school should also have children leaders, pitch to them too. It will give other students incentive to be involved.
- I'm not sure how easily you could integrate the program into the curriculum… you would have to talk with the headmasters about that.
- There were quite a few aspects about getting the children to walk to school:
    - A lot of parents drop off their kids on their way to work… this was challenging because if the parents are already driving, why wouldn't they just drop off their children?
    - We tried to work with setting up a drop-off zone two blocks away from the school
    - Giving the children clear directions for the drop-off zone was a major factor

Appendix II: Unstructured interview with Eileen Wrabel, college student whom worked on the Walk to School on Wednesdays program in Croydon for Worcester Polytechnic Institute

April 9th, 2013,

In attendance: Austin Brais, Katherine Longhurst, Tim Theriot

Interview Questions

- What are your group's methods?
- How many schools are you working with?
- How do you increase parental involvement?
- How do you work with the headmasters of each school?
- Where are the schools you are working with located?
- What is the ethnic breakdown of each school?
- Is there a language barrier problem?
- What incentives do the children most enjoy?
- How easily could we integrate our program into the curriculum?

Interview Notes

- Main Methods:
  - Hold workshops with classes at schools
  - Use surveys with the children
  - Interviews with teachers and headmasters
  - Interviews with council officials like those in the public health and transport for London department
  - Observe student pick-up and drop-off times to see how many cars drive by the school, how much traffic there is, etc.
- We are working with seven schools: three who regularly participate in WOW, two who are new to the program, and two who have never used it before
- No suggestions for getting parents more involved, too difficult:
  - We sent home 480 parent surveys and got maybe 30 back.
  - Most teachers we interviewed believed stated parents are the ones who need to change their ways.
- Headmasters tend to be really nice and very involved in their schools. We simply met with them and discussed our program.
- The schools we were worked were all over the place, both in the south as well as the north.
- I don't know exactly, all I can say is that ethnic diversity is very prominent here.
- Though it is ethnically diverse, we have never run across a problem involving the language barrier.
- That is actually the point of our project, to find alternative and inexpensive incentives the children will enjoy. Successful incentives were:
  - Increased playtime at recess
  - More candy
  - Getting to wear their own clothes
- I'm not sure how easily your program could get implemented; I suggest talking to the headmasters about that.

Appendix III: Unstructured interview with Therese Goulet, 6th Grade teacher working at Paxton Elementary School outside Worcester, Ma

April 23rd, 2013,

In attendance: Austin Brais, Gabrielle Bitzas, Katherine Longhurst

Interview Questions

- What is the best way to keep children engaged in a lesson?
- How do we best manage our time for each lesson plan?
- What is the difference between lessons taught to older kids than to younger kids?
- Is this difference large enough for us to be concerned?
- How involved do parents tend to be?
- Should parents change their ways and become more involved?
- What do you think about the safety factor of having children walk to school?
- How do children from your school who do not take the bus walk home?
- Can you tell us a little about how you teach your students?
- What do you think about the incentives we use in our program?
- How can we best accommodate a teacher's schedule and still implement our program?
- How do we keep the program sustainable?
- What is the best way of measuring impact, satisfaction, participation, etc.?

Interview Notes

- Children have their niches, tap into them. Some like to draw, some like to write. Offer activities that cater to all forms of learning.
- Worksheets take longer than you think in younger grades…must give time to debrief, think, and talk about it. Double the amount of time you think it will take to complete.
- Offer the children group activities; it lets them feel less alienated and more involved.
- Older children like to be structured and on time while younger kids are very loose
- Big difference between big kids and little kids?
    - Not true, activities can engage the entire school
    - Children don't see doing things on their own nearly as fun as in groups
- Parents are not very involved. I am currently working on a carbon footprint project that involves the students going home and submitting work online, and I heard nothing back from parents.
- Parents have to change the most because they question the project harshly.
- Traffic safety is a big concern for children walking to school.
    - In London, there are big sidewalks and lots of people walk, so it is less of a concern
- How far do kids have to walk alone?
    - Half a mile across the road while there is a crossing guard.
    - Walking restriction is 2 miles
- How do I teach my students?
    - Note books for the week, draw pictures, write what they learned.
    - At the end, give them a card with a question and have them answer it then collect right away.
- Little kids will want to please you, they love visitors and it sounds like you will make a big impact.
- Teaching reaction to the intervention?
    - Depends on what's going on during the time we are there, standardized testing etc.
- Younger kids love the stickers and will definitely do that. Older kids will not.
- To accommodate for teachers, put lesson plans in priority order, example: 10 lesson plans 45 minute block, need to know what would need to get done in priority
- I highly recommend getting in contact with Professor at Worcester State Duke Dawson teaches on how to teach kids for elementary school science.
- The project is too big but if you found dedicated teachers in the school to keep the program alive. National science teachers association in London?
- Measuring satisfaction/participation?
    - Pre-posttest definitely
    - Survey 4-6 on enjoyment and approving feed back

Appendix IV: Unstructured joint interview with Martha Cyr, Executive Director of Science, Technology, Engineering, and Math (STEM) Education Center at WPI, and Katherine Elmes, former 1st Grade Teacher

April 25th, 2013,

In attendance: Katherine Longhurst

Interview Questions

- What challenges do you see our program running into?
- What is the biggest difference between each grade level that we should be aware of?
- How do you best recommend grouping the grade levels in terms of lesson plans?
- How do you recommend creating lesson plans for each group?
- Can you elaborate a little on the effectiveness of group work?
- How well do you feel our lesson plan will keep children engaged?
- How do you feel about using tangible incentives to motivate a child to learn?
- What is the best way of conducting assemblies with each school during the week?
- Should we be worried about older students finding the events too childish?
- What can we do to keep the program sustainable?
- How can we make our lesson plans run most smoothly for each teacher?

Interview Notes

Martha Cyr's notes are denoted by M
Katherine Elmes notes are denoted by K

- M: The hardest part of your project will be getting the schools and the teachers to commit
- K: I agree; in the U.S., science subjects are often the smallest part of teaching, especially at lower grade levels
    - Consider learning how comfortable the schools are in the science levels
    - Also consider breaking your group up into two groups of two, with two people running assemblies or events and the other two travelling to different schools and touching up on them, asking questions such as, "What can we do for you?"
- M + K: The biggest difference between grade levels is the reading and writing ability
    - K: Kindergarten through 3rd grade is all different, but 4th-6th is very similar
    - M: most kindergarteners are not yet readers
- M: the best way to break up the learning groups is Kindergarten – 1st, 2nd-3rd, and 4th-6th
- K: Lesson Plan recommendation:
    - Kindergarten - 1st, draw a picture about the subject and write something simple. Worksheets. Remember, the teacher will be reading every question.
    - 2nd – 3rd, write one to three sentences about the topic, *not* a paragraph. Small writing prompt and drawing.
    - 4th – 6th, much more open-ended. Group work is very effective.
- M: Group work is *highly* recommended. Make sure they are at most in groups of three. When incorporating group work into a lesson plan, ensure you have three clear phases:
    - 1. An opening for teacher to give clear instructions
    - 2. A time frame for the teacher to have the freedom to walk around the room and individually check up on each group
    - 3. A time at the end for the class to discuss what happened and what they learned
- M + K: Everything you are doing seems to be great and will actively keep the children involved.
- M: I do not think incentives are a good idea. I believe they are detrimental to learning.
- K: Giving them the motivation to try and be a Zero Hero is enough of an incentive, play that up.
- K + M: First grade is a nightmare to have an assembly for. The only thing an assembly is good for at the younger levels is exciting the children about an event in a community sense, not for gauging participation or anything else for that matter.
    - K: Instead of an assembly I'd suggest one of your partners dressing up as a Zero Hero and visiting each classroom individually. It would give you a better sense on the individual level

    - M: If you do an assembly, do it in the form of a skit. That's effective for all grade levels. Have the focus be less on assessing participation at an assembly and more about creating a sense of community involvement
- M + K: Don't worry about older children wanting to be treated "like an adult". That comes at the 7th grade level, you just miss it.
- K: In terms of sustainability, find out if they have educational standards in London like they do in America.
    - Here, a teacher is required to teach a standard for each grade level. If London has something like that, try to align what you are doing with the different standards.
    - Keep in mind, it isn't just a science standard you have to follow; it is also a reading and writing standard.
    - Make it really clear what the learning objectives are for the students
- M: I have a resource I highly suggest for you… www.teachersdomain.org from WGBH
- K: I have a tip you might not be aware of: when you visit with the headmasters for the first time, do your absolute best to avoid sounding as if you are trying to "save" them by implementing this
    - Say things such as, "We heard that your school is doing great things. We are working really hard on this project and would be honored if you took part in it."
    - Try to make yourselves available to talk to teachers and get their input on your worksheets, you will gain another foot up the ladder.
    - Do not come in acting like you know anything better than the teachers and staff do
- M: I agree with that last statement, you are here to compliment the teacher's skills, not show off your own.
- K: Keep asking the teachers and headmasters how you can make this easy for them and allow things to run smoothly. Stress to them the question, "How can we help?"

Appendix V: Unstructured interview with Colleen Mucha, principal of West Brookfield Elementary School

April 23rd, 2013,

In attendance: Katherine Longhurst

Interview Questions

- Being the principal of an elementary school, how would you react if a group of dedicated people arrived at your school wishing to implement a program similar to ours?
- How does the walk-to-school program at your school work?
- Do you have a scheduled walking school bus, or do the students walk on their own?
- How did the Safe Routes to School program conduct the survey?
- How happy are you with your walk to school program?
- How do you keep your students enthusiastic about the program?
- What is the best way to approach the headmasters?
- Which do you prefer, having assemblies for the students or walking from classroom to classroom?
- How do you keep the program sustainable?
- How easily will we be able to get the schools to have the desire to keep this program for future years?

Interview Notes

- A few years ago a group very similar to yours representing Safe Routes to School approached me about implementing their walking school bus. It was an easy sell:
    - They stressed the benefits, exercise, clean air, etc.
    - The most impressive thing they did was perform a pre-assessment on the students. After surveying how far the kids lived, I learned most of them were less than a mile from school. That's what convinced me.
    - Make sure to educate the headmaster and assure them you will take up the legwork.
- At our school we have two big walk-to-school events a year during which we promote the program, offer kids breakfast, etc. It falls on National Walk to School day
- We draw up a map that has very detailed points for pick-up and arrange a walking school bus. Parents and staff alike volunteer to keep it running. We also have children that walk on their own or in groups.
- The Safe Routes to School program conducted the survey by going from classroom to classroom for about ten minutes each and asking students to raise their hands if they walked that day.
- I am incredibly pleased with this program and wish to see it continue for future years.
- We offer our students little incentives. You probably won't have the budget on your own to create anything, but if you can get the headmaster to buy into it that's a possibility.
- Approach the headmasters with everything lined up, and leave it up to them to decide which parts of the program they want to implement and which they don't. Offer all of your materials as suggestions.
- I would prefer classroom to classroom over holding an assembly. It would be much easier to gauge the students on an individual basis and to maintain a controlled environment.
- We keep it sustainable by running it weekly with people who are committed to making this work. We have big posters in the hallways advertising walking to school, and we make it a priority. It is only sustainable if you get people to buy into the program, identify team players.
- How easy is it to convince people to implement this for future years? It all depends on how you present it. Hard data is the most convincing argument. Find out how many kids are participating, how much money or air pollution is saved, how much healthier is it for the children, etc.

Appendix VI: Unstructured interview with Mrs. Ellsworth, current pre-school teacher, former Kindergarten and 2nd grade teacher

April 23rd, 2013,

In attendance: Austin Brais, Gabrielle Bitzas, Katherine Longhurst, Tim Theriot

Interview Questions

- How do you interact and teach such young children?
- What is the best way to keep the children engaged?
- What is your opinion of overall parental involvement?
- How would you feel if researchers, like us, came in to implement such a large event in your classroom?
- What is the best way to accommodate for the teachers time and schedule, as well as the best way to deliver a lesson plan.
- Is it a good idea to use assemblies as a teaching tool?
- In regards to program sustainability, do you have any suggestions on how to make the program sustainable in the future?
- Would a spirit week event affect the environment of the classroom?
- How would teachers feel about filling out a teacher evaluation sheet?
- Do you have any alternative suggestions to the program?

Interview Notes

- I would suggest using techniques like:
    - Asking the kids questions at the start to assess their basis of knowledge, “What do you know about conserving energy?”
    - Giving the kids’ books
    - Reading to them, to engage them more
    - Use kid friendly terms to create the least amount of confusion possible
    - Ask the kids questions during the lesson, to see who is understanding the concept and if the message is getting through to the group as a whole
    - Bring up pictures to give the children an idea of what different materials and vocabulary look like
    - “Basically, the more you make it relate to the kids, the more it will get through to them”
- Technology is one of the best ways to keep the kids engaged, and moving along. They really love hands on materials that they can play with and look at in person.
- Parents are extremely busy with work and outside activities at my school. It is tough to get them to fill out simple forms that the administration needs… It is really tough to get them involve too, but a way that might work is communicating with them electronically or trying to set up after school office hours.
- I would be very excited and willing to work with the researchers or activity planners. Although I would want to make sure that their idea or activity actually works.
- A lesson plan, with a formatted objective would definitely make the activity easier for a teacher to administer. A list of material and questions to ask the children would be beneficial. The lesson plans should have a follow up of what will be the next lesson, and they lessons should try to address a smaller group of children at first to make sure that they are affective. You can also ask the teachers preferences of what they would need and ask them what the classroom environment is like.
- Assemblies will not do an efficient job of teaching the material. You should try to individually approach each classroom. In regards to the amount of time you should spend there, keep in a half an hour or less. That will keep the excitement and not leave the children bored. You could extend the lesson in a subsequent visit. It won’t be a distraction to approach each of the classrooms individually.
- If you want to keep the program sustainable in years to come you would have to get in touch with the administration.
- Yes, teachers would fill out evaluation sheets, if they knew that they would have a purpose in the overall project.
- My only suggestion would be to create a student survey with a rating scale of 1-5 or 1-10.

Appendix VII: Unstructured interview with Lynn Fiandaca, current 5th grade teacher, former 4th, 6th, 7th, and 8th grade teacher

April 30th, 2013,

In attendance: Katherine Longhurst, Tim Theriot

Interview Questions

- Should we be worried about older students finding the events too childish?
- Will dressing up as a superhero be too gimmicky for older students?
- How do you keep your students engaged in a lesson plan?
- As a teacher, how can we design a lesson plan to best accommodate you?
- How do you manage your time for each lesson plan?
- How does our lesson plan sound to you?
- Have you ever worked with a walk-to-school program?
- How did you keep the walk safe?
- How do you keep parents involved?
- Do you ever offer your students incentives?
- How can we best accommodate the teacher's schedules?
- How do you best measure the success of a lesson?
- How can we keep our program sustainable?
- What can we, as guest speakers, do to make the teachers most comfortable?
- Have you ever had a speaker walk from classroom to classroom?

Interview Notes

- In my experience, students start growing out of childlike gimmicks at around 5th grade. You can present the same material to them, just be sure to present it in a more upfront and adult way.
- I think the biggest change comes from transition of schools, not from age. The moment the students it middle school their behavior alters
- By the way, I find great videos for lessons on studyjam.scholastic.com
- Dressing up as a superhero shouldn't be too gimmicky as long as you present yourself well
- For 4th and 5th graders, they will stay engaged if you give them hands-on lesson plans. I like to do think-pair sharing, where I prompt them to brainstorm ideas and then interact in groups
- With 6th graders, sometimes lessons are better with more independence
- Most successful lesson plans are ones with simple objectives, also, *bullet points*. Write how you think the students might respond. Put the material list at the top. Finally, answer sheets are wonderful, even if there is no one right answer to a question
- For lesson plans I usually break it up into intervals, ten minute intro, 35-40 min. activity, 10-15 regroup and share-out
- Your lesson plans sound great! Make sure you have time for conclusions at the end, clear directions, and examples of possible answers
- Our school is actually currently working on a walk-to-school program
- The guidance counselors and the principal mainly organized it
- We organized a drop-off zone for both the parents AND the busses about a quarter of a mile from our school where all the students will walk to school together
- Every student got sent home with a permission slip that asked the parents only to fill it out and turn it in if they *don't* want their child to walk
- We kept the walk safe with police involvement and by having teachers stand on the side of the street as the students walk. The street is very safe, too. There are no houses, just a baseball field
- We keep parents involved by giving them activities to do with their child such as discussions for the child to bring home and talk about with their guardian
- The most successful incentive I use on my students is the offer of free time.
- I plan my lessons a week ahead of time, so the best way to accommodate my schedule would be to plan this kind of event two weeks prior. I think most teachers would be on board for this
- Worksheets may be the best measure of success
- It will be sustainable if you give minimum input with maximum output, a clear and concise package plan. Don't make others put in too much extra work to make it successful. Other than that, all you need is commitment from the principal and it will be sustainable

- The teachers will be most comfortable with you as a guest speaker so long as you accommodate for their lesson plans
- It isn't common, but we've occasionally had speakers walk from class to class. In those cases, the speaker usually spends about ten minutes per class

Appendix VIII: Zero Heroes Week materials

Zero Heroes Week schedule

Day 1	Day 2	Day 3	Day 4	Day 5
Zero Heroes Introduction Day	Zero Heroes Week cont.	World Environment Day	Zero Heroes Week cont.	Zero Heroes Conclusion Day
Introduce Hero: Nicola	Introduce Hero: Sonya	Introduce Hero: Klaus	Introduce Hero: Anu	Introduce Hero: Rin
Lesson #1 What is Air Pollution and where does it come from?	Lesson #2 How does Air Pollution affect you?	Lesson #3 What can you do to reduce pollution?	Lesson #4 Road Safety and Transportation	Lesson #5 What did you learn? (conclude)
Dress up in Green for Environment Stuff		Dress up as a Zero Hero Day		
Walk Around the World Start-Off		Art Contest Winner Announced	Zero Hero Drawing Banners put up	Walk Around the World Winners Announced – School and Gender
Plant Experiment Results				Quiz – Older Kids
			Post – Test first two schools	Post – Test last two schools
Visit School 1	Visit School 2	Visit School 3	Visit School 4	Younger Kids – Group Interview
Ongoing: Every day the Walk to School program will be running Turn in paper to prove you walked for Walk Around the World contest				

Figure 24: Zero Heroes Week schedule

Zero Heroes Advertisement Banner design

Zero Heroes Week

Your School's Fight against Air Pollution

Zero Heroes?
Super heroes are here to help you learn about air pollution and teach you ways to fight it.

In an upcoming school week, you and your classmates will find out what it means to be a Zero Hero through activities and lesson plans given by your teachers.

Activities coming to your school include:

- **Plant Experiment**
- **Pollution Tool Demonstration**
- **Colouring Activities**
- **Art Contests**
- **Participating Contests**
- **Rewards**

All of these activities are geared towards walking to school to help the environment!

AND on the last day of the week a FREE breakfast will be available for everyone to celebrate walking to school on that day!

Parent Email Template

Parents of ********* Primary School,

We would first like to introduce ourselves. We are a student project group from the United States working with Peter McDonald of the Croydon Council who is the Travel and Transport Planning officer. Zero Heroes week is a creation by Peter and others that is designed to teach primary school students about air pollution and transportation through activities and a designated day of walking to school. This program was done last year at one school and is being re-created and expanded to four. Our project group began working on this week of activities back in March 2013 and have been putting tremendous amounts of effort trying to design it so that it is easiest on the schools and the parents but still effective.

We understand that getting your children to school is hard enough in the morning. Some parents work and bringing their child to school is just a part of the daily routine and walking to school with him/her is out of the question. So what do we ask of you? We only ask that you try to have your child walk to school one day during that week, Zero Heroes day. Whether they walk, scoot, or bike is up to you. We would just like the children to realize that through walking to school they are each individually making a difference that can really affect them throughout their lives. In order to make this easier, we are also offering drop-off zones. These zones, designated by the school, will allow you to drop your child off on Zero Heroes day with a teacher or staff from the school between a certain time period and they will all walk together to school under supervision. These drop-off zones are designated on the map below.

[MAP OF SCHOOL]

This event is not mandatory, but strongly encouraged for the health and wellbeing of your child, yourself, and your community; only on this one day we ask that you try to have your child walk to school to participate in the program and be a Zero Hero for the day! We are extremely excited for Zero Heroes week and cannot wait to meet all of the students!

Your Zero Hero Dates:
********** Start of Zero Hero Week Activities
********** Zero Heroes Day

Thank you on behalf of the Croydon Council!
Zero Heroes Student Project Group

Lesson Plan Day 1: Years 4-6

Years 4-6

What is air pollution and where does it come from?

Lesson Topic	What is Air Pollution?
Materials	Coloring Sheet Coloring materials Post-activity survey
Key Objectives	• Teaching the students the basics of air pollution. • Introducing the zeroes hero week • Teaching the students what causes air pollution • Have students fill out post-activity survey
Potential Questions	What is air pollution? Can you see air pollution? Is air pollution a big problem in the world? How clean is the air in London? Why do we need to clean the air? What are the disadvantages of being driven to school? If you could choose how you got to school every day, what would you choose? Would this way be harmful to the environment?
Basic Information	• **Air pollution** is the introduction of chemicals into the atmosphere, that cause discomfort, disease, or death to humans, damages other living organisms such as food crops, or damage to the environment in general. • Air Pollution is a very large problem in Croydon, and London as a whole. • Air pollution can cause respiratory diseases and induce asthma attacks. • Air pollution is most prevalent in large cities, like London. • Small cars and other private vehicles cause the largest amount of air pollution. • The emissions from the cars rise into the atmosphere and create the pollution.
Verification	Have the students fill out the post-activity survey. Upon completion, collect all quizzes.

Lesson Plan Day 1: Years 1-3

Years 1-3

What is air pollution and where does it come from?

Lesson Topic	What is Air Pollution?
Materials	Coloring Sheet Coloring materials
Key Objectives	• Teaching the students the basics of air pollution. • Teaching the students what causes air pollution. • Introducing the zeroes hero week • Have students fill out post-activity survey
Potential Questions	What is air pollution? Can you see air pollution? Is air pollution a big problem in the world? Why do we need to clean the air? What are the disadvantages of being driven to school? If you could choose how you got to school every day, what would you choose? Would this way be harmful to the environment?
Basic Information	• **Air pollution** is the introduction of chemicals into the atmosphere, that cause discomfort, disease, or death to humans, damages other living organisms such as food crops, or damage to the environment in general. • Air pollution is a very large problem in Croydon and London as a whole. • Air pollution can cause respiratory diseases and induce asthma attacks. • Air pollution is most prevalent in large cities, like London. • Small cars and other private vehicles cause the largest amount of air pollution. • The emissions from the cars rise into the atmosphere and create the pollution.
Verification	Ask the students the potential questions above, to assess the knowledge retained.

Lesson Plan Day 2: Years 4-6

Years 4-6

How does air pollution affect you?

Lesson Topic	How does air pollution affect you?
Materials	Coloring Sheet Coloring materials Post-activity survey
Key Objectives	• Teaching the students how air pollution affects them • Have students fill out post-activity survey
Potential Questions	How does air pollution affect the environment? How does it affect your health? Is air pollution something we should worry about and try to reduce? Why? What would the world be like if there was zero air pollution?
Basic Information	• Children living in an urban environment have a 20% greater chance of getting a respiratory disease. • Air pollution can induce additional asthma attacks. • Air pollution can affect water and the crops, through acid rain, that become the food that society eats.
Verification	Have the students fill out the post-activity survey. Upon completion, collect all quizzes.

Lesson Plan Day 2: Years 1-3

Years 1-3

How does air pollution affect you?

Lesson Topic	How does air pollution affect you?
Materials	Coloring Sheet Coloring materials
Key Objectives	• Teaching the students how air pollution affects them
Potential Questions	How does air pollution affect the environment? How does it affect your health? Is air pollution something we should worry about and try to reduce? Why? What would the world be like if there was zero air pollution?
Basic Information	• Children living in an urban environment have a 20% greater chance of getting a respiratory disease. • Air pollution can induce additional asthma attacks. • Air pollution can affect water and the crops, through acid rain, that become the food that society eats.
Verification	Go through the potential questions with the kids, to assess the amount of information retained by the kids.

Lesson Plan Day 3: Years 4-6

Years 4-6

How can you prevent air pollution?

Lesson Topic	Preventing air pollution
Materials	Coloring Sheet Coloring materials Post-activity survey
Key Objectives	• Teaching the students what they can do to prevent air pollution • Have students fill out post-activity survey
Potential Questions	When is it appropriate to be driven somewhere, and when can you avoid it? What alternative forms of non-polluting transport can you use to get to school instead? Do you think your life will be impacted if you started walking to school instead of being driven? Would your life be impacted if everyone in your school started walking instead?
Basic Information	• Walking to school each day can reduce the air pollution in your environment. • Walking to school creates 0 air pollution. • Biking, along with any other activity that doesn't release harmful pollutants in the environment can also reduce pollution. • Carpooling is a good way to reduce pollutants if you can't walk.
Verification	Have the students fill out the post-activity survey. Upon completion, collect all quizzes.

Lesson Plan Day 3: Years 1-3

Years 1-3

How can you prevent air pollution?

Lesson Topic	Preventing air pollution
Materials	Coloring Sheet Coloring materials
Key Objectives	• Teaching the students about preventing pollution
Potential Questions	When is it appropriate to be driven somewhere, and when can you avoid it? What alternative forms of non-polluting transport can you use to get to school instead? Do you think your life will be impacted if you started walking to school instead of being driven? Would your life be impacted if everyone in your school started walking instead?
Basic Information	• Walking to school each day can reduce the air pollution in your environment. • Walking to school creates 0 air pollution. • Biking, along with any other activity that doesn't release harmful pollutants in the environment can also reduce pollution. • Carpooling is a good way to reduce pollutants if you can't walk.
Verification	Go through the potential questions with the kids, to assess the amount of information retained by the kids.

Lesson Plan Day 4: Years 4-6

Years 4-6

Traffic and Road Safety

Lesson Topic	Traffic and Road Safety
Materials	Coloring Sheet Coloring materials Post-activity survey
Key Objectives	• Teaching the students about walking to school safely • Have students fill out post-activity survey
Potential Questions	What do you do when crossing the road? If a stranger offers you a lift, should you accept it? If a stranger offers you a ride, should you talk with him/her? Is every stranger a bad person? What are some basic road signs to pay attention to?
Basic Information	• When crossing the road, make sure to always stop, look, think, and listen • Do not accept rides from strangers • If a stranger offers you a ride, do not engage in conversation. Simply walk away • Every stranger is not a bad person. Most people are not trying to harm you, but it is better to be safe and acknowledge that good or bad, they are still a stranger. • Pay attention to crossing traffic, yield signs, caution signs, etc.
Verification	Have the students fill out the post-activity survey. Upon completion, collect all quizzes.

Lesson Plan Day 4: Years 1-3

Years 1-3

Traffic and Road Safety

Lesson Topic	Traffic and Road Safety
Materials	Coloring Sheet Coloring materials
Key Objectives	• Teaching the students about walking to school safely
Potential Questions	What do you do when crossing the road? If a stranger offers you a lift, should you accept it? If a stranger offers you a ride, should you talk with him/her? Is every stranger a bad person? What are some basic road signs to pay attention to?
Basic Information	• When crossing the road, make sure to always stop, look, think, and listen • Do not accept rides from strangers • If a stranger offers you a ride, do not engage in conversation. Simply walk away • Every stranger is not a bad person. Most people are not trying to harm you, but it is better to be safe and acknowledge that good or bad, they are still a stranger. Pay attention to crossing traffic, yield signs, caution signs, etc.
Verification	Go through the potential questions with the kids, to assess the amount of information retained by the kids.

Lesson Plan Day 5: Years 4-6

Years 4-6

What have you learned about air pollution?

Lesson Topic	What have you learned about air pollution?
Materials	Coloring Sheet Coloring materials
Key Objectives	• Asking the students what they have learned through the week of activities. • Thanking all of the students for reducing air pollution and participating in Zeroes Hero Week.
Potential Questions	What was the most impacting thing you learned this week? What did you do this week to reduce air pollution? What was the best part of the week? Did you have fun?

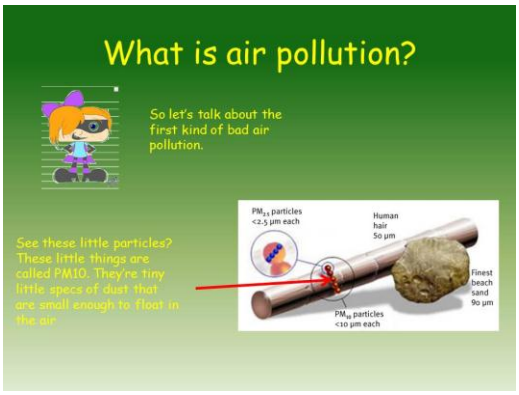
Lesson Plan Day 5: Years 1-3

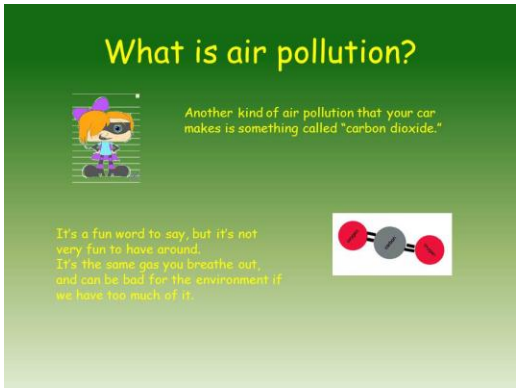
Years 1-3

What have you learned about air pollution?

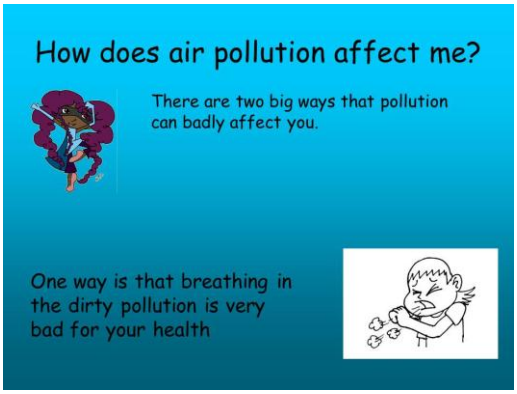
Lesson Topic	What have you learned about air pollution?
Materials	Coloring Sheet Coloring materials
Key Objectives	• Asking the students what they have learned through the week of activities. • Thanking all of the students for reducing air pollution and participating in Zeroes Hero Week.
Potential Questions	What was the most impacting thing you learned this week? What did you do this week to reduce air pollution? What was the best part of the week? Did you have fun?

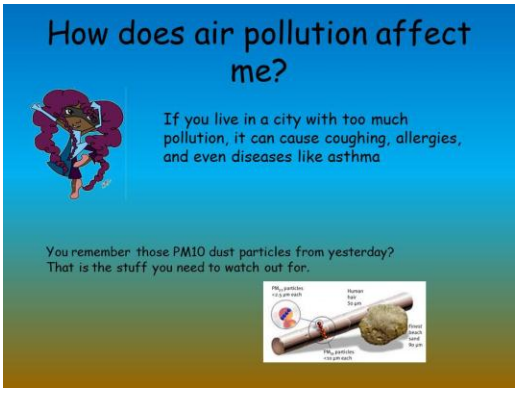
Lesson One Slide Show

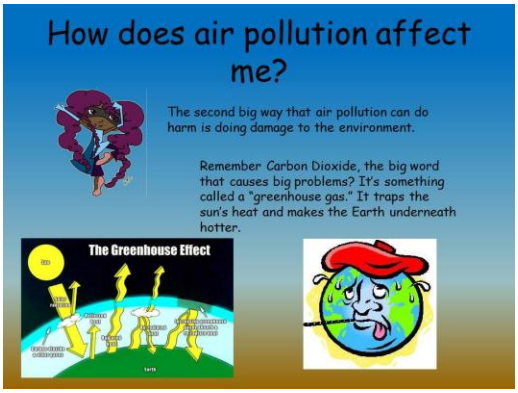


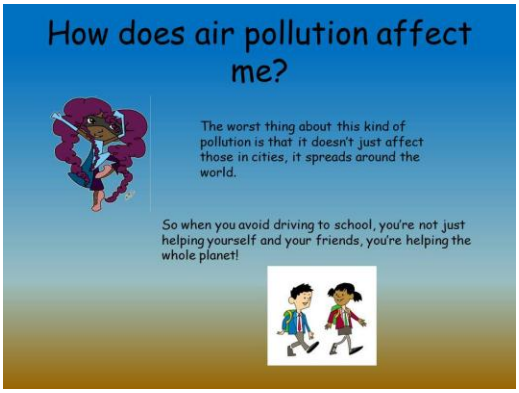


Lesson Two Slideshow



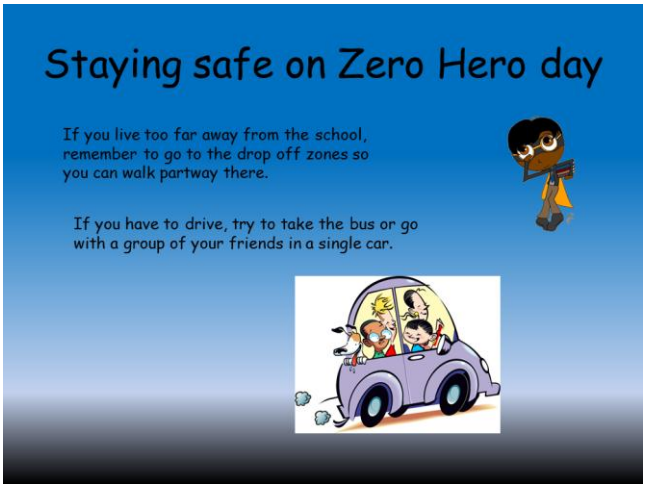


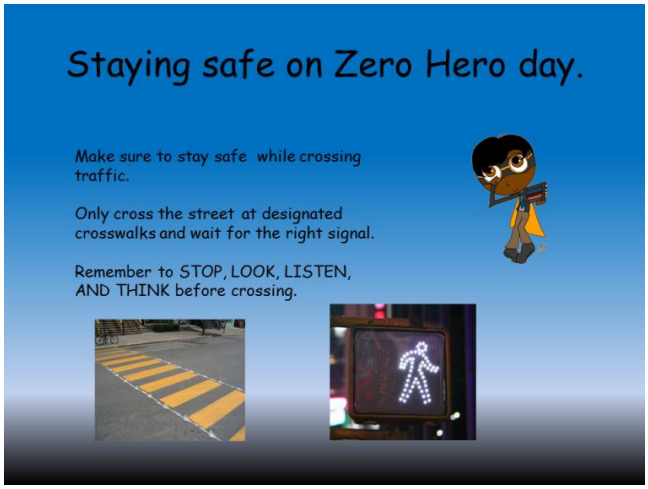




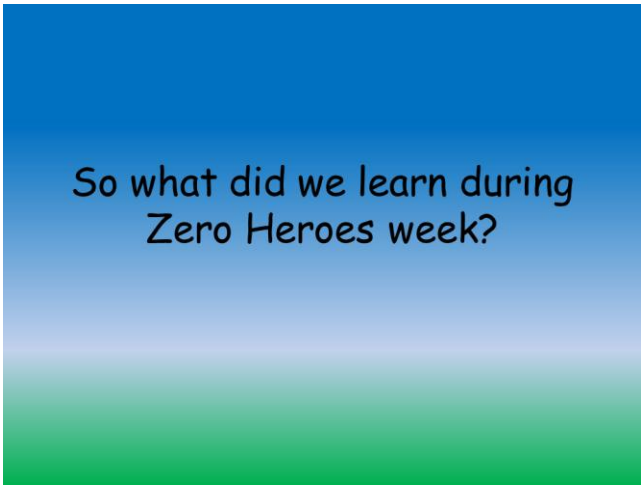
Lesson Three Slideshow

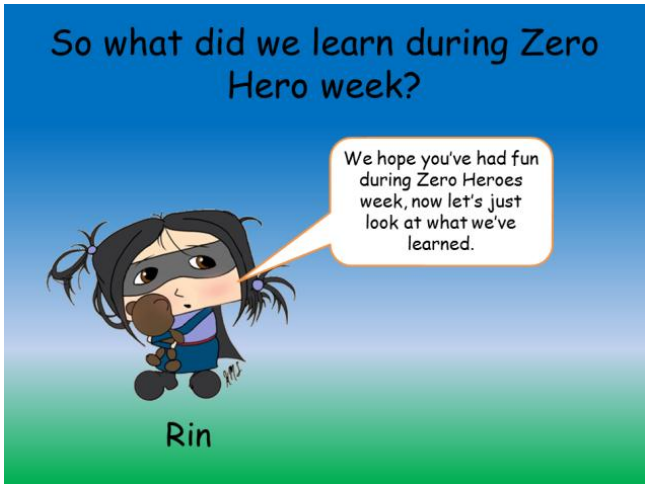
Lesson Four Slideshow

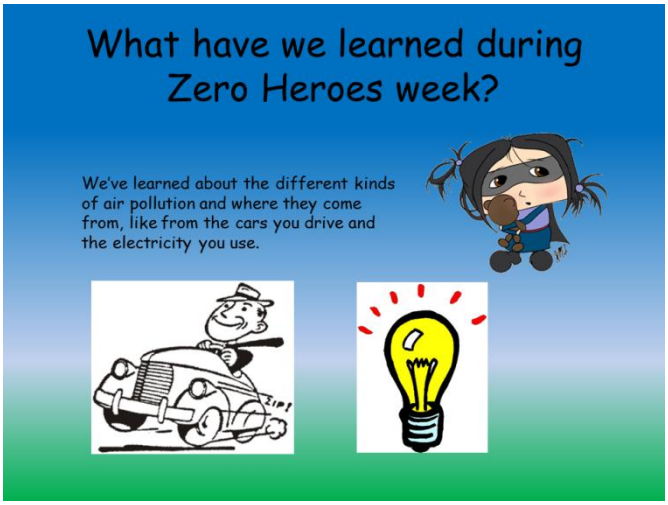


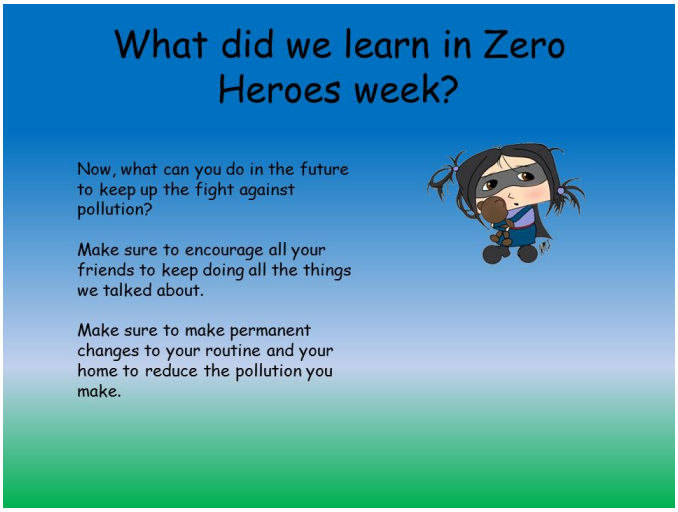


Lesson Five Slideshow









Nicola is looking outside to find air pollution.

Draw a polluted city out the window.

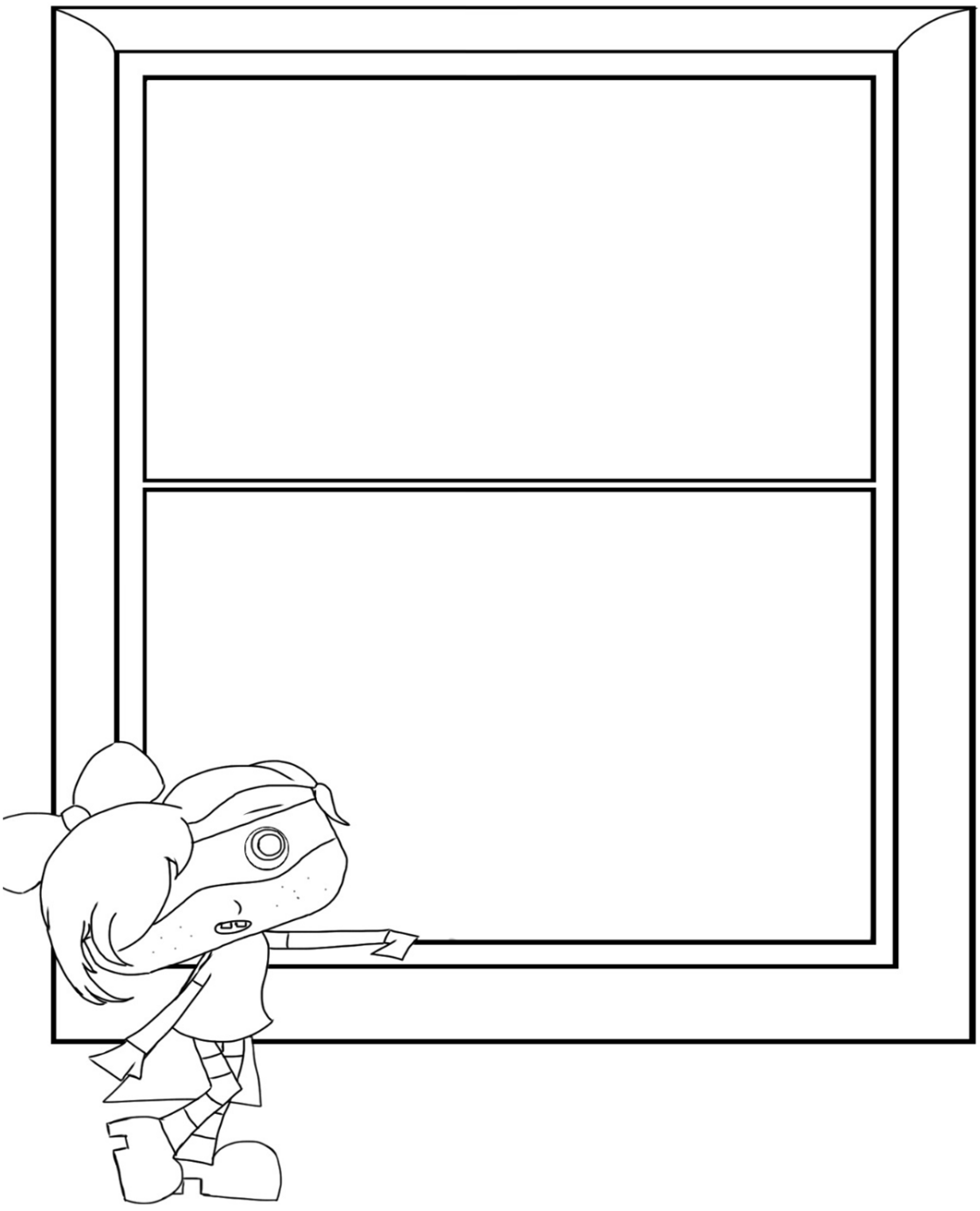


Figure 25: Lesson Plan Day 1 worksheet

Sonya is doing an experiment growing one plant in polluted air and one plant in clean air. Draw the clean plant in pot C and the polluted plant in pot P.

Figure 26: Lesson Plan Day 2 worksheet

Klaus is outside having fun and fighting air pollution by walking to school instead of being driven. Draw other ways he can get to school without harming the air.

Figure 27: Lesson Plan Day 3 worksheet

Anu is flying over the city, studying road safety.

Draw what the people are doing to keep safe while walking.

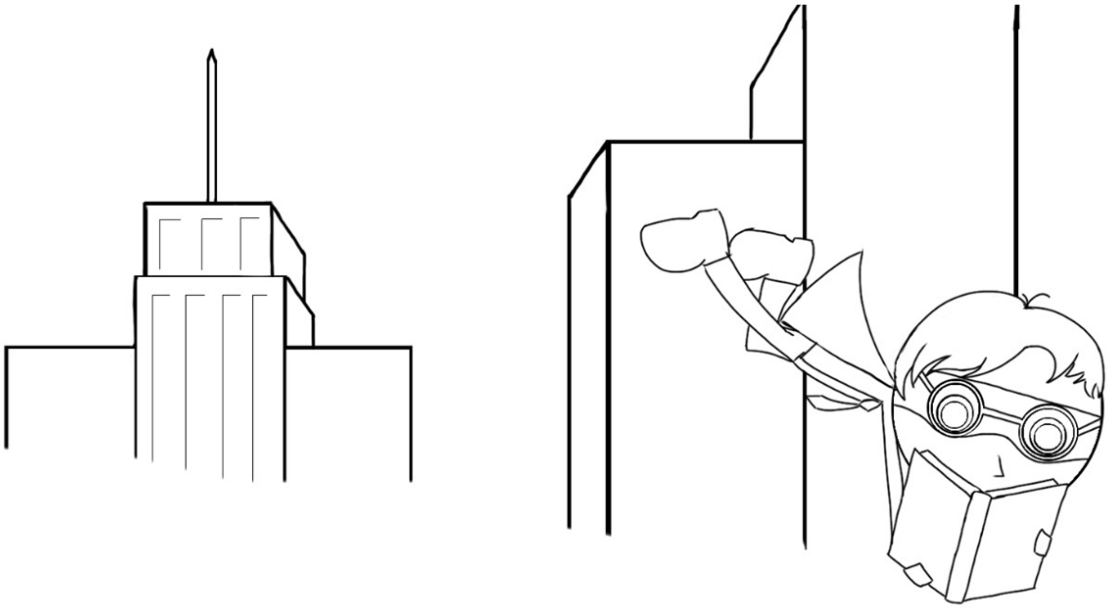


Figure 28: Lesson Plan Day 4 worksheet

Rin is outside enjoying the clean air.

Draw a world free of air pollution.

Figure 29: Lesson Plan Day 5 worksheet

Zero Heroes Week: Group Discussions

Along with the worksheet to be handed out, each day have the students engage in a group discussion (no more than three to a group). Questions to be discussed for each year are outlined below.
For years 5-6, have the students write down in a notebook their group's thoughts and ideas.
For years 3-4, have the students write down 2-3 sentences about their group's thoughts.
For years 1-2, have the students discuss only, no writing.

Each day's prompts should take about ten to fifteen minutes. After each group is finished, have a class discussion about what each group talked about and perhaps share the drawings done.

All materials can go home when completed. Try to have the students write their prompts and keep their drawings in the same notebooks.

Group Work Prompt Day 1:
Years 5-6: What is air pollution and why is it a problem? How are cars harmful? What are the disadvantages of being driven to school? What do you know about London air pollution?

Years 3-4: What is air pollution? What causes air pollution? What is the air in London like?

Years 1-2: What is air pollution and why is it bad? What causes air pollution?

Group Work Prompt Day 2:
5-6: How does air pollution affect the environment? How does it affect your health? Is air pollution something we should worry about and try to reduce? Why? What would the world be like if there was zero air pollution?

3-4: How does air pollution affect the environment? How does it affect your health? What would the world be like if there was zero air pollution?

1-2: Is air pollution bad for your health? Why?

Group Work Prompt Day 3:
5-6: When is it appropriate to be driven somewhere, and when can you avoid it? What alternative forms of non-polluting transport can you use to get to school instead? If you could choose how you got to school every day, what would you choose? Would this way be harmful to the environment?

3-4: When is it appropriate to walk somewhere instead of being driven? How else can you get to school without causing pollution? How would you choose to get to school every day if it was up to you?

1-2: How did you get to school today? Do you want to get there differently? What are ways you get to school without causing pollution?

Group Work Prompt Day 4:
5-6: What does it mean to be safe when walking to school? Why do you need to be aware of your surroundings? How is road safety different when biking than when walking? List some safety tips that can be followed when going to school.

3-4: What does it mean to be safe when walking to school? Why do you need to be aware of your surroundings? How is road safety different when biking than when walking?

1-2: How can you be safe when walking or biking to school?

Group Work Prompt Day 5:
5-6: What was the most important thing you learned this week? What did you do this week to reduce air pollution?

3-4: What did you learn about air pollution? What did you do this week to reduce air pollution? What was the best part of the week?

1-2: What did you learn about air pollution? What was the best part of the week?

Zero Heroes Achievement Sheet

Figure 30: Zero Heroes Achievement Sheet + Stickers

Zero Heroes Drawing Contest poster

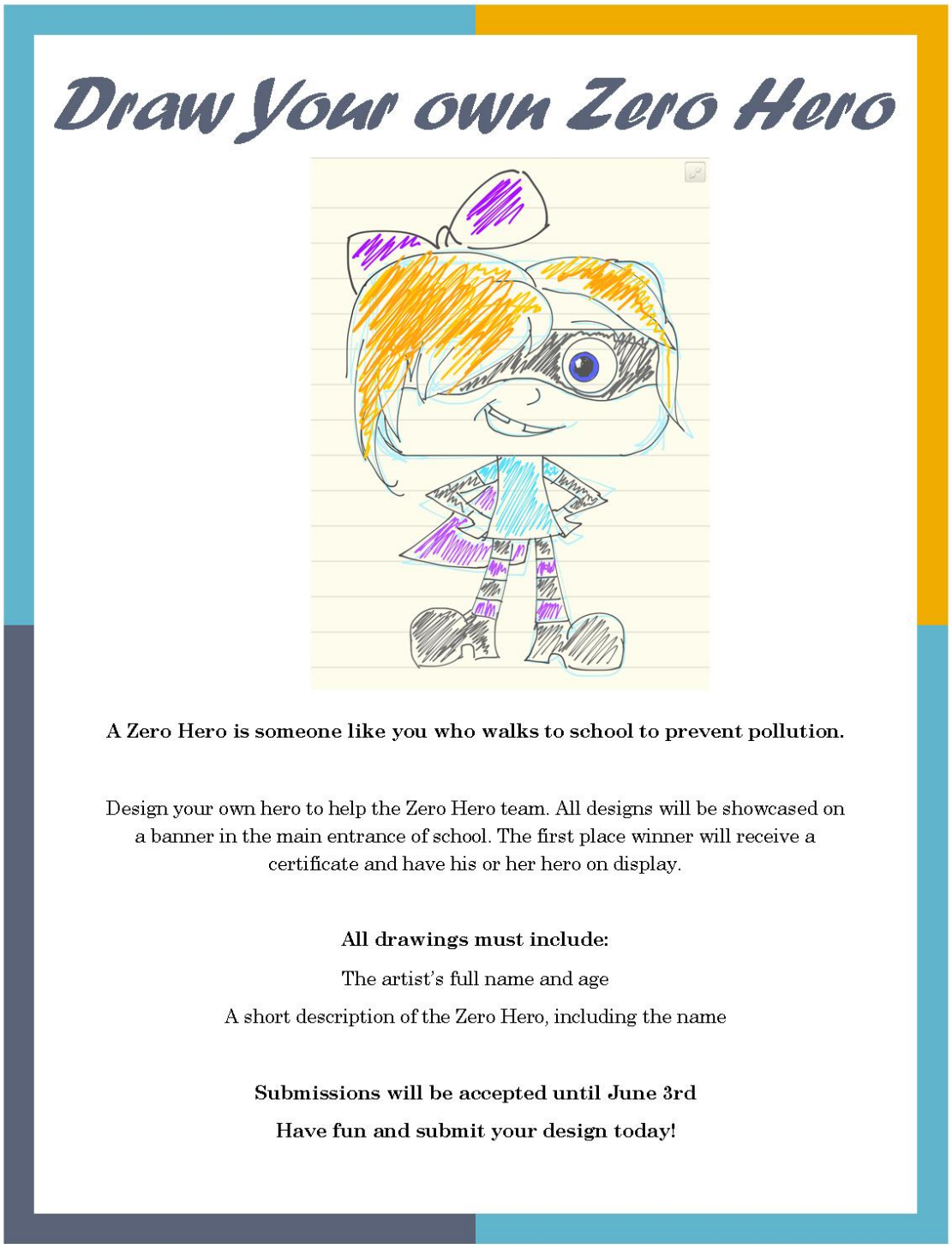


Figure 31: Zero Heroes Drawing Contest poster

Art Contest Judging Criteria

Judging Criteria for Zero Heroes Art Contest

Background Information

The Zero Hero Art contest is a competition for the students to create their own representation of a Zero Hero by drawing, naming, and describing him/her.

Participants: Pupils at each school (judged separately).

Because there are differences in artistic abilities of age groups the years will be divided into two separate judging pools:

- Key Stage 1 (years 1-3)
- Key Stage 2 (years 4-6)

Winners: One winner will be chosen for each group along with two runner-ups for each group.

What is a Zero Hero?

Posters and handouts will be given to the students entailing this message of what a Zero Hero is:

What is a Zero Hero to you? What does he/she look like? Do they fly? Have super strength? It is your turn to decide! Draw your own Zero Hero the way **YOU** see it and give them the powers you think a Zero Hero needs! Your design has a chance to be featured with the rest of the Zero Hero Super Team!

Your submission must:

Be drawn on A4 size (8.25in x 11.75in) paper. Include your Hero's name and an optional description of what they do!

Criteria to Look for in a Submission

1. **Banner Elements**
    a. This is not a scored area. The purpose of this is to decide whether or not the submission should be included on the school banner. What should be noted is if there is an effective part of the submission such as a well-drawn Hero or if there is a scene pertaining to air pollution. The reason for inclusion must be described even if the submission may not be a winner.
2. **Message**
    a. The submission should have a Hero that portrays the message of the program. This means a hero that makes zero emissions while traveling to school or helps someone else reduce their emissions through education, or assistance. This category includes the optional description that will help students explain what their Hero does.
3. **Relation to Target Audience**
    a. The submission needs to have a message that is age appropriate for group the submission comes from.
4. **Overall Design and Technique**
    a. This is a category that is more subjective than the others. It is based on the quality of the artwork, its impact, aesthetics, use of colour and patterns, and other artistic techniques.

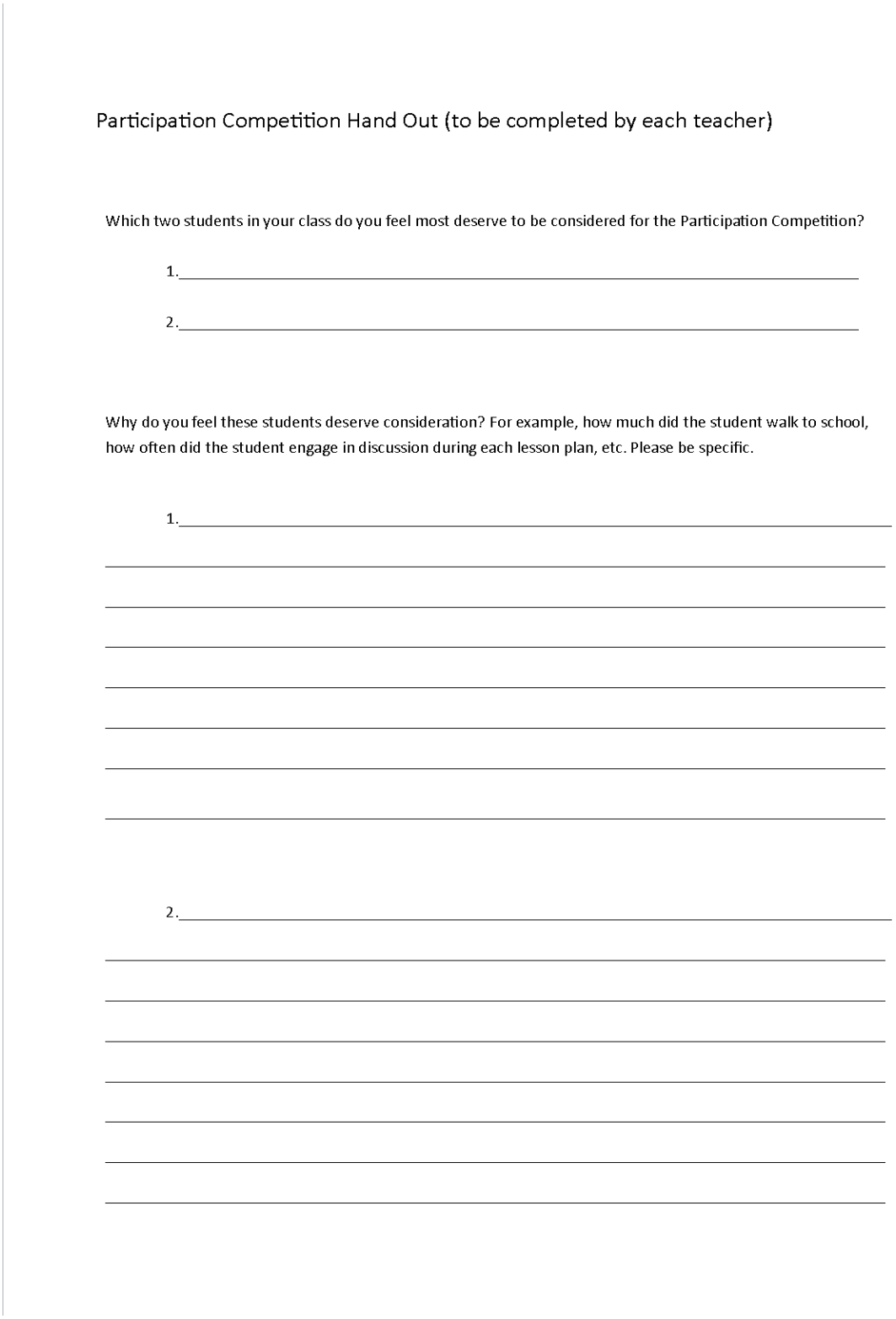
Sample Grading Rubric

Name		
Class		
Banner Element	**Y / N**	**Description:**
	Score (1-10)	**Notes:**
Message		
Relation to Audience		
Overall Look and Feel		
TOTAL		

Zero Heroes Drawing Contest winning certificate

Figure 32: Zero Heroes Drawing Contest first place certificate

Participation Competition Hand Out



Participation Competition Hand Out (to be completed by each teacher)

Which two students in your class do you feel most deserve to be considered for the Participation Competition?

1._____

2._____

Why do you feel these students deserve consideration? For example, how much did the student walk to school, how often did the student engage in discussion during each lesson plan, etc. Please be specific.

1._____

_____

_____

_____

_____

_____

_____

_____

2._____

_____

_____

_____

_____

_____

_____

_____

Figure 33: Participation Competition Hand Out

Observation of Student Participants

Borough of Croydon in London, England

Delivery Model:

☐ Researcher Observations

☐ Teacher Observations

Date of Visit: _____/_____/_____
Day Month Year

Observers:

_____ _____

_____ _____

Demographics:

Group/Class size: _____ Males: _____ Females: _____

Name of School: _____

Type of School:

☐Public ☐ Private ☐Religious

Activity Being Conducted: _____

Grade/average age of students: _____

Student 1:	**Student 2:**	**Student 3:**
☐ Male ☐Female Description: _____ _____	☐ Male ☐Female Description: _____ _____	☐ Male ☐Female Description: _____ _____

Observations of the key elements listed across the top of the following chart will be observed for each student at each exhibit or every 5 minutes during the activity. The observer(s) will assign a score for each element at each exhibit using the guidelines outlined in the Key (right). They will also record the time spent at each exhibit (minutes).

Key:	
Score:	**The level at which the student is exhibiting characteristic**
1	Not at all
2	Somewhat
3	About half the time
4	Almost the entire time
5	All the time

Observation Recording

Activity Instructor: _____

	Student Identifier	Eye Contact	Discussion	Concentration	Excitement	Participation	Questions	Distraction	Boredom
0-5 minutes	**1**								
	2								
	3								
6-10 minutes	**1**								
	2								
	3								
11-15 minutes	**1**								
	2								
	3								
16-20 minutes	**1**								
	2								
	3								
21-25 minutes	**1**								
	2								
	3								
26-30 minutes	**1**								
	2								
	3								

Additional Notes:

_____

_____

Observation of Croydon Schools Zero Heroes Activities

	Student Identifier	Time Spent	Eye Contact	Discussion	Concen-tration	Excitement	Participation	Questions	Distraction	Boredom
Activity 1	**1**									
	2									
	3									
Activity 2	**1**									
	2									
	3									
Activity 3	**1**									
	2									
	3									
Activity 4	**1**									
	2									
	3									
Activity 5	**1**									
	2									
	3									

Additional Notes (Please note overall group environment):

_____

_____

_____

_____

Pre/Post-Intervention Student Survey

PRE-SURVEY

1) What does pollution mean (circle one)?

a) Contamination of air by smoke and harmful gases.
b) A type of monkey that lives in the Amazon jungle.
c) Contaminated water in the ocean.

2) Do you take any actions to help reduce pollution (check all that apply)?

☐ Walk/Bike to school 1 day a week
☐ Walk/Bike to school 2 days a week
☐ Walk/Bike to school 3 days a week
☐ Walk/Bike to school 4 days a week
☐ Walk/Bike to school 5 or more days
☐ Other

3) What types of gases cause air pollution?

a) Nitrogen
b) Carbon Monoxide
c) Oxygen
d) A and C
e) B and C
f) A and B
g) All of the above

4) How can you reduce air pollution? (Circle one)

a) Walk to School
b) Bike to School
c) Car pool
d) Take the Bus
e) All of the above

5) Air pollution can cause harm to which of the following? (Circle one)

a) You
b) Animals
c) Plants
d) All of the above

6) True or False: Smog doesn't irritate eyes and lungs?

☐ True
☐ False

7) True or False: Only cars cause air pollution?

☐ True
☐ False

8) True or False: Walking to school will reduce your risks of having asthma attacks?

☐ True
☐ False

9) True or False: Acid rain can kill plants and animals?

☐ True
☐ False

10) Why can it be dangerous walking to school?

a) Cars kill people very frequently
b) Traffic violations occur often
c) You could arrive late to school

POST-SURVEY

1) Which of the following Activities did you take part in? Check all that apply.

☐ **Activity 1** ☐ **Activity 2** ☐ **Activity 3** ☐ **Activity 4** ☐ **Activity 5**

2) What does pollution mean (circle one)?

d) Contamination of air by smoke and harmful gases.
e) A type of monkey that lives in the Amazon jungle.
f) Contaminated water in the ocean.

3) Do you take any actions to help reduce pollution (check all that apply)?

☐ Walk/Bike to school 1 day a week
☐ Walk/Bike to school 2 days a week
☐ Walk/Bike to school 3 days a week
☐ Walk/Bike to school 4 days a week
☐ Walk/Bike to school 5 or more days
☐ Other

4) What types of gases cause air pollution?

a) Nitrogen
b) Carbon Monoxide
c) Oxygen
d) A and C
e) B and C
f) A and B
g) All of the above

5) How can you reduce air pollution? (Circle one)

f) Walk to School
g) Bike to School
h) Car pool
i) Take the Bus
j) All of the above

6) Air pollution can cause harm to which of the following? (Circle one)

a) You
e) Animals
f) Plants
g) All of the above

7) True or False: Smog doesn't irritate eyes and lungs?

☐ True
☐ False

8) True or False: Only cars cause air pollution?

☐ True
☐ False

9) True or False: Walking to school will reduce your risks of having asthma attacks?

☐ True
☐ False

10) True or False: Acid rain can kill plants and animals?

☐ True
☐ False

11) Why can it be dangerous walking to school?

d) Cars kill people very frequently
e) Traffic violations occur often
f) You could arrive late to school

12) Match the Zero Hero on the left with their name on the right.

(A) 

(B) 

(C) 

(D) 

(E) 

Nicola _____

Sonya _____

Klaus _____

Anu _____

Rin_____

Post- Activity Student #1 Survey: What is air pollution and where does it come from?

Lesson #1 SURVEY

1) What does air pollution look like? Check all that apply.

☐

☐

☐

☐

2) What does <u>pollution</u> mean (circle one)?

a) Contamination of air by smoke and harmful gases.
b) A type of monkey that lives in the Amazon jungle.
c) Contaminated water in the ocean.

3) Air is made up of… (Circle one)?

a) Solids
b) Gases
c) Liquids
d) Dust

4) True or False: Air pollution is a problem in only big cities.

☐ True
☐ False

5) True or False: You can help reduce air pollution.

☐ True
☐ False

6) What can cause air pollution in your area (circle one)?

a) Cars and Buses
b) Plants
c) Animals
d) Electric Cars

7) True or False: Cars and buses contribute little to air pollution.

☐ True
☐ False

8) True or False: Electric cars cause air pollution too.

☐ True
☐ False

9) True or False: Only kids can be affected by the harmful effects of air pollution.

☐ True
☐ False

10) What cause air pollution? Check all that apply.

☐

☐

☐

☐

6) What would you like to learn about in your next lesson? Do you have any suggestions?

Post- Activity Student #2 Survey: How does air pollution affect you?

Lesson #2 SURVEY

1) How does air pollution affect your life? Check all that apply.

☐

☐

☐

☐

2) Air pollution can cause harm to which of the following? (Circle one)

a) You
b) Animals
c) Your Family
d) Plants
e) All of the above

3) True or False: Air pollution causes are more harmful to young children, people with lung problems and asthma, as well as the old people?

☐ True
☐ False

4) True or False: Smog can't hurt the eyes and lungs?

☐ True
☐ False

5) True or False: Heat from the sun, wind, and the warm layer above a city can all worsen the air or increase the air pollution?

☐ True
☐ False

6) What would you like to learn about in your next lesson? Do you have any suggestions?

Post- Activity Student #3 Survey: What can you do to reduce air pollution?

Lesson #3 SURVEY

1) What can you do to reduce air pollution? Check all that apply.

☐

☐

☐

☐

2) How can you reduce air pollution? (Circle one)

- **a)** Walk to School
- **b)** Bike to School
- **c)** Car pool (drive in a group, so less cars drive to school)
- **d)** Take public transportation
- **e)** All of the above

3) True or False: Walking to school can do more than just reduced air pollution?

☐ True
☐ False

4) True or False: Walking to school will reduce your risks of having asthma attacks?

☐ True
☐ False

5) Getting regular exercise won't help your body; it will only make it tired?

☐ True
☐ False

6) What would you like to learn about in your next lesson? Do you have any suggestions?

Post- Activity Student #4 Survey: Traffic Safety

Lesson #4 SURVEY

1) **What is the proper way of crossing any road? (Check all that apply)**

☐

☐

☐

☐

2) Crossing the street if it looks like no cars are coming but there is not a cross walk is okay.

☐ True
☐ False

3) What are 3 things you should do before crossing the street?

1) _____
2) _____
3) _____

4) Why can it be dangerous walking to school?

g) Cars kill people very frequently
h) Traffic violations occur often
i) You could arrive late to school

5) What would you like to learn about in your next lesson? Do you have any suggestions?

Post- Activity Student #5 Survey: What did you learn?

Lesson #5 SURVEY

Write 4 different things that you have learned about air pollution:

(1)

(2)

(3)

(4)

5) Would you like to do Zero Heroes week again?

☐ Yes
☐ No