Evaluating the Effectiveness of the Educational Delivery Models at Zoos Victoria

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WPI

Evaluating the Effectiveness of the Educational Delivery Models at Zoos Victoria

An Interactive Qualifying Project submitted to the Faculty of
WORCESTER POLYTECHNIC INSTITUTE in partial fulfilment of the requirements for the Degree of Bachelor of Science by:

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Abstract

To assist Zoos Victoria in their goal of becoming the world's leading zoo-based conservation organisation, we established a system to determine the effectiveness of the three different educational delivery models at Melbourne Zoo. By analysing observations, surveys, and teacher interviews from school excursions, we were able to detect numerous correlations and trends between the data sets. By comparing the efficiency of each model in increasing students' understanding of the zoo's conservation campaigns while also promoting positive behavioural changes, we were able to determine which delivery model was the most effective in achieving Zoos Victoria's mission. Recommendations could then be made to the organisation about improvements to the different models for future educational programs.

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Executive Summary

An increase in the number of extinct and endangered species around the world and throughout Australia has driven numerous organisations to increase and expand upon their conservation initiatives. These organisations are looking to increase people's conservation awareness and promote behavioural changes that can help reverse the negative impacts that human activity is having on biodiversity. Botanical organisations and zoos have worked to become leaders and active participants in undertaking this endeavour. With their goal of becoming the world's leading zoo-based conservation organisation, Zoos Victoria has taken the lead in this conservation effort by continuously working to improve and implement new educational delivery models for their Learning Experience Programs in an effort to effectively educate as many people as possible.

The Zoos Victoria organisation is partnering with numerous conservation campaigns around the world in an effort to help endangered species populations in as many ways as possible. It is the goal of Zoos Victoria to effectively relay important conservation information to its visitors, especially students, and stimulate an interest in conservation-based behavioural changes. Melbourne Zoo has made an effort to link five of these conservation campaigns and corresponding behavioural changes to five separate exhibits throughout the zoo. These exhibits are known as the five ambassador species, as they are being used to represent their respective campaigns. The five ambassador species with their corresponding campaigns and behavioural actions are summarised in Figure 1 below.

				
They're Calling On You	***Don't Palm Us Off***	***Wash for Wildlife***	***Seal the Loop***	***Wipe for Wildlife***
Recycle Old Mobile Phones	Use Only Sustainable Palm Oil	Switch to Phosphate Free Cleaning Products	Recycle Plastic	Switch to 100% Recycled Toilet Paper

Figure 1: Five Ambassador Animals, Campaigns, and Corresponding Behaviour Change

In order to spread conservation awareness and promote behavioural changes to a large portion of the population, the zoo needs to make sure that students understand the main messages that are being presented to them. Previous research has shown that Melbourne Zoo is currently meeting the expectations of the teachers in regards to teaching conservation concepts and fulfilling curricula objectives. The next step is for the zoo to accomplish their organisation's mission of informing students of their campaign involvement and what each

individual can do to make a positive difference. Melbourne Zoo plans to achieve this by incorporating these lessons into their educational delivery models in an effort to educate the largest number of students as possible. For this goal to be achieved, the Zoo is looking to evaluate the effectiveness of their current two delivery models as well as the new model that they are trialling for the first time.

The goal of this research project was to evaluate the three separate educational delivery models to determine how effective each was in achieving Zoos Victoria's mission of promoting wildlife conservation and positive behavioural changes while also offering valuable learning experiences. To complete this goal, we established the following objectives:

- Evaluate how engaged students were during each educational program and how self-directed they were towards learning throughout the duration of their visit
- Measure the students' understanding of conservation campaigns and how that affects conservation-based behavioural changes in the students exposed to each learning model
- Measure demographic indicators and other socioeconomic factors to determine if they uniquely impacted the effectiveness of each education model
- Compare the overall effectiveness of the three delivery models

The methods involved in collecting the relevant data for this study were done through observations, student surveys, and teacher interviews. The observations were used to obtain an understanding of the levels of students' engagement and self-directedness throughout the day, including any educational sessions or shows they attended and their exploration of the exhibits. Surveys were administered to each class before they left the zoo to test their understanding of basic conservation concepts and campaign knowledge. A follow-up survey was collected three weeks following their visit to test these same cognitive skills in order to analyse the amount of knowledge retention. The students were also asked if they had taken any conservation-based actions since their visit to the zoo. This was important in understanding the level of behavioural changes made by the students and if any of the campaigns were more successful in getting students to participate. Lastly, teacher interviews were used as a way to understand the trends and outside factors that were unique to each school's visit.

Upon completing our data collection and analysing the results, we compiled a set of findings that could be presented to the zoo to show the effectiveness of each of the three

delivery models. From observation data, it was found that the level of engagement was not dependent upon the delivery model that the students were participating in, whereas the level of self-directedness is shown to be notably less in the educator-led model as shown below in Figure 2.

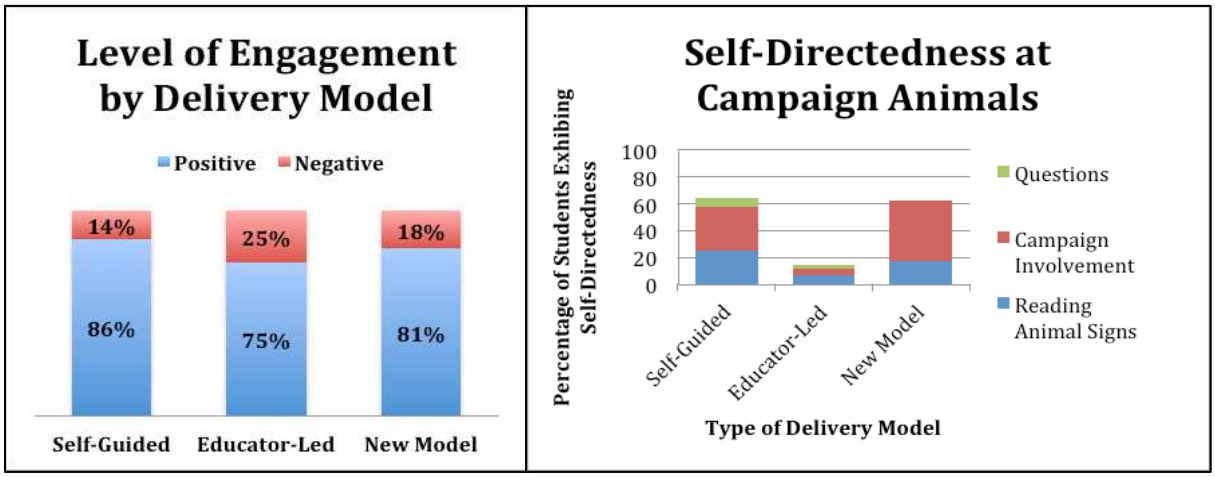

Figure 2: Level of Students' Engagement and Self-Directedness by Delivery Model

Before the students left the zoo, a survey was administered to test their basic understanding of conservation topics as well as the five different campaigns. From an analysis of the on-site survey (Survey 1), it was found that the New Model was the most effective in accomplishing Zoos Victoria's mission of increasing students' knowledge of the conservation campaigns and the behaviours that can be taken to aid each of the five ambassador species. A graphical representation of this analysis is shown below in Figure 3, and can be interpreted by knowing that the classes who scored the highest on each campaign question would be closest to each vertex of the polygon.

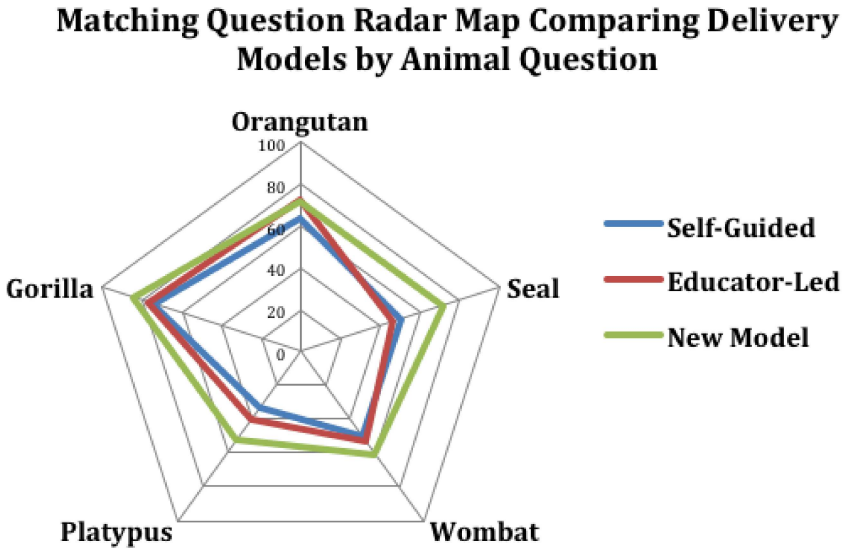

Figure 3: Students' Knowledge of Conservation Campaigns By Model

A follow-up survey that was completed by the students approximately three weeks following their visit was used to test their level conservation-based behavioural changes and knowledge retention. It was determined that the schools exposed to the new model and all those with a specific educational focus to their visit were more likely to participate in the campaign actions after their visit. We also determined that the recycling action associated with the *Seal the Loop* campaign was by far, the most common behaviour change. For testing of knowledge retention, Figure 4 shows that the classes participating in the new model still retained more information regarding the conservation campaigns than those exposed to both the other models. This shows that the new model was overall the most effective in achieving the goals set forth by Zoos Victoria and the Learning Experiences Team.

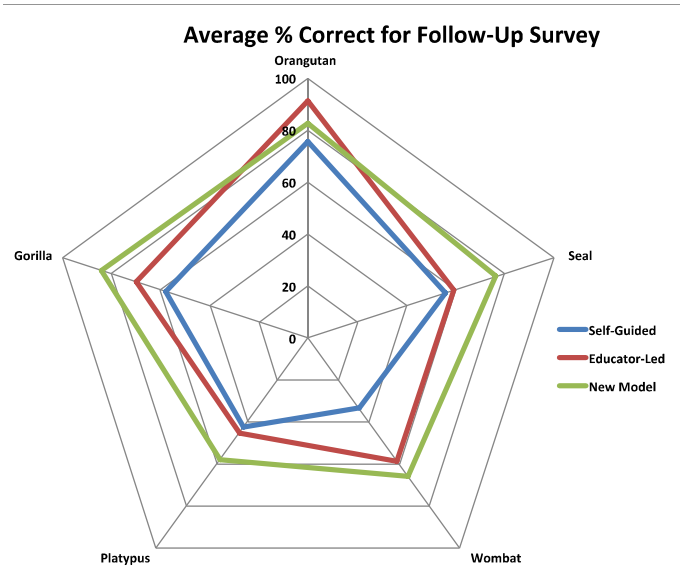

Figure 4: Average Percentage Correct for Follow-Up Survey Based on Animal

The recommendations that are addressed below are based upon observations and data analysis and can be used by Zoos Victoria as they continue to improve upon and implement their different types of learning models. We have included recommendations that we feel are the most feasible and will produce the best results.

New Model Improvements

With the new delivery model achieving as much success as it did during the first two trials, a few small and simple improvements could potentially lead to even greater educational and behavioural outcomes for the students.

- ***Move the optional workshop from the Ranger Station location***

A more centralised location, such as the Historic Enclosure near the Main Drive would be much more convenient for the students to get to during the allotted time period. If it is not

possible to move the location, it is recommended that a longer time slot be available for the workshop and/or shorter workshops at multiple times throughout the day.

- ***Offer a variety of workshop topics***

From our analysis, it is clear that students understood some of the conservation campaigns more easily than others. Therefore, in order to ensure that the students are grasping some of the more difficult concepts, workshops focused on different ambassador animals may be beneficial.

- ***Flip the orientation of the map***

All school groups enter the zoo from the rail gate located at the back entrance, and are often confused that their starting location is actually at the bottom of the map. Flipping the map or providing a "You are here" symbol would be very useful.

Zookeepers and Campaign Shows

Due to the arrival time of many of the schools to the zoo, the current times for zookeeper talks and the Seal show are sometimes impossible to attend. Also, it is important for students and teachers to be aware of these available learning experiences and to be reminded numerous times before heading off in their smaller groups for the day.

- ***Zookeepers***

Currently, the only zookeeper talk that is associated with an ambassador animal is the Gorilla at 9:30am. Not only do we feel that more ambassador species should be used for keeper talks, but the times need to be changed in order to make them more feasible for school groups to attend. A time later in the morning or in the early afternoon would be more convenient.

- ***Seal the Loop Campaign Show***

Results taken from the first survey showed that the student's attendance at the *Seal the Loop* show had a significant impact on their understanding of the campaign. It's recommended that the show be moved from 1:30pm to a time somewhere between 10am-12pm in order to allow for a larger group of students to attend.

Campaign Signs and Visuals

Through observations and survey results, it was noticeable that certain campaigns and ambassador animals were better understood than others. Large factors that could have influenced the students' understanding of the ambassador campaigns were the signage, visuals, and other ways in which it was advertised. A map of campaign related visuals throughout the zoo also shows that some exhibits such as the Gorilla are more effectively advertised than others, such as the Platypus.

- ***Platypus***

The platypus and the *Wash for Wildlife* campaign was the most consistently unknown ambassador campaign. Factors that had an effect were: Signage being too high and not easily understood by students as well as the confusing connection between the campaign and the washing machine with the fish. Better signage on and around the washing machine and additional displays would be helpful in relaying this important message to the students and other visitors.

Future Research to Validate Findings

With the findings presented in this report based on a small sample size, we have also included recommendations about further research that can be conducted to validate the results.

- ***Method of Observations***

If this study were to be repeated or expanded upon, it would be beneficial to know more about how the time of day correlated with different behaviours. This would be able to show if the time of day was a factor in the amount of engagement and self-directedness towards learning exhibited by the students.

- ***The amount of learning in workshops (10-minute session vs. 45-minute session)***

If a study were conducted to understand the level of learning that took place during the 45-minute educator-led sessions compared to the 10-minute optional session offered during the New Model, the zoo educators would have a better understanding of how effectively their time is being spent. If the students are learning the same in both sessions, a 45-minute session might be too long and not an effective means of educating the students. If instead the students were learning more in an educator-led session, perhaps a change to the new model's workshop would be valuable in giving students a better opportunity to learn the same concepts.

- ***Experiment with the time of day in which the educator-led session takes place***

The self-directedness of students' learning could be potentially due to the fact that they are put in a formal education setting directly upon their arrival at the zoo. Behaviours should be compared before and after the educator-led session (if in the middle of the day) in order to see if there is a difference in the amount students' self-directedness in learning with the formal learning session being offered at different points during their visit.

1.0 Introduction

The extinction of various species around the world continues to increase at startlingly high rates (Conservation International, 2013b). Illegal hunting practices, lack of conservation education, overuse of natural resources, and the destruction of species' natural habitats are all factors that are contributing to damaged ecosystems and a decline in biodiversity. Educating global communities on conservation practices is essential in order to counteract and reverse people's harmful social behaviours regarding wild animals and their habitats. By informing the population of the harmful effects of their actions and suggesting alternative behaviour practices, a positive change can be made to help stop the threats of extinction.

Global organisations such as the World Wildlife Fund (WWF), the World Association of Zoos and Aquariums (WAZA), and the Nature Conservatory have been working together with botanical organisations and zoos to help promote active participation in the fight against extinction. In order to do this, many of these organisations have teamed up with partner sponsors to help preserve the most fragile species and habitats while also reaching out to communities to help educate the people on conservation (World Wildlife Fund, 2013). Australia is among many countries that are facing serious extinction problems. Australia is home to more than 600,000 different species, with a high percentage of these mammals (83%) and birds (45%) unique to the region/continent (Australian Government, 2010). Consequently, this geographic location and the animals that live there are a high priority in terms of initiating conservation principles.

Zoos are a critical factor in promoting conservation as they provide hands-on activities and engaging learning programs that attract the attention of students and surrounding communities. Zoos Victoria is a dynamic leader throughout the country and the State of Victoria in the area of conservation awareness. Their goal is to increase conservation awareness in their student visitors in the hopes of creating environmentally friendly behaviour changes in the younger generations of Australians. There are many factors influencing zoo visitors' attitudes and behaviours towards conservation. According to Swanagan (2000), it has been concluded that zoo visitors are more interested in zoos' natural exhibits where they can see animals in their natural habitats (Swanagan, 2000). Also, according to Swanagan, visitors reported that they were more interested in conservation issues when given a set of specific tasks or activities they could do such as, "donat[ing], wise consumerism, signing petitions, writing support letters, or making phone calls to legislators" (Swanagan, 2000, p. 27). By applying this finding to their sites and exhibits, Zoos Victoria is

capable of achieving its mission of becoming the world's leading zoo-based conservation organisation.

Zoos Victoria has expanded and updated their sites and exhibits since its initial establishment in 1862 (Fairley, 2012). With more natural exhibits and conservation-based information available to visitors, the zoo educators are interested in determining the most effective learning model available to student groups in regards to positive conservation behavioural outcomes. The zoo is currently utilising two existing models and has recently developed a new, more interactive model. The zoo hopes to compare the three models and reach a conclusion about the effectiveness of each model in delivering the conservation message while also promoting behavioural change.

Our goal is to provide Zoos Victoria with the information they need to be able to determine which of their three learning models is most successful in achieving their objectives. To do this, we will observe student groups at the zoo, conduct interviews with the teachers and students, and establish a system to track behavioural changes in the students exposed to each learning model. This tool will be to be used by the zoo in the future to conduct further research on a wide range of educational programs. Our recommendations will help Zoos Victoria's obtain a better understanding of what aspects of the three different learning experience models are most effective in order to guide them in a decision about which models to offer in the future.

2.0 Background

As one of the largest zoo-based conservation programs in the world, Zoos Victoria, offers a variety of educational programs that strive to stimulate visitors' interests in the importance of preserving wildlife and natural habitats. These educational programs work towards achieving the zoo's mission by encouraging surrounding community members to become involved in the fight to counteract many of the conservation issues that plague countless areas around the globe. To achieve their mission, they aim to incorporate conservation awareness in all aspects of their programs. Currently, Zoos Victoria's main target audience is students. With little room in many standard school curricula for additional topics not outlined in the national standards and the Victorian Essential Learning Standards (VELS), non-formal learning experiences, such a school excursion to the zoo, may be the only opportunity that many students have to learn about conservation (Victorian Curriculum and Assessment Authority, 2012). Therefore, it is essential that Zoos Victoria is able to effectively deliver their conservation awareness message to as many student visitors as possible.

The zoo has expanded to more locations throughout Victoria since it was first founded in 1862, which has resulted in the zoo's message being received by a larger portion of the population (Fairley, 2012). The Zoos Victoria organisation is currently divided into three different zoos, situated in three separate locations of Victoria. The Melbourne Zoo is located just minutes from downtown and houses over 300 different species of animals from all parts of the world. It has many special attractions and exhibits including "Trail of the Elephants," "Orang-utan Sanctuary," and "Baboon Lookout." The Werribee Open Range Zoo, located southwest of the city, has a wide variety of animals in an open range environment. Home to mostly African animals, the zoo also has animals from Asia, North America, and Australia. The third zoo in the Zoos Victoria organisation is the Healesville Sanctuary. Located about an hour northeast of the city, this zoo is famous for its variety of native Australian animals. Each of the aforementioned zoos has programs and exhibits unique to their particular site. However, one aspect that is consistent among them is the emphasis placed on incorporating conservation awareness in as many of their programs as possible in the hopes that visitors will become more actively involved in the fight to save wild species and habitats (Zoos Victoria, 2013i).

Between each of the three zoo sites, there are a wide range of exhibits and educational learning programs that visitors can experience that incorporate aspects of environmental

conservation. For student groups visiting the zoo, the effectiveness of these programs is based on how well they are able to merge teachers' needs and expectations with the zoos overall learning mission (Zoos Victoria, 2013c). Previous research on this topic by WPI students focused primarily on the programs' effectiveness from the teachers' perspectives. Through literature review, survey analysis, and personal interviews, the student researchers concluded that teachers perceived zoo learning programs as highly effective in conveying conservation concepts to the students while also adhering to curricula objectives (Tymon et al., 2012). After verifying that their programs were receiving positive feedback from local teachers and schools, Zoos Victoria has shifted their focus to solidifying their overall mission and integrating it into their educational programs (Livermore, 2013).

With the educational programs successfully meeting teachers' expectations and matching curricula objectives, it's now a priority to ensure that the mission of the zoo is also being achieved. Currently, Zoos Victoria has two educational delivery models in place that are used to deliver learning experiences to student visitors (Zoos Victoria, 2013i). While these methods have had success in the past, the organisation is working to develop a third delivery model that they hope will be more successful in conveying their mission and encouraging conservation action to a larger number of students and groups (Livermore, 2013). Every group of student visitors will likely experience the zoo and engage with the message of conservation differently based on varying personal factors such as learning styles, schools' geographic location, and program costs and duration. By having different delivery models, teachers are able to choose what type of learning environment their students will experience at the zoo. It is the zoo educators' hope that this variation in learning styles is a successful means of helping all the students retain as much educational information about conservation as possible from their visit. With two of these models already in place and one ready to be tested, it's our goal to evaluate the three separate educational delivery models to determine how effective each is in achieving Zoo Victoria's mission of increasing wildlife conservation awareness through positive behavioural changes, while also offering valuable learning experiences through non-formal education programs.

2.1 Conservation

Zoos Victoria's mission is driven by the growing concern of the critical issue of conservation preservation that requires immediate attention and action to lessen the depletion rate of endangered species and habitats. Conservation is defined as a "value-driven discipline

based on the premise that the preservation of species diversity, ecological systems, and evolutionary processes in nature is important to the maintenance of life on our planet" (Miller et al., 2004, p. 7). The protection of our planet's natural resources, wildlife, and natural environment is a cause that multiple organisations are working on. Zoos and aquariums have led the way in undertaking this mission in hopes of educating their visitors on biodiversity and the factors that eventually lead to the diminishing of species and their surroundings. The variety of species and habitats on earth compose what is known as biodiversity. Maintaining biodiversity and preserving wildlife go hand in hand and are the two key components involved in conservation.

Biodiversity is essential to human survival, as every day we rely on access to food, energy and countless resources from nature (Australian Government, 2010). Conserving biodiversity provides substantial benefits to meet immediate human needs, such as those for clean and consistent water flows, protection from floods and storms, and a stable climate (Conservation International, 2013a). Due to the importance of these fundamental resources being at risk, many global organisations have collaborated in their efforts to protect biodiversity and promote conservation awareness.

Through a well-developed conservation strategy, the Australian Government hopes to engage people in building a successful ecosystem, strong enough to resist a changing climate. The purpose behind the strategy is to "set out [the] priorities which will direct [Australia's] efforts to achieve healthy and resilient biodiversity" (Australian Government, 2010). With more efforts focused on maintaining stable conservation, the Australian Government hopes to restore the strength of the ecosystem. The strategic plan, developed in 2010, has a 20-year projection in which the organisation has established a set of measurable goals. These goals include "achiev[ing] a 25% increase in the number of Australians and public and private organisations who participate in biodiversity conservation actions…[and] a national increase of 600,000 km^2 of native habitat managed primarily for biodiversity conservation" (Australian Government, 2010). If all of the aforementioned goals are met, Australia will be well on its way to maintaining its biodiversity and increasing protection of endangered species and natural habitats across the continent, while also increasing the number of active participants in their conservation awareness organisations. Therefore, it is vital that zoos are actively engaged in ensuring that these goals, set at the national level, are achieved.

2.1.1 Zoos' Conservation Missions

Some of the major leaders of wildlife preservation and conservation awareness education are zoos, aquariums, and botanical organisations. Approximately 600 million people visited zoos and aquariums worldwide in 2008 (Gusset & Dick, 2011). Attendance had increased from a previous survey in 1990 in more developed countries from regions such as North America, Australasia, and Europe (Gusset & Dick, 2011). These zoos and aquariums spent $350 million in 2008 on wildlife conservation, which is the main mission of most of these organisations (Gusset & Dick, 2011). The increasing attendance rates and money spent on conservation indicates that zoos, aquariums, and botanical organisations have the ability to play a major role in the conservation of wildlife and environmental education (Gusset & Dick, 2011).

Botanical organisations, aquariums, and especially zoos, have begun to develop a more active role in conservation awareness as they have moved from being a place for just entertainment to a network of organisations concentrated on science and education (Turley, 1999). Although the common theme of visitation for personal enjoyment has remained consistent over the years, the issue of conservation has come into focus since the mid-20th century (Turley, 1999). In 1980, the International Union for Conservation of Nature (IUCN) put together the World Zoo Conservation Strategy (Turley, 1999). This conservation strategy was made up of a series of documents that examined the relationship between the global environment and humans. It suggested that all zoos formulate their mission statements to align with the conservation objectives put forth by the IUCN (Turley, 1999). The World Association of Zoos and Aquariums (WAZA) have also defined responsibilities of conservation for all zoos across the world. WAZA is one of the founding members of IUCN and has actively worked for the issue of conservation. WAZA has created the World Zoo and Aquarium Conservation Strategy. It was first published in 1995 and has aligned its goals with the IUCN World Conservation Strategy (WAZA, 2012). Since this publication in 1995, zoological organisations have worked to make improvements to their organisations in general and their involvement in wildlife preservation.

Zoos Victoria is a not-for-profit conservation organisation that works to fight wildlife extinction and provide educational learning experiences to visitors through interactive and more natural behaviour based shows and exhibits. The official vision and mission of Zoos Victoria, according to their website is:

> Our vision is to be the world's leading zoo-based conservation organisation. Our mission is to galvanise communities to commit to the conservation of wildlife and wild places. We will achieve this by connecting people and wildlife in the following ways:
>
> •**Opening the door** by providing exceptional wildlife encounters that reach beyond the boundaries of our campuses
>
> •**Leading the way** by communicating and demonstrating the role of conservation and research in all we do
>
> •**Catalysing action** through inspiring experiences that motivate participation, leading to conservation and sustainability outcomes.
>
> (Zoos Victoria, 2013i)

In their efforts to become a worldwide leader in conservation-based organisations, Zoos Victoria has taken on an active role internationally in spreading conservation awareness. They are currently involved in six different programs around the world with each specifically designed to aid conservation efforts in each region. The programs are located in Papua New Guinea, Kenya, Borneo, Democratic Republic of the Congo, Cambodia, and the Philippines (Zoos Victoria, 2013). These programs focus on various social and environmental issues that generate concern among conservation groups. For example, in Papua New Guinea, significant increases in population in the Torricelli Mountains along with changes in hunting patterns has led to a significant decline in the Tenkile tree-kangaroo population. Zoos Victoria and their partner organisations hope to implement stricter regulations on hunting in the mountains and also raise public awareness in the surrounding communities (Zoos Victoria, 2013i).

In addition to their international outreach programs, Zoos Victoria is also committed to fighting extinction by being actively involved in many local conservation programs in Australia and the State of Victoria. With more than 1,700 species and ecological communities threatened and at risk of extinction across the continent, the stabilising of the bionetwork is imperative in order to prevent a complete collapse of the system (Australian Government, 2010). Right now there are 20 species located in southeastern Australia that are very close to extinction. The zoo designates these species as “priority species” in order to aid them in a recovery of population. One particular native species that Zoos Victoria has made a priority to protect is the Tasmanian Devil. The population is being threatened by Devil Facial Tumour Disease (DFTD), which has led to a dramatic reduction in the native population. Zoos

Victoria's Healesville Sanctuary has become an active member of the 'Save the Tasmanian Devil Program,' established by the Australian and Tasmanian governments (The Department of Primary Industries, 2013). In order to do their part to help the species avoid extinction, Zoos Victoria has been and continues to breed and manage a captive population of Devils, assist with population monitoring, and help increase community awareness of the issue (Zoos Victoria, 2013i). With the Tasmanian Devil, and the rest of Australia's endangered populations, the recovery plan aims to increase local awareness by actually allowing individuals at the zoo to interact and connect with the endangered species. By providing people a better understanding of these animals, the Zoo aims to ensure that no Victorian terrestrial vertebrate will become extinct (Zoos Victoria, 2013).

In addition to global and local organisations, there are also individuals that have devoted a significant amount of time and energy towards researching and understanding the importance of conservation and preservation awareness. Academic Patricia Patrick and colleagues examined zoos' mission statements in the United States to identify the common goals of both conservation and education (Patrick, Matthews, Ayers, & Tunnicliffe, 2007). They found that most zoos contain both conservation and education statements in their mission statements, but do not address what their specific goals are or how they will achieve these goals. Their results showed that the concept of conservation education is important to most zoos; yet, "propose that priorities of conservation and education be integrated so that conservation education is clearly articulated in zoo mission statements" (Patrick, et al., 2007). Conservation education is vital in order for the visitors of zoos to understand the importance of preserving wildlife and their habitats, which explains why it has become the main theme in zoos' mission statements (Patrick, et al., 2007).

In addition to educating people about what conservation is and what can be done to help reverse a weakening ecosystem, organisations are also focusing on promoting behavioural changes and actions. Through their mission statement, the Wildlife Conservation Society is able to articulate their goal of saving wildlife and habitats "through science, global conservation, education and the management of the world's largest system of urban wildlife parks…[in order to] change attitudes towards nature and help people imagine wildlife and humans living in harmony" (Wildlife Conservation Society, 2013). This encompasses an attitude that is essential to achieving awareness about the subject. The Wildlife Conservation Society along with many others around the world such as the Disney Worldwide Conservation Fund, strive to promote and teach lifelong conservation values. Through conservation education, the public is provided with personal and meaningful connections to

nature and with the use of effective conservation messages, people learn simple strategies or behaviours that can make a difference for wildlife and wild places everywhere (International Zoo Educators Association, 2013).

The success of conservation education relies in large part on the percentage of the population that receives the message that zoos and other collection-based organisations are trying to convey. One hindrance in reaching a large portion of the population is due to the geographic location where many people reside. This is especially relevant when trying to educate people living in large city environments. About 50% of the world's population lives in cities. Educating the urban population about nature can increase their support for conservation, which is the main goal of many zoos (Miller, et al., 2004). One unique contribution zoos add to the conservation cause is the presence of zoos in urban areas. Zoos and other collection-based institutions allow the urban population, who are generally disconnected with nature, to see wildlife exhibits and stimulate interest in nature.

Zoos must keep a balance between conservation education and entertainment. The results of a 1983 survey by the English Tourist Board (ETB) showed that the average zoo visitor is a family that has young children from ages five to twelve. Most visits are for entertainment and recreation, however most zoos' goals are geared toward education and natural conservation (Turley, 1999). Zoos have looked to educate these recreation-seeking visitors by giving them inspiring experiences in the hopes they will take away the message of conservation. They are working to do this by improving the animal exhibits and demonstrations that are offered. Throughout the history of zoos, the animal displays have progressed from plain enclosed cages to wide open areas that attempt to recreate the animals' natural environments. These improvements in the animal exhibits were due in large part to strong opposition from environmentalists who felt it was cruel and unfair to keep the animals in captivity instead of their natural habitats (Ballantyne, Packer, Hughes, & Dierking, 2007). Fortunately for zoos, these new types of interactive displays and "non-captive wildlife encounters" add to the education and entertainment of zoo visitors' experiences (Ballantyne, et al., 2007).

Animal shows and feeding programs have recently been used as a tool to teach visitors about specific animals and enhance their educational experience. These techniques make up what is known as third generation exhibits. These new and improved encounters "often include wide open areas, water features and sound recordings to mimic wilderness environments" (Ballantyne, et al., 2007). Through these devices, zoos are able to provide information to guests that link animals and conservation in each specific exhibit (Ballantyne,

et al., 2007). Animal shows have become more sophisticated as they have grown from the stereotypical sea lion with a ball balanced on its nose to an educational show that incorporates the animal's natural behaviours (Ballantyne, et al., 2007). Visitors are also able to observe the animals' natural behaviours through scheduled feedings. Third generation exhibits incorporate scent trails and puzzle feeding containers in an effort to "stimulate species-specific behaviour that will give visitors an insight into how captive animals would behave in the wild" (Ballantyne, et al., 2007). It is the hope of the zoo that incorporating more third generation exhibits will increase overall understanding of extinct animals and their natural behaviours and promote positive conservation awareness.

2.2 Educational Models

One major way to raise conservation awareness is by teaching the students who visit the zoo through educational programs. Currently, Zoos Victoria has two educational delivery models in place with a third model being developed. These different models are all used to collaboratively deliver learning experiences to as many students as possible. The three program types are (Zoos Victoria, 2013):

- Self-guided
- Zoo Educator-Led
- New Model

The self-guided option allows teachers the opportunity to take their students throughout the zoo and instruct them first hand on conservation information. Teachers have the opportunity to either let their students explore the zoo and visit exhibits that they want or to provide the students with worksheets and maps that offer a more direct focus to what exhibits and information should be observed. To participate in this model, the school needs only to pay for admission tickets to the zoo as no zoo staff will be actively involved with teaching the students.

The second model is the zoo educator-led experience, which is available at an additional cost for approximately 30 students. Within the 45-minute session, students are educated on certain aspects of conservation that are linked with the schools' curricula. As part of the TEC Asia program, which was the only educator-led model observed for this research, a large portion of the lesson is dedicated to hands-on learning where the students are given certain artefacts or products with information cards and asked to present them to the

rest of the group. The educator also tries to motivate learning by asking probing questions and getting as many students involved as possible Figure 5.

Figure 5: Student Participation during TEC Asia Educator-Led Session

At the end of the lecture, a close-up animal encounter is provided which helps to create an exciting learning atmosphere as shown below in Figure 6. Upon the competition of the lesson, the remainder of the day is spent as a self-guided visit.

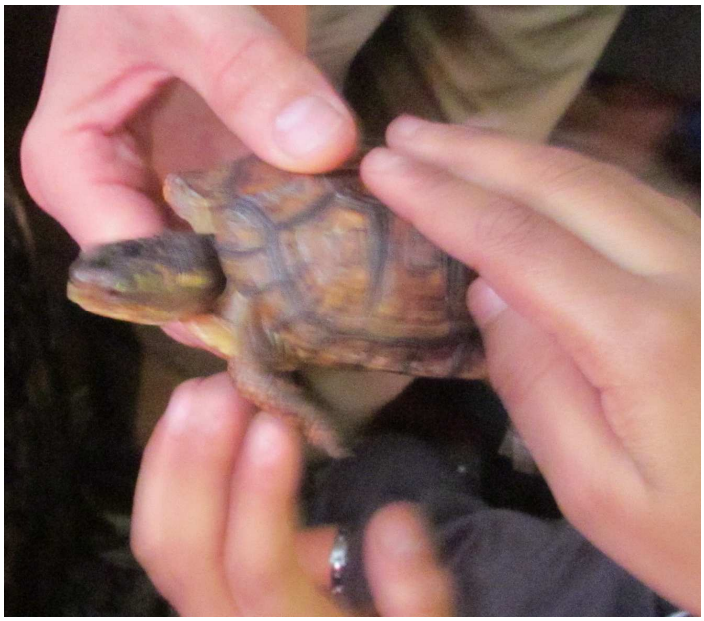

Figure 6: Close Up Animal Encounter during TEC Asia Educator-Led Session

The last model is going to be offered to student groups and was evaluated for the first time this autumn. This new challenge-based activity aimed to engage a larger group of students in a more creative way by supplying them with a map that highlights five specific exhibits throughout the zoo as shown in Figure 7 below. On the back of the map, the students are encouraged to write notes about what they can do to help each of the five ambassador species at the exhibits they visit (Figure 8).

Figure 7: Map Used for New Delivery Model

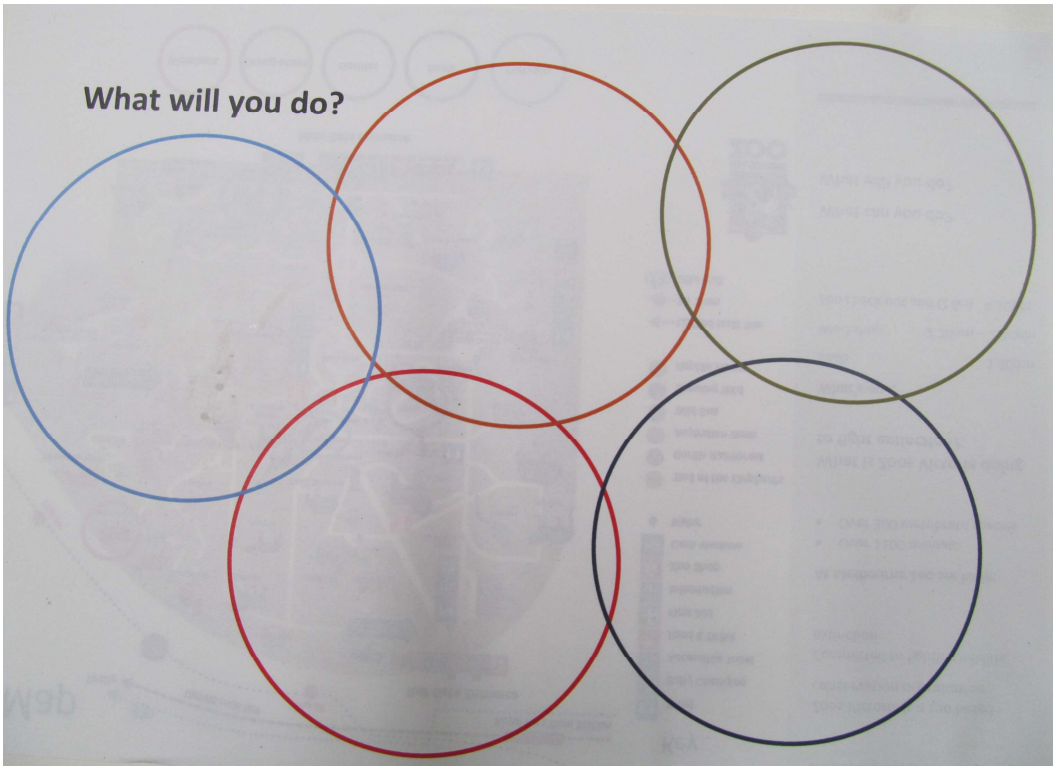

Figure 8: Back of Map Used in New Delivery Model

This model has been designed in the hopes of keeping the students focused on learning and conservation awareness throughout the duration of their visit (Livermore, 2013). A zoo educator also meets with the class before their exploration of the zoo to encourage them to visit the ambassador animals and learn about what can be done to help them. The educator meets with the class again before they leave the zoo to discuss what they learned and conclude the program. With these three very different models available, the zoo wants to assess each of the models in order to determine each ones' effectiveness in delivering the conservation message to the students while also promoting behavioural changes in regards to conservation.

With a wide range of interactive and modern open range exhibits, Zoos Victoria has worked continuously to develop different educational models in order to effectively deliver their conservation message to visitors, especially students. Student learning experiences can generally be broken down into three categories: formal; non-formal; and informal education practices. Formal education is the planned and systematic approach to teaching, which often takes place in a classroom setting (La Belle, 1982). Non-formal education is often characterised by a structured out-of-classroom experience. It aims to educate students by engaging them in more hands-on and creative activities that ultimately result in the students' "display[ing] interest, enthusiasm, motivation, alertness, awareness, and a general openness

and eagerness to learn, characteristics that tend to be neglected in school" (Ramey-Gassert, 1997, p. 435). Informal education is "the lifelong process by which every person acquires and accumulates knowledge, skills, attitudes and insights from daily experiences and exposure to the environment" (Coombs & International Council for Educational Development, 1973, p. 8). Figure 9 illustrates these three types of learning.

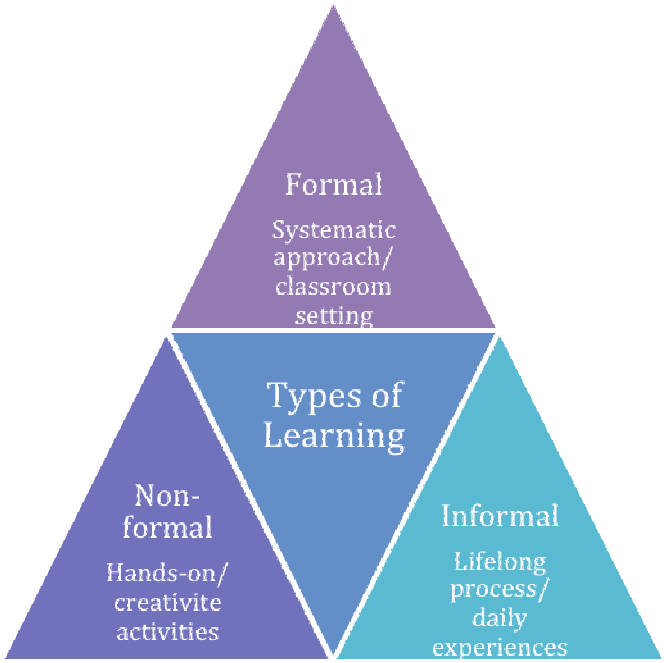

Figure 9: Three Types of Learning

Non-formal education is described as "any organized, systematic, educational activity carried on outside the framework of the formal system to provide selected types of learning to particular subgroups in the population, adults as well as children" (La Belle, 1982, pp. 161-162). Although informal and formal learning are essential parts of every students' education, non-formal teaching education models in a zoo environment are the most suitable due to the increased opportunity for students to be involved in hands-on activities in a more creative and unstructured type of learning atmosphere. This type of active learning often focuses a greater amount of attention on the individual students and enhancing their practical skills and knowledge in a more flexible learning setting (Etling, 1993). Conservation is often conveyed to students in a much more effective manner through non-formal education programs (Ballantyne, et al., 2007). By being able to visit a zoo, students are able to experience first-hand the different animal exhibits and learning experiences. By being able to connect the conservation issues they are learning about with the actual animals, students are likely to

have a clearer understanding of the overall conservation message that the zoo and the teachers are trying to communicate.

2.3 Assessment of Non-Formal Education

The assessment of non-formal education models is necessary in order to evaluate the level of success that a particular model has in developing students' skills and interests in the subject matter as a direct result of their experience with the program (Colardyn & Bjornavold, 2004). If the students are not gaining any additional knowledge or insight through a field trip or other non-formal education experience, then teachers will not view these experiences as a positive addition to the formal curriculum. Thus, it is imperative that different strategies for evaluating knowledge transfer and behaviour change are considered so as to develop the best evaluation instruments for the particular situation at hand.

In a non-formal education environment such as the Melbourne Zoo, knowledge and the comprehension of important educational information by students is a high priority for both teachers and zoo educators. According to *Bloom's Taxonomy,* there are six levels of cognitive processes that are identified by Bloom; remember, understand, apply, analyse, evaluate, and create (Vanderbilt University, 2013). These six cognitive processes all stem from basic knowledge, which is subcategorised as factual, conceptual, procedural, and metacognitive. Factual knowledge is being able to understand facts, terminology and specific details. Conceptual knowledge involves recognising classifications, categories, theories, and generalisations. Procedural and metacognitive knowledge are more in-depth and involve subject-specific retention and strategic knowledge (Vanderbilt University, 2013). When evaluating school aged children from ages 10-15, factual and cognitive knowledge of conservation would be an appropriate goal for a learning experience at the zoo. By being able to assess students on their factual and cognitive retention of conservation information and compare the analysed data to the delivery model they were exposed to, it is expected that trends will emerge to help the zoo effectively compare how successful each model was in conveying the pertinent conservation information.

Understanding the evaluation and assessment strategies that have already been developed and implemented by other conservation-based and zoo organisations will provide insightful information about evaluating effectiveness within this type of non-formal sector. The article, "Education and Conservation: Lessons from an evaluation," presents an analysis of the evaluation of the global educational programs developed by the Worldwide Fund for

Nature (WWF) (Fien, Scott, & Tilbury, 2001). The organisation was looking to evaluate criteria such as identifying the successful approaches that helped achieve WWF's conservation mission and goals, the constraints and resource issues that influence the level of success, and identifying successful networking activities that will ultimately enhance the effectiveness of WWF's programs and activities (Fien, et al., 2001). WWF set up their evaluation by dividing their evaluation into three phases as shown below in Table 1. These evaluation criteria are broken down in a way that enables this chart to be utilised by other organisations, including Zoos Victoria.

Table 1: WWF Evaluation of Activities in Contributing to the Achievement of Conservation Goals (Fien, et al., 2001)

WWF Evaluation of Activities in Contributing to the Achievement of Conservation Goals		
Phase 1	**Phase 2**	**Phase 3**
Interviews with senior staff of WWF International	Case Study visits to WWF offices and projects in 16 counties to conduct **field observations** and **interviews** with WWF staff and other key players	**Data analysis and interpretation**
Surveys sent to WWF offices	Purpose: Test and confirm findings from Phase 1	Development of **recommendations**
Analysis of: resources, materials and planning, evaluation documents	Purpose: Collect further information and data about education processes within the conservation mission	Prepare a **final report** of all the findings

2.4 Assessment of Behavioural Action in Conservation Campaigns

In addition to information retention, Zoos Victoria is also looking to measure how many students become actively involved in helping aid the conservation fight after their time at the zoo and how this relates to what delivery model they were exposed to. In order to effectively measure this without a large bias, the students from every group need to have the opportunity to be exposed to the same information during their visit. The zoo has taken this into account and recognises that every student who visits the site will have the opportunity to specifically visit the Sumatran Orang-utan exhibit (Livermore, 2013). By visiting this exhibit, every visitor will be informed of Zoos Victoria's involvement with the international campaign; *Don't Palm Us Off* (Zoos Victoria, 2013a). This campaign works to raise awareness about unsustainable palm oil production and encourage community action in support of the campaign. Deforestation of the orang-utan's natural habitats in south-east Asia has increased dramatically over the past 100 years to enable logging and palm oil plantations

to expand (Zoos Victoria, 2013e). This in turn has led to the Sumatran Orang-utans currently being categorized as a critically endangered species after a widespread destruction of their rainforest habitat.

By visiting the orang-utan exhibit, visitors are informed of this campaign and what they can do to help make a difference (Zoos Victoria, 2013e). One such way that visitors can become involved in the campaign is to voice their opinion about specific labelling of consumer products that contain palm oil and whether the palm oil used is considered CSPO (Certified Sustainable Palm Oil) or unsustainable (Zoos Victoria, 2013b). The campaign is working towards this change in legislation in order to give consumer's the power and choice to make informed decisions about their purchases (Zoos Victoria, 2013b). Student visitors are also encouraged to write to one of their favourite food manufacturers and request that they only source CSPO (Zoos Victoria, 2012).

In addition to the *Don't Palm Us Off* campaign, Zoos Victoria is actively involved in four other campaigns that visitors can learn about during their visit to the zoo. The Western Lowland Gorillas species is currently in danger as the illegal mining of coltan continues to destroy their native habitat. The *They're Calling on You* campaign is working to collect and refurbish old mobile phones that contain this mineral (coltan) in order to reduce its demand and ultimately help save gorillas from extinction (Zoos Victoria, 2013f). The platypus is part of the *Wash for Wildlife* campaign, which encourages the public to switch to phosphate-free cleaning products in an effort to keep waterways and other water sources clean and healthy for platypuses and other species (Zoos Victoria, 2013g). The southern hairy-nosed wombat is the ambassador species for the *Wipe for Wildlife* campaign. Wombats' habitats are being dramatically affected by deforestation as they lose their homes and become more exposed to the threats of other predators and human activities. Switching to recycled toilet paper is an easy way to help decrease deforestation and ultimately help the wombat species (Zoos Victoria, 2013h). Seals are the final ambassador species that Zoos Victoria has associated with a conservation campaign. The *Seal the Loop* campaign is committed to recycling plastic waste, specifically fishing line that entangles marine wildlife (Zoos Victoria, 2013d). These campaigns and the exhibit that they correspond to are summarised below in Figure 10. These ambassador species and campaigns are just another method of learning that the zoo is working to incorporate into learning programs in order to increase learning outcomes and positive behavioural changes.

Figure 10: Animal Exhibits and Corresponding Conservation Campaigns

In order to measure if the students became actively involved in fighting extinction and took away the zoo's mission of conservation importance, a standardised way of evaluating the students' active participation in the campaign efforts would be required.

2.5 Summary

By aiming to become the worlds-leading zoo-based conservation organisation, Zoos Victoria is looking to evaluate the effectiveness of their current educational delivery models and the new model in increasing conservation awareness and promoting positive behavioural changes in student visitors. Educational visits in non-formal environments such as zoos, is one of the best opportunities for students to learn about conservation and what their role is in helping to preserve endangered species and habitats. Our project will aid the organisation by presenting our findings in an official report and offering recommendations about the effectiveness of each delivery model in achieving Zoos Victoria's mission.

3.0 Methodology

The focus of this study was to evaluate three separate educational delivery models to determine how effective each was in achieving Zoos Victoria's mission of promoting wildlife conservation and positive behavioural changes while also offering valuable learning experiences through non-formal education programs. Our objectives for this project were:

- Evaluate how engaged students were during each educational program and how self-directed they were towards learning throughout the duration of their visit
- Measure the students' understanding of conservation campaigns and how that affects conservation-based behavioural changes in the students exposed to each learning model
- Measure demographic indicators and other socioeconomic factors to determine if they uniquely impacted the effectiveness of each educational model
- Compare the overall effectiveness of the three delivery models

The evaluation of Zoos Victoria's educational delivery models required a combination of assessment methods due to their mission statement being two-fold; they were interested in evaluating an increase in conservation awareness and measuring any behavioural changes that were conservation-based. The three models are each unique and offer a different type of learning experience to students and needed to be assessed separately and then compared to each other. Also, additional information in regards to the types of students participating in each delivery model was essential. Student demographics, budgeting allowance, the school's geographic location, and numerous other factors had an effect on the program that was selected by each school and therefore had an impact upon the overall results. It was necessary for the organisation to develop a standardised model that would be successful in helping to determine the overall effectiveness that the delivery models would have in achieving their mission.

3.1 Evaluating Students' Level of Engagement and Self-Directedness

Our team evaluated how engaged the students were during each educational program and how self-directed they were towards learning throughout the duration of their tour. We used an observational assessment method to gather data on the students' behaviours during their visit (refer to Appendix A). Our observations allowed us to see how each student

behaved during their experience at the zoo. We evaluated these observations to determine if the students were engaged and self-motivated during each educational program.

To conduct these observations, each member of our group observed two or three children per tour. After the students split up for the day, two or three students were selected in randomly chosen groups. We made observations about each student by following a criteria checklist to determine if the students were engaged in the conservation message at each exhibit. We used a sample size of approximately five to twelve students for each class with class sizes ranging from 30-120 students. This made the total sample size for each delivery model to be approximately 14-27 students. By observing individual students over the period of time they were at the zoo, we gathered information from the sample to determine if the delivery model the students were exposed to kept them engaged. We analysed these observations to determine how much of the delivery model's effectiveness was dependent on the students' individual motivations.

Figure 11 shows five criteria used to determine if students were engaged in *The Endangered Challenge* educator-led session. Observations were taken every three minutes on each student during *The Endangered Challenge*. Out of the five criteria stated in Figure 11, the first four were positive indicators that showed if the students were engaged and the last one was a negative criteria that indicated that the students were not engaged in the lesson.

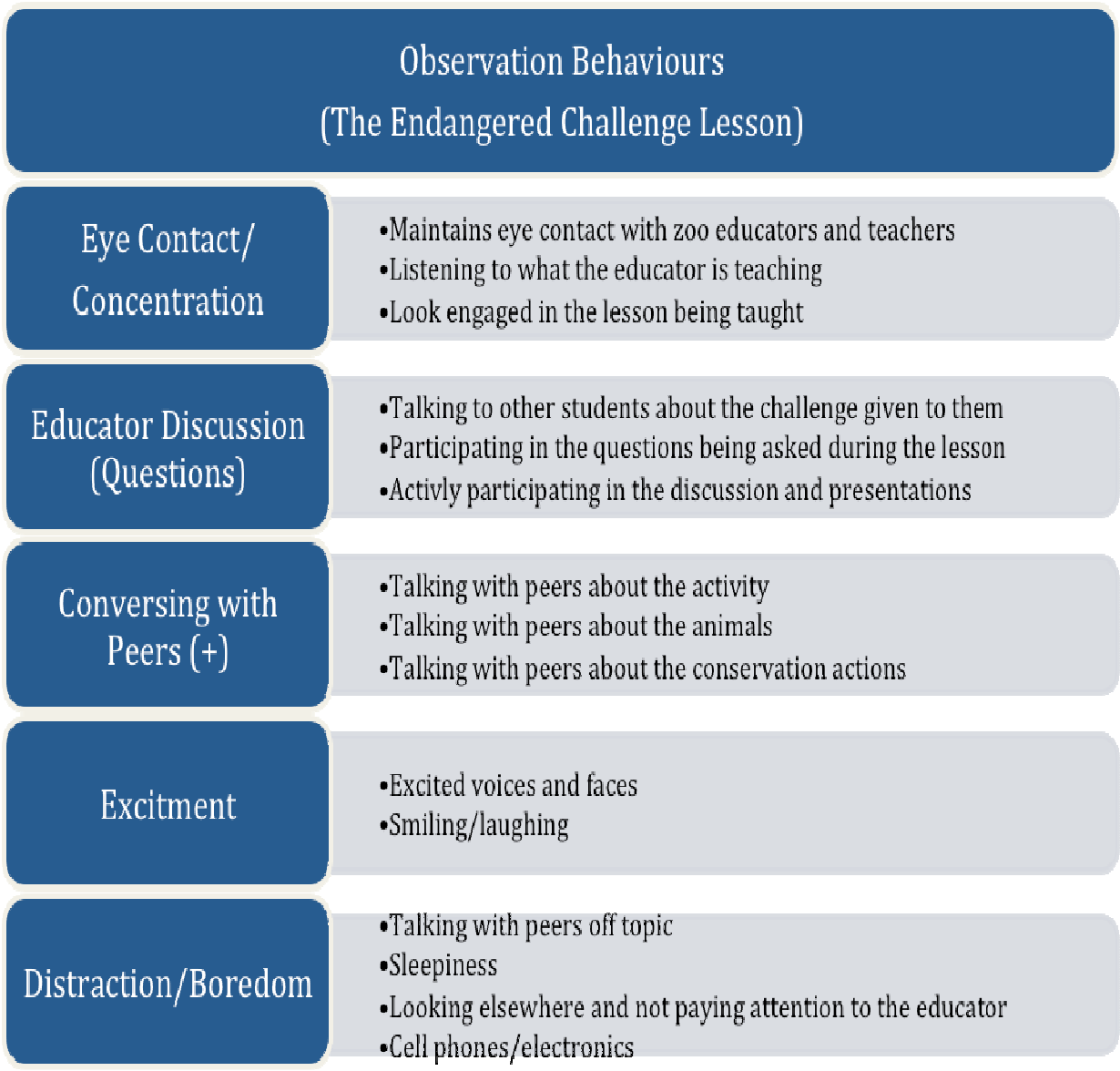

Figure 11: Observation Behaviours Criteria for Educator-Led Delivery Model

We used a second set of criteria that were observed at each exhibit along with the time spent at each exhibit. Figure 12 shows each of the criteria used to determine the engagement and self-directedness of the students. For example, if the student was excited and talking positively with peers, they were engaged in the exhibit and if the students were reading animal signs and asking questions they were self-directed in their learning. The first three criteria in Figure 12 show if the students were self-directed in their learning, the first five criteria show if the students were engaged at the exhibit, and the last two criteria show if the students are not engaged in the exhibit.

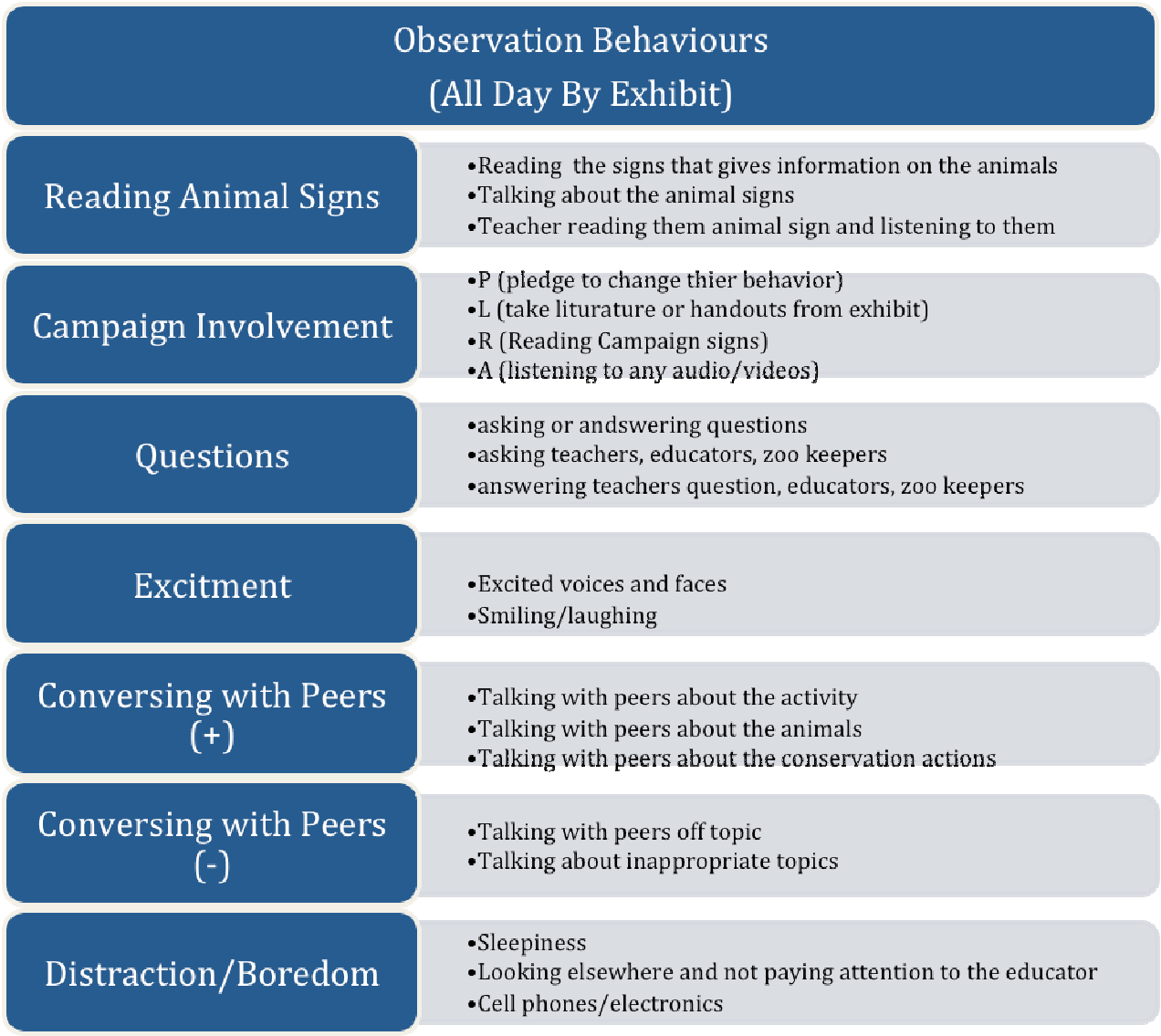

Figure 12: Observation Behaviours Criteria for Self-Guided Portion of Delivery Models

These observations allowed us to see how the delivery model the students were exposed to affected their learning throughout the day. There were other incidental factors that also influenced the students' learning throughout the day; e.g. quality of teacher's instruction, weather, and behaviour of other students, but these observations were primary indicators of which delivery model was most effective.

3.2 Measure Students' Campaign Understanding and Conservation-Based Behavioural Changes

Another method we used to evaluate the delivery models was to distribute two similar surveys to the students that were completed at the conclusion to their visit to the zoo, and after they returned back to their schools a few weeks later. Although observing students gave

us valuable data pertaining to how interested the students were during their time at the zoo, we still needed to determine how well they retained information they learned. Information was also collected to determine if the students were planning to act on conservation issues the zoo is trying to promote and if they actually did. Before leaving the zoo, the teachers were given a post-visit survey. We asked them to administer the survey to the students about three weeks after their visit, just after the students returned from a two-week school holiday.

The short surveys included questions asking the students if they have done anything to help the conservation effort. They were made up mostly of multiple-choice questions, making it easier for students to respond, while also giving us valuable data. Because it would have been incredibly difficult for us to directly observe if the students took any of the five conservation actions, we included questions about the behaviour actions in the surveys. An example action question was, “Did you take any actions to help endangered animals (check all that apply)?” This part of the survey told us how many students participated in a conservation campaign action that they learned at the zoo, and on which issues they found most important. There was also a knowledge-based section of questions on both surveys in order to determine if the students absorbed and understood the learning concepts presented to them during their visit to the zoo and if they were able to recall the same information three weeks later.

A matching question tested their understanding of which conservation action correlated to which endangered animal by having them draw a line from each of the endangered animals to the action that can be taken to aid them. This information along with knowing which of the five ambassador species the students visited were extremely important in being able to determine which delivery model was the most effective in increasing the students visitation at the ambassador exhibits while also educating them on the conservation-based campaigns that were advertised there. Another question asked what they knew about conservation in general. The full surveys that were given to the students can be seen in Appendix B and Appendix C. These surveys gave us an understanding of how well the zoo influenced the students, what lessons they took away from their visit, what actions they took, if any, to aid the conservation effort, and how well they retained the information presented to them by the exhibits and zoo instructors.

Although the surveying of the students was the most important method of evaluating behaviour change, there was an additional method that gave us good data in regards to finding out if the students took action. At around the same time that the students took the second survey at their schools, we contacted the teachers and conducted a brief phone

interview with them. These post-interviews helped our team gather information about the students' participation in following through with their conservation actions. The interviews were semi-standardised, meaning this type of interview allowed our group to ask pre-determined questions, while also allowing the interviewers to ask additional probing questions. This technique allowed our team to conduct more of a discussion with the teachers to find out if they picked up on any noticeable behaviour changes that the students displayed. An example question from the interviews was, "Have you heard any of your students talking about any of the endangered animals after your visit to the zoo?" We also asked them how related their trip to the zoo was to the curriculum and if they had taught any conservation-based lessons before or after their visit. These interviews gave us more of a "big picture" idea about the behavioural changes of the students, focusing more on the class as a whole instead of each individual student's actions. The list of interview questions we asked the teachers can be found in Appendix D.

3.3 Compare Effectiveness of Each Delivery Model

By evaluating the information gathered from surveys, observations, and post-visit interviews with teachers, we were able to compare the effectiveness of each delivery model. In order to measure if the students became actively involved in fighting extinction, a standardised way of evaluating conservation action taken by the students was required. At the end of our two-week observation period, we followed up with the students to determine if any actions were taken. By using surveys and conducting interviews, we were able to know if the students made any behavioural changes after their visit to the zoo. We then systematically organised the data and information for each delivery model.

To analyse the observations gathered, we summed all the scores recorded for each student in our sample in order to rank the effectiveness of each model. Each category was assigned a score of zero if the characteristic was not observed or one if the characteristic was observed. An average of these scores was used to show the level of student engagement, excitement, boredom, etc… for each exhibit individually and for each learning model overall. The scores were analysed separately and collectively in order to understand the changes in engagement throughout the day and how that depends on each delivery model, the type of exhibit, and the self-directedness of each student.

The analysis of the surveys was categorised by each question. Percentages of correct answers were computed for each multiple choice and matching question. These values were

compared for each delivery model and each school in order to assess basic conservation knowledge and understanding of the zoo's five campaign programs. The surveys also provided information that was useful in comparing which campaign exhibits the students visited to the students' knowledge of the conservation campaign corresponding to that ambassador animal. The first survey prompted the students to choose a conservation campaign to act on, while the second survey followed up with the students to see if any actions were taken and what they were. After compiling all survey data, we were able to analyse the surveys both individually and collectively based on school and delivery model. This provided us with the information necessary to gage knowledge retention and behavioural action.

We analysed the observations, surveys, interviews, and behaviour changes to compute a ratio of students to conservation action taken. This ratio allowed us to list the delivery models in order of how effective they were in promoting behavioural changes. Using the data from both the observation scores and the computed ratios, we were able to see how the students' engagement in the delivery model affected the behaviour change in the students. The surveys and interview responses also provided us with useful demographic information and extraneous factors that were helpful in explaining some of the trends that arose from the collected data.

Demographic and socioeconomic information was collected from each group that was observed at the zoo. These factors included class size, age of students, gender of students, type of school, schools' location, and the schools' regional economic class. Some of the above factors played a role in influencing the type of learning program selected, the amount of information retained, and the behaviour change in the students, ultimately explaining the results of our collected data. This information could be potentially used by the zoo organisation to obtain a better understanding of why certain models align better with different schools. This information in combination with all the analyses determined which delivery model was the most successful in achieving Zoos Victoria's mission of increasing both conservation awareness knowledge and behavioural action.

By evaluating conservation knowledge retention and positive behaviour changes in regards to conservation action, the zoo expected that specific trends would arise when comparing the different delivery models. The results of these assessments will have a pivotal impact on Zoos Victoria as they continue to move forward and make improvements within their organisation. Evidence and data were collected in order to determine if one model was significantly more successful or unsuccessful than the others.

4.0 Results and Analysis

The findings presented for this project are a result of direct observations, post-visit surveys, and phone interviews conducted with teachers. We observed 64 students between seven different classes; collected on-site and post-visit survey results from 317 and 220 students respectively, and conducted interviews with all seven teachers. The decreased number of surveys was due to student absences as well as missing follow-up data from one school.

An analysis of this information accompanied by additional literature review determined how effective each delivery model was when compared to each other. Observations were quantified in order to determine the level of engagement and self-directedness exhibited by the students partaking in each model. Furthermore, specific data that shows correlations between students' knowledge of conservation-based concepts/campaigns and the delivery model that they participated in were analysed to determine how effective each individual model was in achieving Zoos Victoria's mission. As a final analysis, the results from the follow-up survey were examined individually and comparatively with the on-site survey. Although the information collected from these findings fulfilled the goals set forth in our initial objectives, the limited sample size resulted in data that revealed notable differences between the three learning models, while not actually being statistically significant (see Appendix E for statistical calculations).

4.1 Sample Size

A small group of students was observed from each of the various delivery models that Zoos Victoria offers as options for schools to partake in when coming to the Zoo. On the first day of observations, HTL came to the zoo for a self-guided visit. The following week, FHS came to the zoo for two days in which both groups of students participated in the educator-led session, *The Endangered Challenge*. On the same day that the second FHS group came, MEC was at the zoo for a self-guided visit. Due to both of these schools being at the zoo on the same day, the sample size for each was significantly smaller than samples for the first two schools because the observers had to split up between the two groups. On the following days, two different schools, RH and SV agreed to visit the zoo and participate in the new delivery model that was being offered. On the last day of observations, we observed another school that participated in the educator-led session of *The Endangered Challenge*. This additional

school, SC, was added to the sample size in order to provide some variability from the results collected from FHS. The sample size for each school can be seen in Table 2 below.

Table 2: Sample Size of Observations

Sample Size of Observations		
School	**Delivery Model**	**Sample Size**
HTL	Self-Guided	8
MEC		6
FHS1	Educator-Led (*The Endangered Challenge*)	10
FHS2		5
SC		12
SV	New Model	11
RH		12

Overall, the variety of students observed varied due to availability and willingness of students to cooperate and participate in our study. The students broke up into numerous groups of varying sizes when traveling through the zoo and were chosen at random for observations.

4.2 Levels of Engagement and Self-Directedness

In each of the three delivery models that Zoos Victoria now offers, a majority of the students' days are spent exploring the zoo and visiting many of the animal exhibits. Our observations looked to measure the level of engagement the students had at the exhibits throughout the day and also the level of self-directedness the students had in their learning. We measured the engagement of the students by looking to see if the students showed any positive behavioural observation criteria; excitement and conversing with peers positively. We also made note of any negative behavioural observation criteria; conversing with peers negatively and distraction/boredom. Additionally, we measured the level of self-directedness the students had in their learning by looking at three different criteria; reading animal signs, campaign involvement, and asking questions.

4.2.1 Engagement of Students Throughout the Day

Through our observations, we found that the students had a high level of engagement throughout the day that was not dependent on the model they were exposed to. The self-guided model kept students positively engaged for 86% of the time that they spent at the exhibits while the new model kept students engaged for 81% of the time. The educator-led session kept the students engaged for an average of 75% of their time spent at exhibits, which was slightly lower but not statistically significant. On average, all models combined for a total of 81% of positive engagement time at the exhibits**.** Figure 13 shows the level of engagement by delivery model by showing positive and negative behaviours of the students while at exhibits.

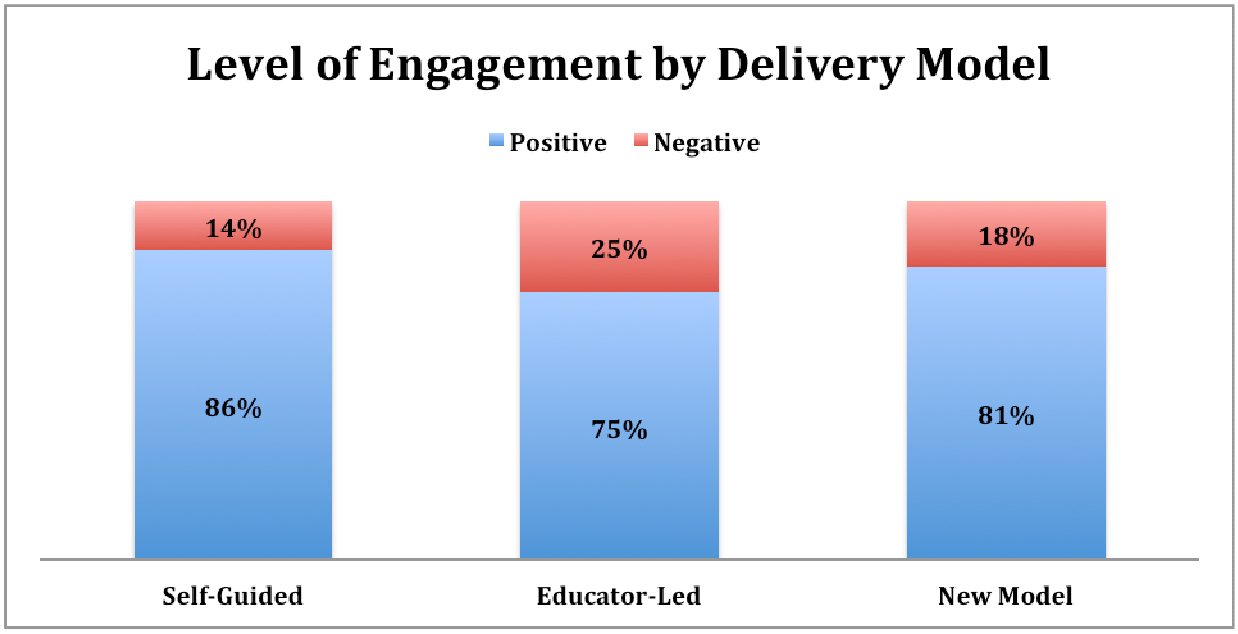

Figure 13: Level of Engagement by Delivery Model

The observations were only taken at each exhibit the students visited because we were passively observing the students to cause minimal effect on their normal behaviours. This means any behaviour that occurred in between exhibits were not accounted for. Regardless, the information that was collected is still relevant and important data that can be used by Zoos Victoria and their education staff. This shows that the majority of the time the students are at the animal exhibits, they were engaged. This piece of data is important for the zoo staff members to know because engagement is the first step in getting the students to learn about the conservation campaigns to help save some of these endangered species. If the students are uninterested in the animals, then they are less likely to change their behaviours to help save them.

4.2.2 Self-Directedness of Students in their Learning

The level of self-directedness was measured in each of the three delivery models. If the students were self –directed in their learning, they were the ones who went out of their way to read animal signs, ask questions if zoo keepers or teachers were there, and/or were active in any campaign involvement at the five ambassador animal exhibits. We only assessed self-directedness at the five ambassador animals because this study focuses on the five campaigns associated with the Gorilla, Orang-utan, Platypus, Seal, and Wombat.

Each ambassador animal exhibit had a different combination of modes in which the campaigns were advertised. The gorilla exhibit had numerous large signs directly relating gorillas and mobile phones that were located all along the *Gorilla Rainforest Trail.* There were also two separate places along the trail where visitors can take mobile phone recycling satchels to help participate in the campaign. Lastly, there is a keeper talk daily at 9:30am in which visitors learn from a zoo educator about gorillas, their habitat, and the *They're Calling On You* Campaign. The Orang-utan exhibit is part of *The Endangered Challenge,* educator-led session in which students are given a focused lesson on the *Don't Palm Us Off* Campaign. The Orang-utan exhibit also has signs and a video that are focused on the campaign and the harmful results of using unsustainable palm oil. The Platypus exhibit has a washing machine with limited signage located in separate room than the platypus itself. The Seal exhibit has both signs and a show associated with the campaign. During the show, visitors are also encouraged to pledge to participate in the *Seal the Loop* campaign and are informed of the importance of recycling. Lastly, the wombat has numerous signs and toilets spaced throughout the exhibit that advertise the *Wipe for Wildlife* campaign. There are also signs in some of the toilets throughout the zoo, but it is unknown whether students were exposed to or read these at any point during their visit. Overall, every exhibit had different ways in which the students could participate or be informed of the conservation campaigns and therefore be self-directed towards their learning.

Figure 14 shows that the level of self-directedness in the students was significantly higher in both the new model and self-guided delivery models. The educator-led model shows about 15% of students observed showed any self-directedness in their learning compared to both the new model and the self-guided, which showed approximately 65% of the students who were self-directed.

When students take the initiative to learn during their visit at the zoo, they are able to learn the conservation message that Zoos Victoria is trying to convey to them. We found that

all three models had a high level of engagement throughout the day at the exhibits, but the level of self-directedness of the students was significantly lower in the Educator-led model compared to the new model and the self-guided model.

The new model shows that a higher percentage of the students are self-directed in their learning. By combining this with the specific direction that the new model gives the students about the conservation campaigns, many of the students exposed to this model took away the message of conservation.

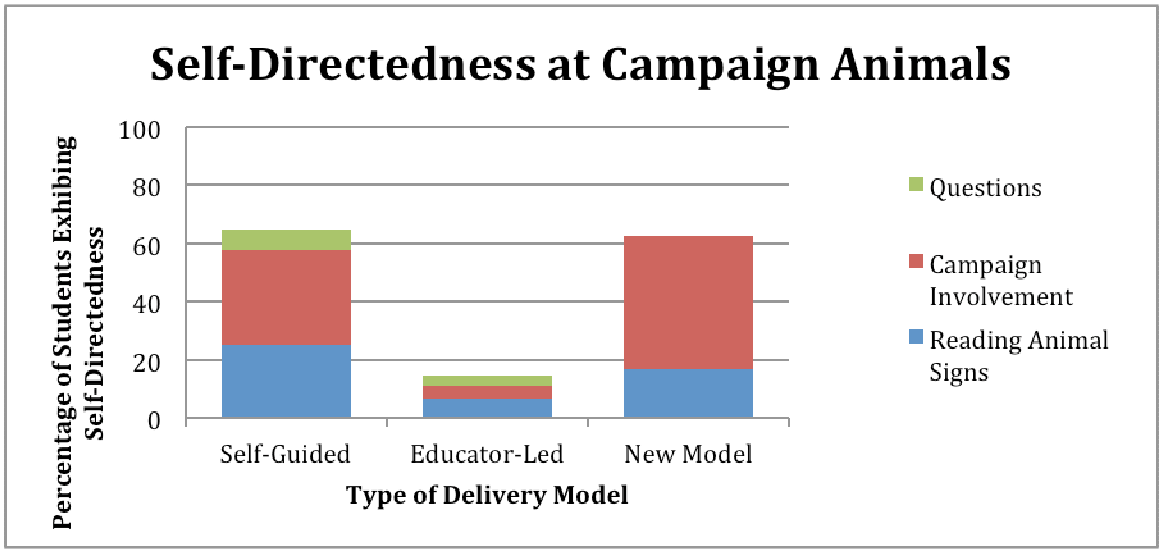

Figure 14: Self-Directedness at Campaign Animal Exhibits

The three criteria we looked at were asking questions, campaign involvement, and reading animals signs. From the graph, one can see that there was more campaign involvement in the new model compared to both the educator-led and self-guided models. This could be due to the new model having a specific focus on learning about the five ambassador animals. Also, the ability to ask questions depended on if there was someone present to answer them. For the self-guided model, the first school observed was chaperoned by a teacher all day, which gave the students the ability to ask their teacher any questions. Also, many of the students in this group went to hear a zookeeper talk about the gorillas and were able to ask him questions as well. The second self-guided model had their teacher present at the orang-utan exhibit, which allowed the students to ask questions there. The only other group to be chaperoned throughout the visit was SV who participated in the new delivery model. The difference with this group was that the chaperones were not teachers but parents, who were not as well educated on the curriculum and animal exhibits, which could explain the lack of questions. As for the educator-led sessions, further research will need to be done to understand the correlation between the classroom-like lesson associated with this model and the low levels of self-directedness exhibited by the students.

4.3 Ambassador Exhibits and Corresponding Campaigns

Zoos Victoria is actively participating in numerous conservation-based campaigns and has been working to incorporate these important concepts and messages into their exhibits at their three different sites. Melbourne Zoo is promoting five of these campaigns and has linked each one to a respective ambassador animal, in the hopes of stimulating students' interest and behaviour changes in regards to the campaign. The Corporate Department at Zoos Victoria has developed a new delivery model that is aimed towards increasing the amount of campaign involvement by encouraging students to visit the ambassador exhibits and understand how they can make a difference. Analyses of the findings showed that students' visitation of the ambassador animals and their campaign involvement significantly increased when exposed to the new delivery model compared to the self-guided and educator-led options.

4.3.1 Ambassador Exhibits and Campaigns

The number of ambassador animals that each student visited was important in order to understand if there was any increased participation or recognition of the different campaigns. Figure 15 is a representation of the seven classes that were observed and the percentage of each class that visited one, two, three, four, or all five of the ambassador animals respectively.

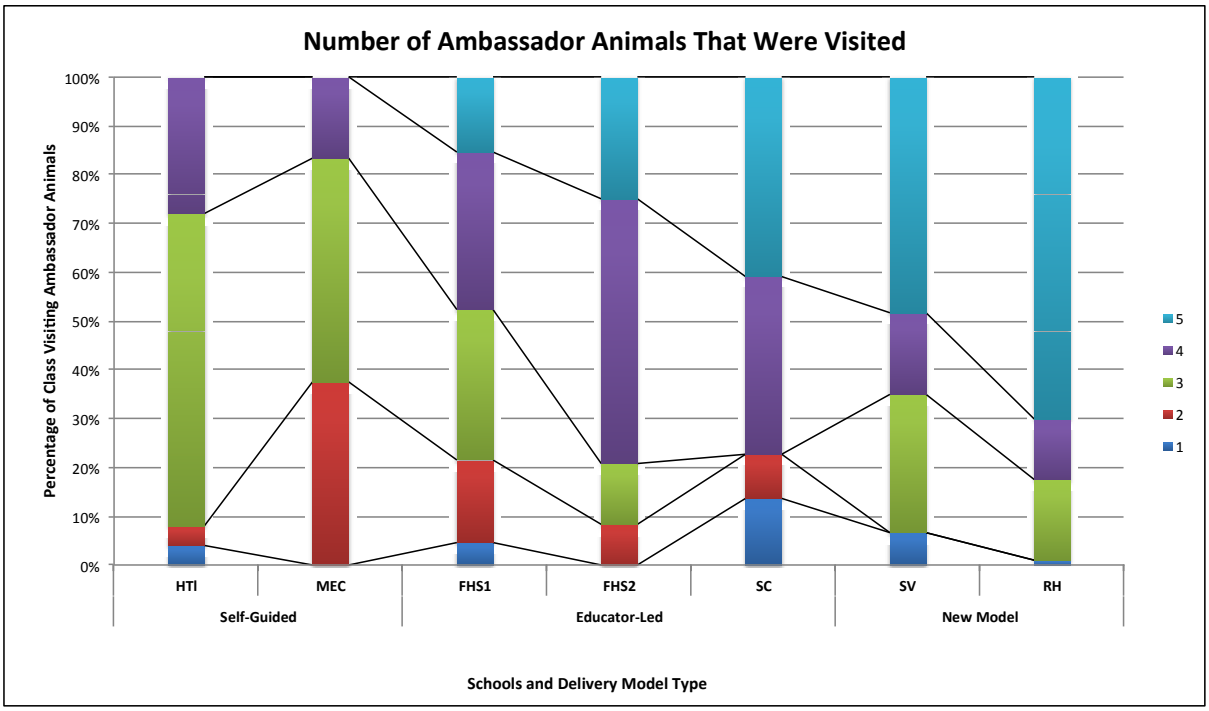

Figure 15: Number of Ambassador Animals That Were Visited

From this graph, it is easily concluded that a significantly higher percentage of the students in classes participating in the new model visited all five of the ambassador animals. There is a clear progression that also shows the educator-led model being the second most effective model at increasing student visitation to all five ambassador animals while no students from either of the self-guided visits made it to all the campaign exhibits. These results are logical based on the primary focus that comes from each delivery model. Self-guided visits are given no direction from zoo staff and therefore would be unaware of the five ambassador animals and the campaigns unless they had done research about the zoo prior to their visit. The educator-led session on the other hand is focused primarily on orang-utans and the *Don't Palm Us Off* campaign and the remainder of their visit usually had a focus that was prepared by their teacher. Naturally when students are given a worksheet or task, they make an effort to find the information they need and stop at as many exhibits as possible along the way. Lastly, for the new model, a zoo educator met with the class at the start of their visit and encouraged the students to visit each of the five ambassador species and learn about what each individual can do to make a difference. By providing the student with a map of the zoo highlighting the locations of the five exhibits (see Appendix F), the students were given the freedom to explore the zoo while also maintaining an emphasis on the specific exhibits that they were encouraged to visit.

4.3.2 Campaign Involvement

When students visited each of the ambassador animals, it was also of interest to know whether they were aware of, and attempting to learn about the conservation campaigns. This information could be evaluated by itself and also in conjunction with the results from knowledge-based questions to show if any trends developed between the amount of conservation participation and percentage of knowledge-based conservation campaign questions answered correctly. The graph shown in Figure 16 below shows the average amount of campaign involvement per school. The graph is broken down by the type of campaign involvement observed in order to educate Zoos Victoria on what types of involvement the students are the most or least interested in.

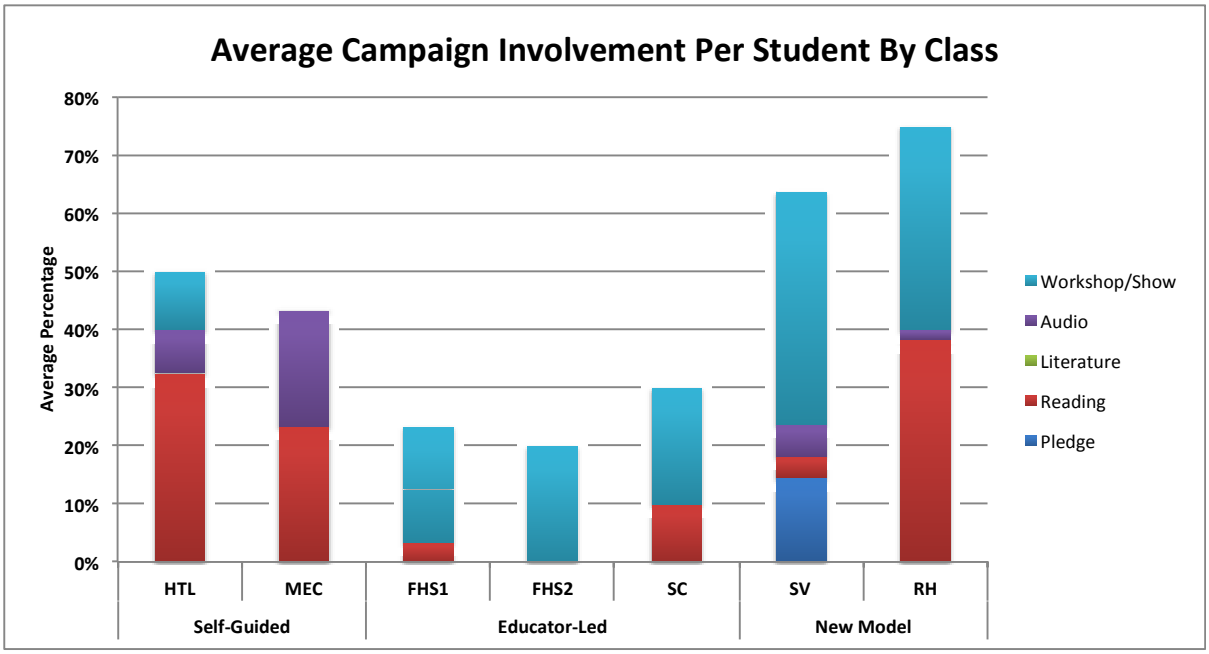

Figure 16: Average Campaign Involvement per Student

Overall, the relevant information that can be obtained from this graphical analysis is that the new model resulted in the most campaign involvement, followed by the self-guided model, and finally the educator-led model. Again, this shows that the new model is working well at increasing the amount of student visitation and participation at the five ambassador species exhibits, which is what the zoo is aiming to accomplish. The limited campaign involvement shown by students in the educator-led model follows the same trends that were observed in Figure 14, and there is a viable hypothesis that can explain the data results. When a group of students go to an informal learning environment, such as a zoo, their first instinct is not usually geared towards learning in a formal-type setting. Therefore, being put in 45-minute learning environment directly upon their arrival may account for the lack of educational campaign involvement throughout the remainder of their visit. According to Boron et al. (1983), a certain level of independence is needed when students are put in an informal learning environment in order to stimulate their interest and lead to further learning and understanding in a formal classroom environment (Borun, Flexer, Casey, & Baum, 1983). This may explain why a shorter workshop offered later in the day during the new model visits resulted in more students being actively involved in the campaigns throughout the entirety of their visit.

4.4 Determining Students' Understanding of Conservation-Based Concepts

The main tool that was used to determine the students understanding of conservation and the various campaign programs was the survey that was given at the end of the day to all of the students involved in the study. The survey was broken down into four multiple choice/matching questions and two open ended questions. The results from each question were analysed by each school and delivery model in order to determine which model was the most effective in delivering important educational information to the students.

4.4.1 Ambassador Animals Visited by Each Student

Although the first question on the survey asked about the exhibits each student visited, it didn't alone tell us their understanding of conservation-based concepts. This question could later be correlated to knowledge-based question results to see how visiting the exhibits affected the students' learning. This question shows which of the ambassador species were the most visited (Figure 17).

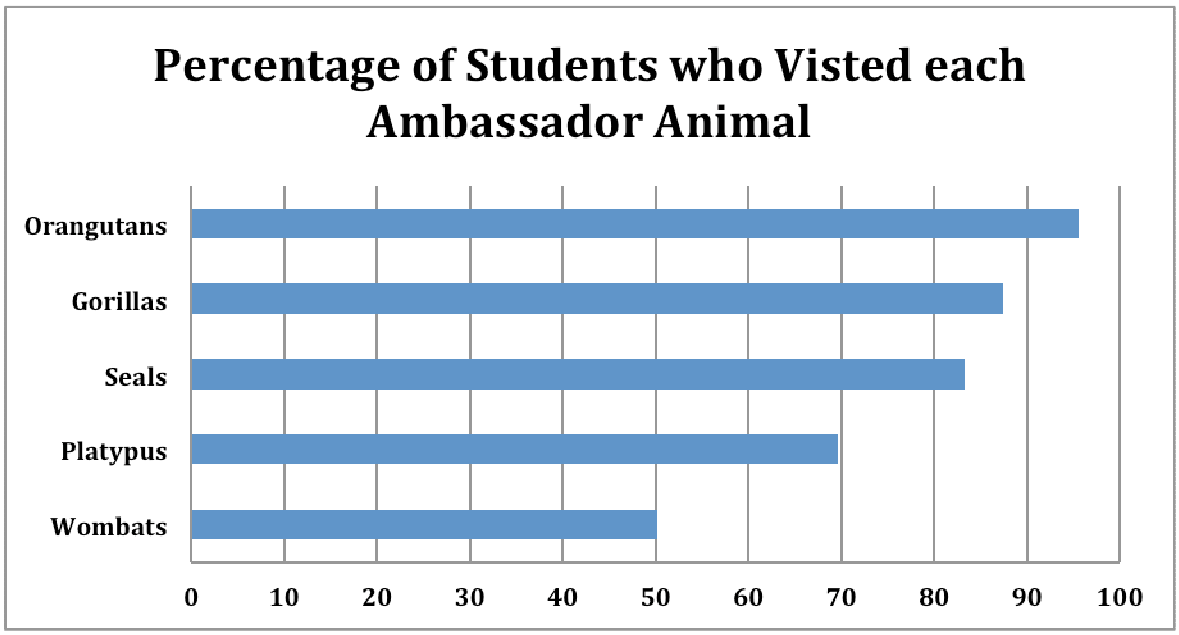

Figure 17: Percentage of Students who visited each Ambassador Animal

4.4.2 General Conservation Knowledge

The second and third questions on the survey were added to assess whether the students knew two basic conservation terms that they had the opportunity to learn about during their time at the zoo. The first asked what "conservation" is while the second one asked what the word "endangered" means. Both questions gave four possible choices with

only one being the correct answer. The correct answers were tallied and percentages of correctness were calculated for each school in regards to each question. The results can be seen below in Table 3.

Table 3: Survey 1, Questions 2 & 3 Results

Results from Survey 1; Questions 2 & 3				
Delivery Model	**School**	**% of Class that answered "conservation" question Correctly**	**% of Class that answered "endangered" question Correctly**	**Average of <u>both</u> knowledge-based questions**
Self-Guided	HTL	88	80	84
	MEC	83	96	89.5
Educator-Led	FHS1	88	91	89.5
	FHS2	67	92	79.5
	SC	82	86	84
New Model	SV	48	78	63
	RH	81	90	85

From this table, it appears that the type of delivery model in which the students participated and therefore the amount of interaction they had with zoo staff members did not have an effect on how much they knew about the terms "conservation" and "endangered." According to this analysis, the schools that participated in the self-guided delivery model actually did better on the two knowledge-based questions than the other two models. Additional research is needed to understand if any other factors influenced this trend such as the schools' curricula.

4.4.3 Knowledge of Five Ambassador Campaigns

The fourth question on the survey was the most important for measuring the students' conservation-based understanding pertaining to each of the five ambassador species.
To gain an understanding of how well the students understood the five campaigns, an analysis of the average total percentage of questions answered correctly was calculated by delivery model. This way, the models could easily be compared to one another to determine which was the most effective in successfully delivering the conservation campaign messages to the students. A visual depiction of this analysis can be seen below in Figure 18.

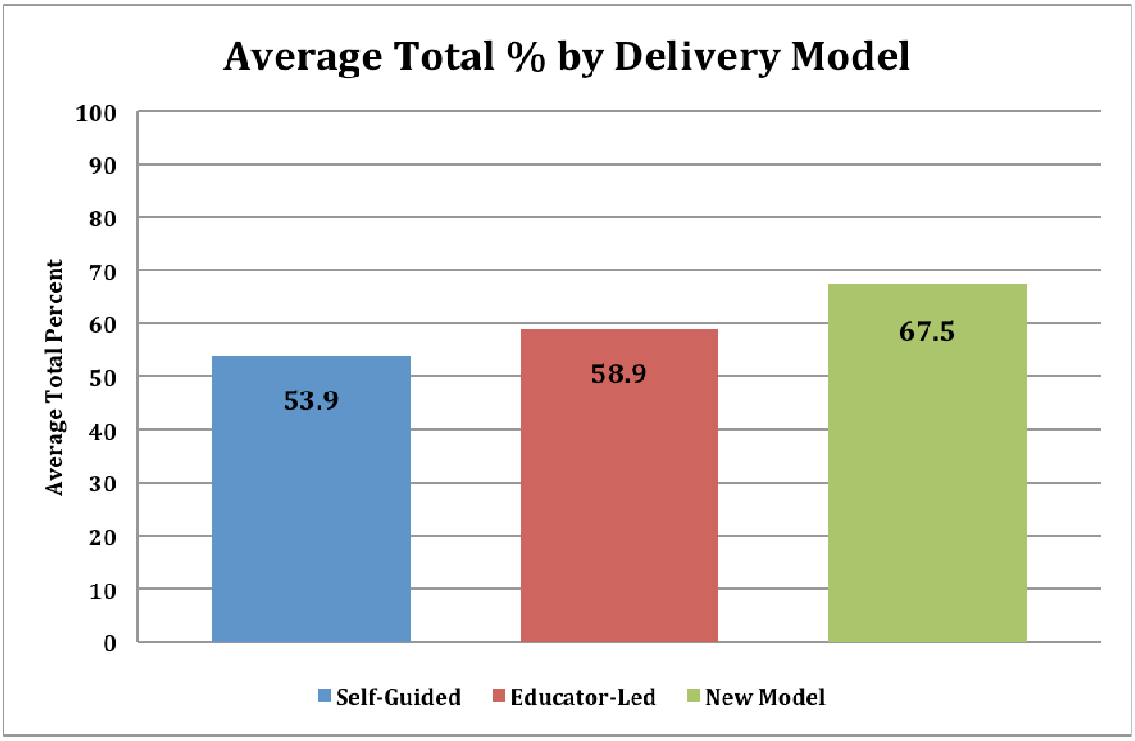

Figure 18: Average Total Percentage of Answers Correct by Delivery Model

This graph normalises the data by taking the mean of the students exposed to each delivery model in order to evaluate the data by model instead of by individual schools. From this analysis, it is apparent that the new model has a considerably higher percentage value than any other model. This again shows that the new model is the most effective in helping students to connect the ambassador animals to their corresponding conservation campaigns. The graph also shows that the self-guided visits scored the lowest overall but a larger sample size would need to be observed to validate these results, especially when comparing the self-guided and educator-led models in Figure 18 above.

Percentages of students who got each answer correct were also calculated for each school and bar graphs could be produced to display the data. A sample of an analysis done for one of the ambassador animals (gorilla) can be seen below in Figure 19.

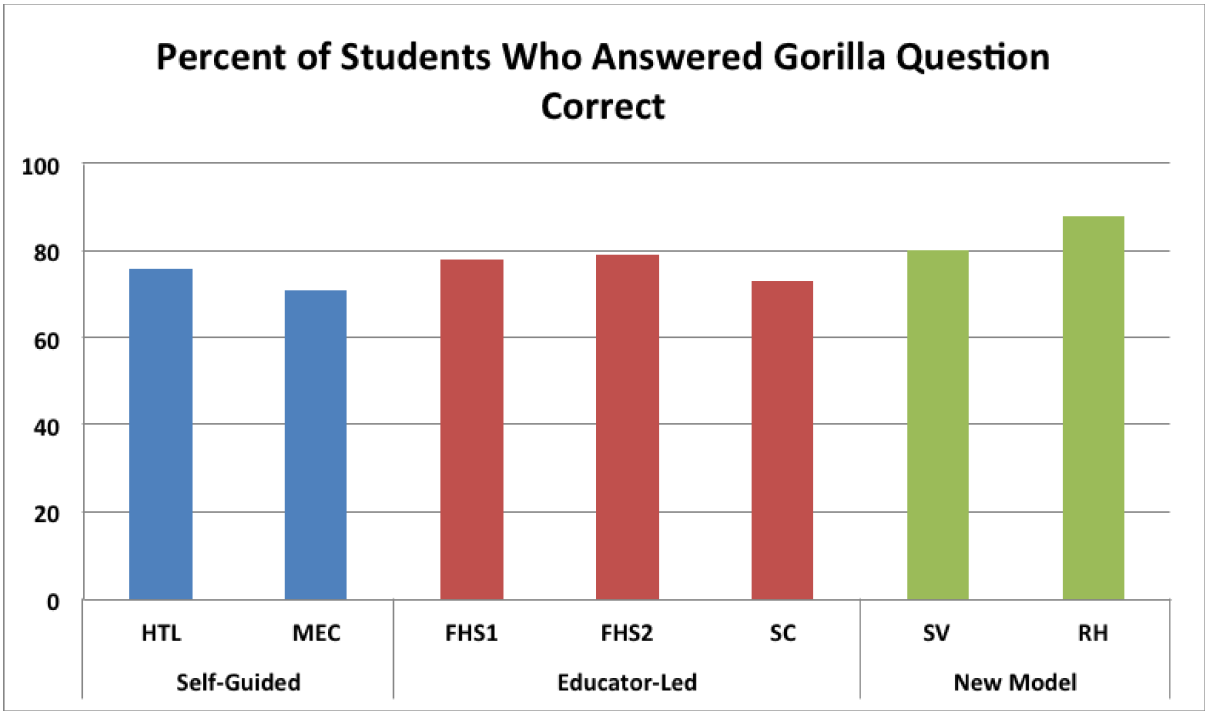

Figure 19: Percentage of Students Who Answered Gorilla Question Correctly

This graph measures the percentages of students from each school who were able to match the recycling mobile phones action to preserving the habitats of wild Gorillas. Although the differences are slight between the three delivery models, the data suggests that the new model was more effective in helping students to understand the connection between the conservation campaign and the ambassador animal. The p value taken from a statistical significance analysis was 0.058, making it just above 0.05 (the chi-square value proving significance). This means that although these data are not quite statistically significant, it can still provide relevant data that can be used in understanding the trends (see Appendix E for statistical calculations).

The other ambassador animal that was important to our research was the orang-utan. This is because the educator-led, *Endangered Challenge* program, focused primarily on orang-utans and the *Don't Palm Us Off Campaign*. It was important to evaluate the percentage of students who answered this matching question correctly in order to understand how successful the educator-led session was in delivering this specific campaign message. The results from this analysis can be seen below in Figure 20. The graphs for the seal, platypus and wombat can be seen in Appendix I.

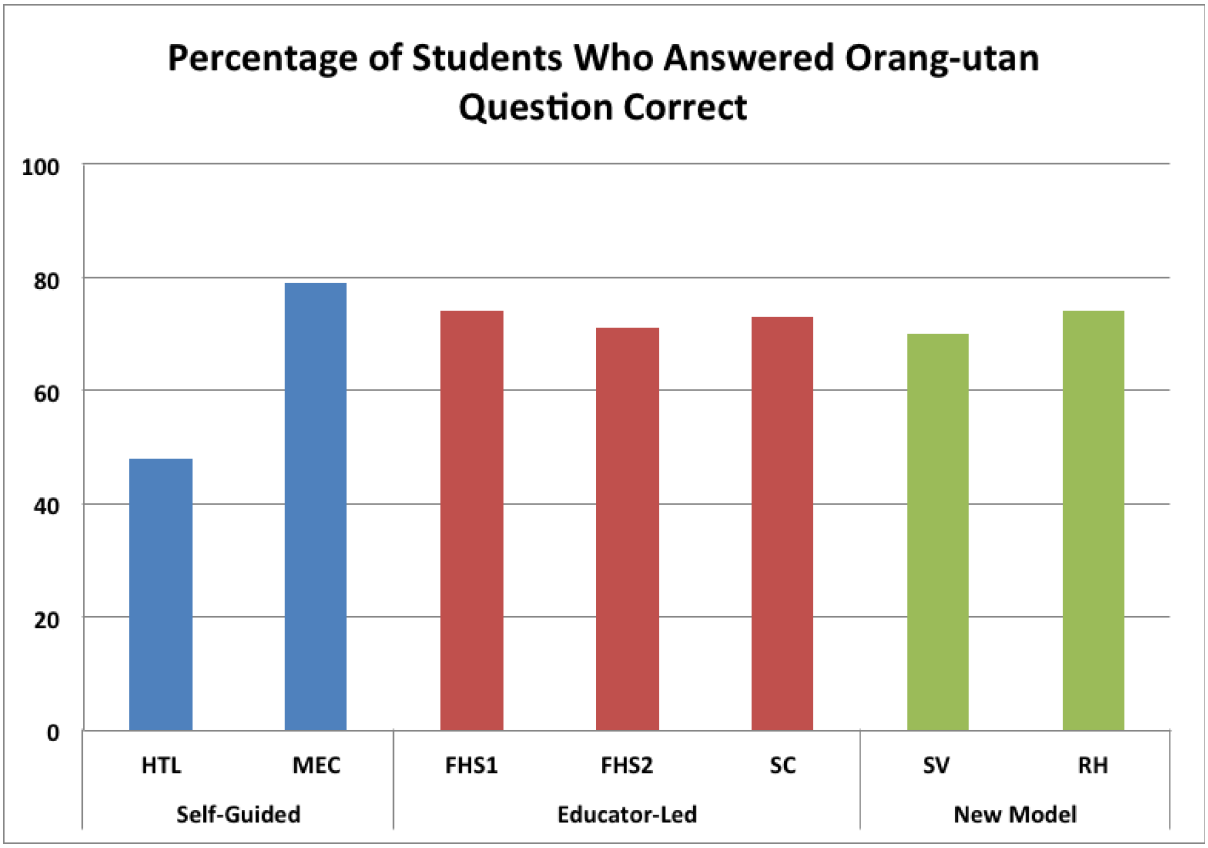

Figure 20: Percentage of Students Who Answered Orang-utan Question Correctly

The graph shows that all the schools exposed to the new model and the educator-led model scored in the low to mid 70th percentile. This is relevant information as FHS1, FHS2, and SC were exposed to a 45-minute educational session and scored no higher than SV and RH who were offered an optional ten-minute session in which they were exposed to the same information. It was approximated that about 60% of the SV class attended the workshop whereas about 70% of the students from RH attended the workshop. Also, there is a notable difference between the two schools exposed to the self-guided experience. This can be best explained by the level of focus that was enforced by the teacher of each school. From an analysis of observations, it was seemingly clear that HTL had much less of an educational focus to their visit compared to MEC (see Discussion section).

Another comparison that was analysed was the average number of ambassador animals visited by each class and the total percentage of correct responses for the matching question. The following table (Table 4) shows the values that were calculated for this comparison. A correlation test was run that resulted in an r-value of 0.411; a medium correlation (see Appendix J for linear correlation scatterplot).

Table 4: Average Number of Ambassador Animals vs. Matching Questions Total % By School

School	Average # Ambassador Animals Visited	Matching Question Total %
RH	4.55	65.6
SV	4.02	70.6
FHS2	3.94	59.2
SC	3.82	53.8
FHS1	3.37	60.4
HTL	3.08	44.0
MEC	2.79	64.2

With the green schools being new model participants, the red being educator-led, and the blue being self-guided, a pattern it can be noticed by observing the table that the new model schools visited more ambassador animals and therefore had a higher percentage of answers correct for the matching question. The reason for the new model schools visiting more of these animals could be due to the way the model is presented but a question could be asked about why all groups that attended the endangered challenge also visited more of the other ambassadors than the self-guided when neither model was directed to those specific exhibits. One possible answer to this could be due to the nature of each school's visit, independent of the delivery model.

Another important observation that can be made about this table is the fact that both new model schools clearly scored higher than all educator-led and self-guided groups. Though one self-guided visit comes extremely close to one of the new model's average percentages, the other self-guided group performed comparatively lower. Each of these groups had outside factors that influenced how well they performed on the knowledge-based questions. The educator-led sessions consistently performed in the 50-60% range, making it less effective than the new model. By inspiring the students to visit more ambassador animals, the new model is fulfilling Zoos Victoria mission more effectively than the educator-led model, which works to target only one specific ambassador animal.

4.4.4 Comparison of Effectiveness By Delivery Model and Ambassador Animal

Though the bar charts displayed in the previous section all contain useful data, a more holistic view of the data can be displayed through the use of radar graphs, which more effectively compare the data.

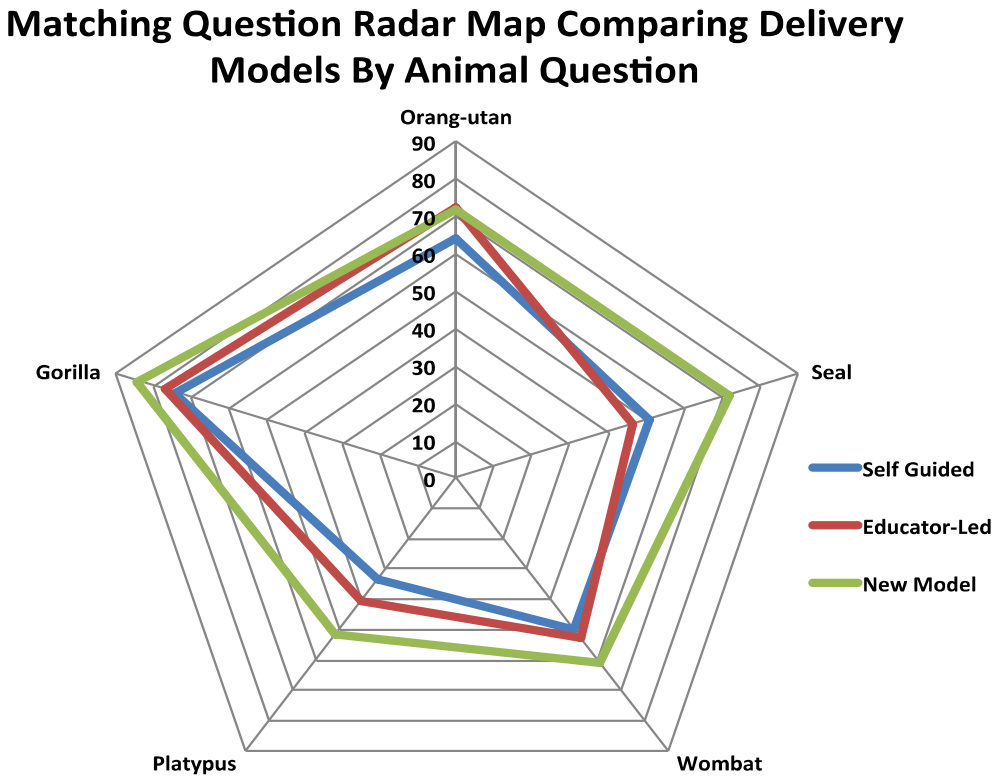

Figure 21: Matching Question Comparing Delivery Models by Animal

Each vertex of the graph shown in Figure 21 above represents one of the ambassador species while each coloured polygon (line) represents one of the three delivery models. The model can best explained in the following way:

- The lower scores are closer to the centre of the graph while the higher scores are towards the outside of the graph

As can be seen above, the new model encompasses both of the other models meaning that the students exposed to the new model, on average, scored higher on all questions than the students on the self-guided and educator-led visits. The slight bit of overlapping of the green and red lines at the orang-utan vertex shows that the students who attended these educator-led, orang-utan-specific sessions scored almost identically on the orang-utan matching question as the students exposed to the new model. Also, for the most part the self-guided students (blue polygon) scored lower than the educator-led students (red polygon), only overlapping at one of the ambassador animal exhibit vertices. This means that even though the students who were in the educator-led group were only directly informed of the issue of

orang-utan extinction, they still performed slightly better overall than the students who participated in a self-guided visit. Also apparent from this graph is the large gap between the green line at the seal vertex and the other two coloured lines. This shows that the students exposed to the new model scored significantly higher on the seal question than students in the educator-led sessions and the self-guided visits. This variation could also be due to SV (New Model) attending the *Seal the Loop* show as an entire group. See discussion section for further information pertaining to this factor.

Another important comparison that was analysed was the percentage of students who visited each of the ambassador exhibits and answered the corresponding matching question correctly. By calculating the Pearson Correlation coefficient, a relationship between the results can be determined. (see Appendix G). There was a moderate correlation between the percentage of students who visited each exhibit and the percentage of students who answered the question pertaining to that respective ambassador animal and campaign correctly. This is important as it shows that more students are likely to learn about and understand the campaigns if they visit the different exhibits, which is the overall goal of the new model. Table 5 below shows these respective values that were calculated for all of the schools in the sample size combined. The correlation coefficient that was calculated from Table 5 was 0.633. The comparison of percentages for each of the individual schools can be seen in Appendix H. It should be noted that this value was determined based on a very small sample size.

Table 5: Comparison of Percentage Students who Visited Exhibit and Percentage of Correctly Answered Questions

Ambassador Exhibits	Percentage of Students who visited Exhibit	Percentage of Students who Answered Question Correctly
Orang-utans	97%	70%
Gorilla	86%	78%
Seals	79%	55%
Platypus	64%	41%
Wombats	40%	54%

Though this map works well to compare the delivery models by breaking down the results by animal, another radar graph (Figure 22) was created and analysed in an effort to compare the animals by displaying the results by delivery model.

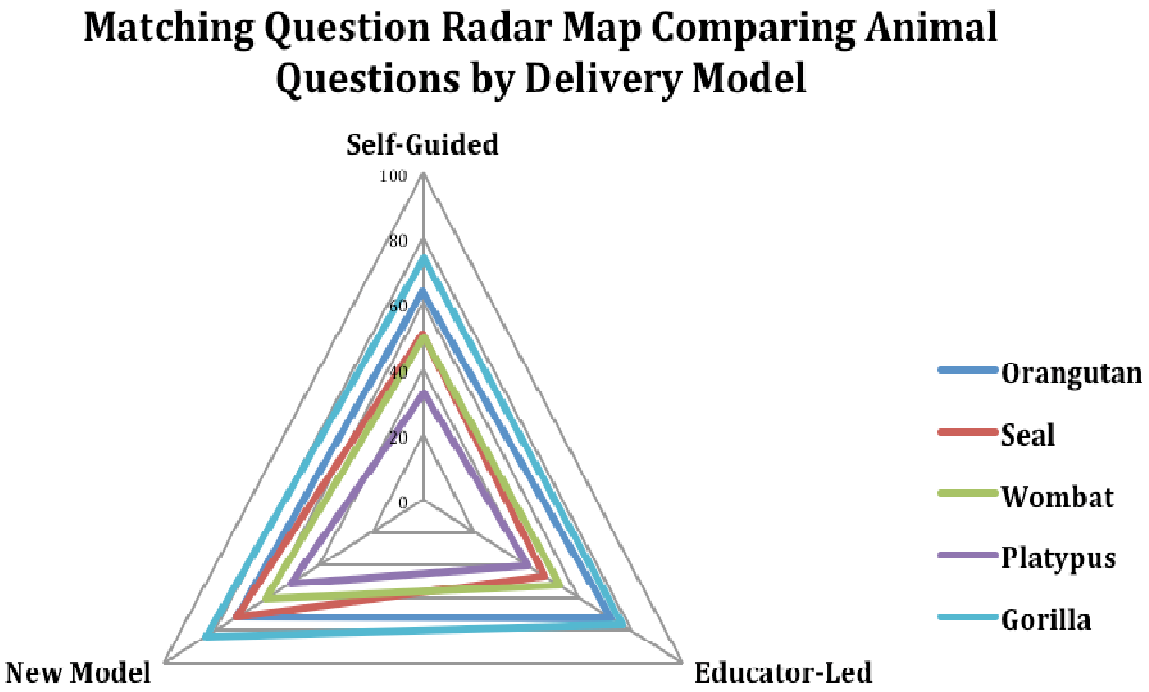

Figure 22: Matching Question Comparing Animal Questions by Delivery Model

In this graph, each corner represents a delivery model while each coloured polygon represents an ambassador species. The light blue lines clearly make up the largest polygon, encompassing all other polygons inside it. This means that on average, students from all models scored the highest on the conservation question about the gorilla. In contrast, the purple polygon is the smallest, as it is inside all other shapes on the graph. This shows that the students scored the lowest on the platypus consistently. These observations are important as we look to understand which campaigns were best understood by the students and allow us to provide useful recommendations to Zoos Victoria about what can be done to improve the students' overall understanding of the five different campaigns.

Another observation that can be made from this visual is that the gorilla line is outside the orang-utan line even at the educator-led vertex of the graph. This shows that students who participated in the educator-led session scored lower on the orang-utan question compared to the gorilla question even though they attended a 45-minute session dedicated almost completely to orang-utans and the *Don't Palm Us Off* Campaign. Additionally, the seal and wombat lines overlap on most parts of the graph except for near the new model vertex where the seal is clearly displaying a larger value. This means that students from the new model scored significantly higher on the seal question than the wombat question, contrary to how the other two model's scores related. Lastly, the corners of all five triangles are pulled towards the new model vertex of the graph. Although this observation is better represented

on the first radar graph because it is a comparison of delivery models, this also shows how students exposed to the new model scored higher on all animal questions on average.

A few hypotheses can be made to explain the trends that arose regarding the successfulness of each animal. As shown clearly in Figure 22 the students' knowledge of the platypus campaign was consistently less than all the other ambassador animals. The only campaign signs and visuals that publicise the *Wash for Wildlife* campaign are in a separate room attached to the platypus exhibit. The visuals in this room are a large washing machine with fish inside of it and a clothesline that hangs above the machine with information on it as seen below in Figure 23.

Figure 23: Campaign Visuals for Platypus

As can be seen, the information provided on the clothes above the washing machine would be difficult for students to fully understand or even notice. This type of signage and its location may explain why the platypus consistently is less known by the students in comparison to the gorilla, which is the most correctly answered question. Unlike the platypus, the signs at the gorilla exhibit are very large, noticeable, and are easy to connect with the *We're Calling On You* campaign.

Figure 24: Collage of Signage for the Gorilla Exhibit and *They're Calling on You* Campaign

The easy to read signs shown in Figure 24 might be the reason why the gorilla campaign was consistently better understood by the students than any other animal campaigns. The gorilla campaign about recycling mobile phones may also be easier for students to understand than the platypus campaign that involves switching to phosphate-free cleaning products. The graph in Figure 22 also shows that that the students' knowledge of the seal and wombat campaigns is relatively equal, even though they are not the most visited ambassador animals. This could be that there are campaign signs relating to these animals at more places than just the exhibit. For example, there are many signs about *Wipe for Wildlife* in the toilets and *Seal the Loop* signs on many rubbish bins that explain how recycling helps save the seals. A map of the zoo showing the various locations of signs and displays for each campaign also indicates that the platypus receives less exposure than the other ambassador animals. This map can be referenced in Appendix K. the questions pertaining to these animals could have been influenced by the students' knowledge of their campaigns that they got from areas other than the exhibit. More research can be done to prove or disprove the hypotheses behind these trends.

4.4.5 Time Spent at Exhibit Compared to Average Percentage Correct for Ambassador Animals

Another important set of data that was collected was the average time spent at each exhibit. Table 7 below shows the average time spent at the five ambassador exhibits

compared to the average percentage of class who answered the matching campaign question correctly for three of the seven schools that participated in the study. The full table of all seven schools can be referenced in Appendix L.

Table 6: Comparison of Time Spent vs. Percentage Answered Correctly for Exhibits

HTL			FHS1			RH		
Self-Guided Model			Educator-Led Model			New Model		
Avg. Time (min)	% Correct	Exhibit	Avg. Time (min)	% Correct	Exhibit	Avg. Time (min)	% Correct	Exhibit
10.5	76	Gorilla	3	78	Gorilla	9	59	Seal
10	48	Orang-utan	0.25	74	Orang-utan	4	88	Gorilla
3	24	Platypus	0.25	58	Wombat	3.25	48	Platypus
1.5	48	Seal	0	49	Seal	2.5	74	Orang-utan
0	24	Wombat	0	43	Platypus	1.125	59	Wombat

This table has been created in such a way that that the ambassador animals visited by each school are in decreasing order according to average time spent at the exhibit. Because the percentage of the class who answered each corresponding question does not follow the same decreasing trend, the two data sets do not consistently correlate with each other. The only exception to this is FHS1. It should also be noted that the average time spent at each exhibit was calculated based on a small subset of the class that was observed whereas every student in the class was tested on their knowledge of the five animals. A more statistically significant sample would need to be collected to verify the reliability of these results.

4.5 Conservation-Based Behavioural Changes

Zoos Victoria has dedicated a large portion of their mission statement to the promotion of conservation-based behavioural changes. They hope that by educating students about the numerous campaigns they created, the younger generation will become more aware of the problems facing endangered species across the globe and can be educated on the steps that can be taken to save those animals from extinction. The zoo is working to promote these campaigns through visual banners and signs, video and audio displays, workshops and animal encounters in which the students are told about specific actions that can be taken to help the animals associated with each campaign. For this study, each student was asked in the on-site survey to pledge something they could do help conservation and fight extinction. A follow-up

question in the second survey asked the students if they had acted on that pledge and if they planned to in the future. This was done in order to measure the amount of conservation-based behavioural changes exhibited by the students during the approximate three-week time interval since their visit to the zoo. By comparing the amount of behavioural changes by delivery model, we were able to deduce which model was the most effective in promoting this type of social change. It should be noted that the follow-up survey from FHS2 is not included in this analyses, as it was not received back from the school in time for data comparison.

4.5.1 Evaluating Whether the Students Made Any Conservation-Based Behavioural Changes

Every student that participated in this research study was asked to pledge what he or she could do to help conservation and fight extinction before they left the zoo on the day of their visit. This question was used to get the students thinking about what they can do as individuals to make behavioural changes to help the different animals they learned about at the zoo. In order to evaluate whether the students made any behavioural changes, we asked a follow-up question in the second survey a few weeks later. In this survey, the students were asked whether they had followed through with their pledge or had taken any type of action. This information is useful as we were able to calculate the percentage of each class that made a conservation-based behavioural change and therefore, can conclude which model was the most effective in fostering students to "act for wildlife." In addition to this, students were also asked which of the behavioural changes associated with the five campaigns they had acted upon. The data collected from this portion of the survey will be helpful for Zoos Victoria as it will show which of campaigns students are more likely and willing to participate in, thus showing how successful each campaign is in promoting behavioural changes.

Figure 25 below shows the different behavioural changes that were made or planned to be made by students at each school. Each student was able to choose more than one action to take, which accounts for the percentages being greater than 100 per cent.

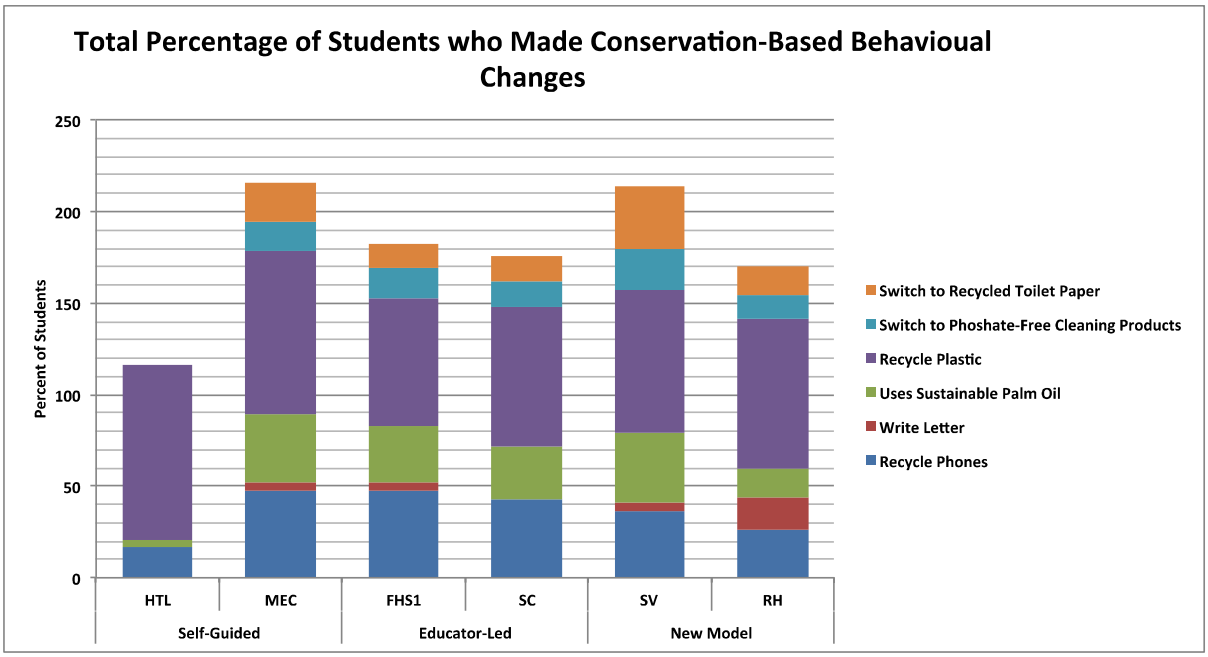

Figure 25: Conservation-Based Behavioural Changes

Additionally, Figure 26 shows which action, and therefore which campaign was the most successful in garnering student participation. The noticeably high level of recycling shows this was the most commonly taken action. A possible explanation for this trend is the level of ease associated with recycling and the younger generation of students. Also, the use of sustainable palm oil, recycled toilet paper, and phosphate-free cleaning products are actions that are not often associated with younger children, and therefore are less likely to be behavioural changes that students would make.

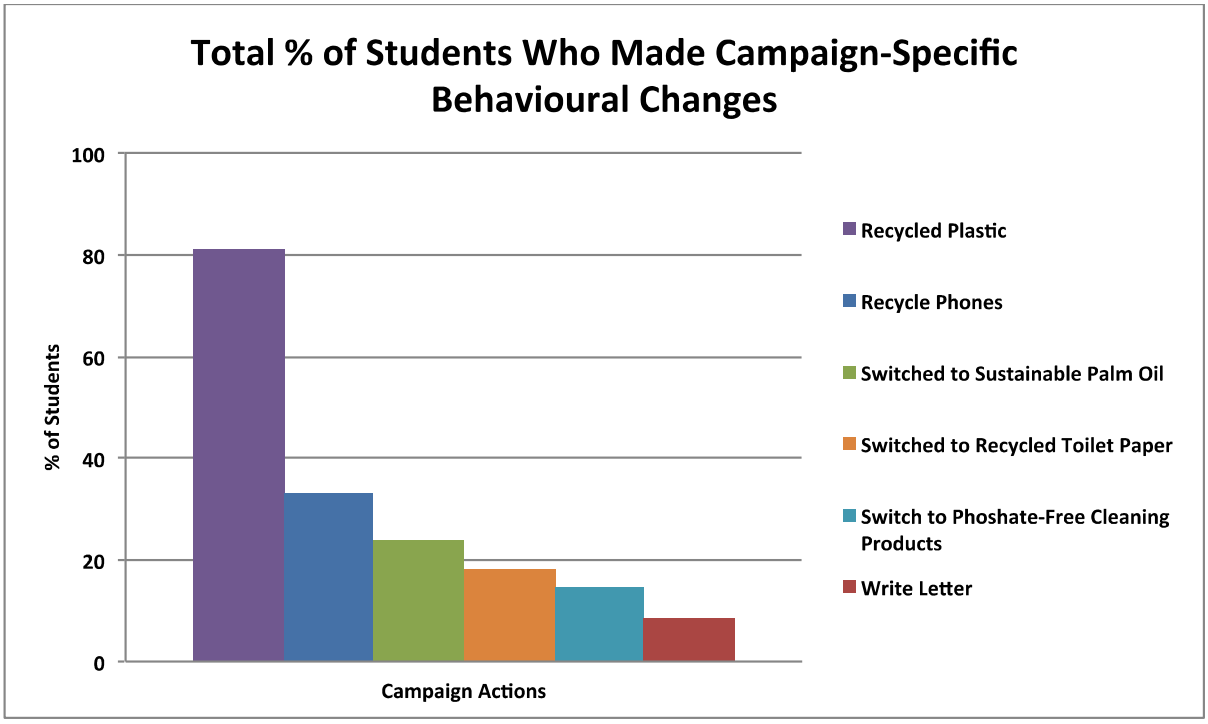

Figure 26: Total Percentage of Students Who Made Campaign-Specific Behavioural Changes

4.6 Knowledge Retention

Knowledge retention is of vital importance in all students' learning. When learning important concepts in an informal learning environment, it is critical that students are able to retain the information and apply it to work done in a formal setting. Zoo visits are a way for teachers to supplement the lessons being taught in class. If the students are not learning and retaining information that is related to a school's curriculum, then the probability that the school will schedule additional visits to the zoo is dramatically decreased. On the other hand, the zoo is also interested in how much the students are retaining. With a main focus put on increasing conservation awareness, it's essential that a majority of the visitors that come to the zoo are able to take away the information that is presented and advertised to them.

4.6.1 Comparing On-Site Survey and Follow-Up Survey Results

A follow-up survey was distributed to students as a means to test their knowledge retention a few weeks after their visit to the zoo. By asking some of the same questions on both surveys, we were able to compare the percentage of correct responses by school and compute an average for each delivery model as was done in the on-site survey. From this information, we were able to compare how each school and each delivery model compared to each other in terms of maintaining a constant level of knowledge about the conservation

campaigns. As shown below in Figure 27, almost every class's knowledge of the conservation campaigns slightly increased.

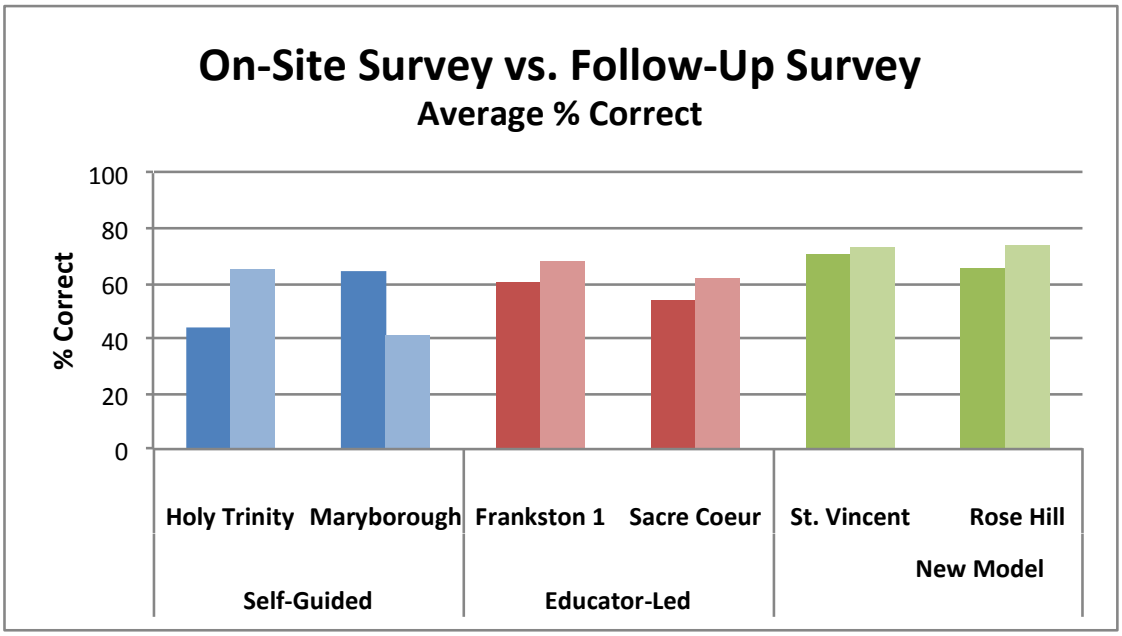

Figure 27: On-Site Survey vs. Follow-Up Survey

The only decrease, exhibited by MEC, could be explained by the fact that they were at the end of their unit of endangered species and palm oil at the time of their visit. The follow-up survey was then administered about three weeks later following a two-week holiday after which the class had moved onto a new topic. Every other school had continued their endangered species and sustainability topics into the second term of classes. This will be discussed further in later sections. Figure 27 shows that students exposed to the new model still had the highest overall level of knowledge in regards to the conservation campaigns. This can be more clearly seen in the radar graph shown in Figure 28.

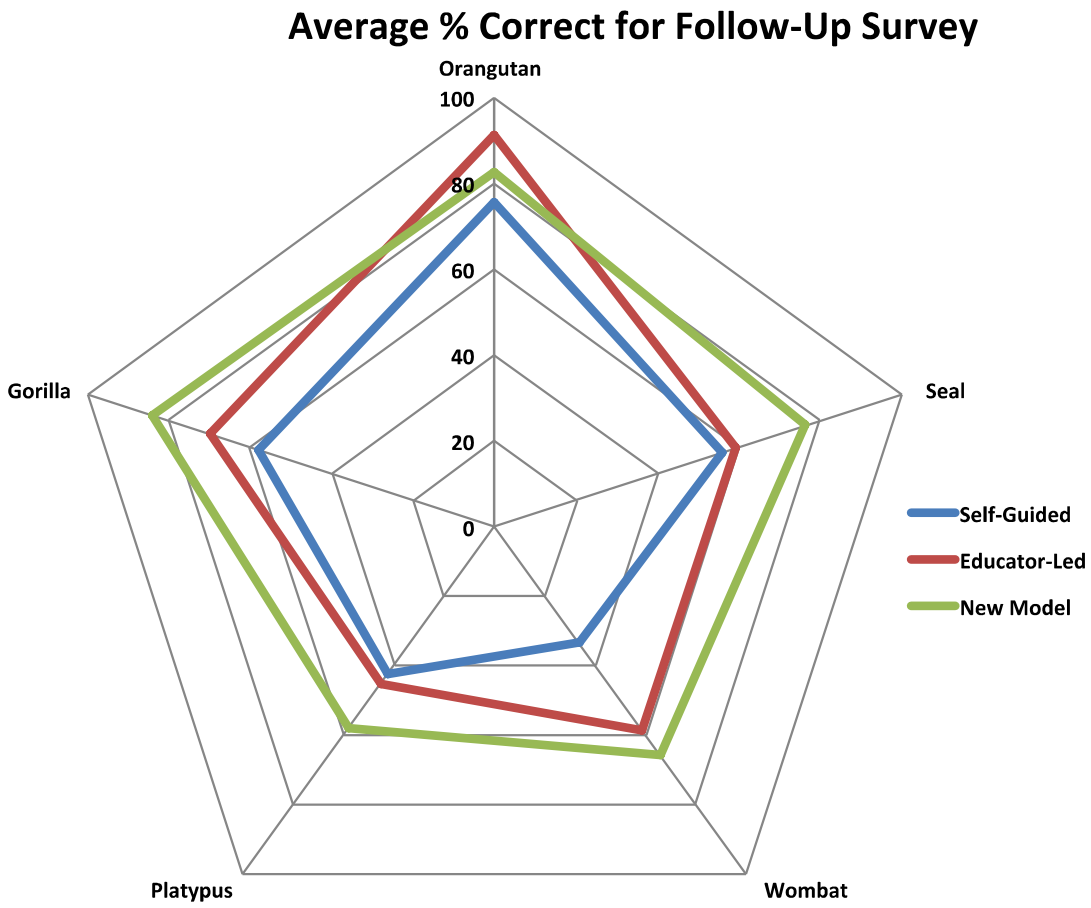

Figure 28: Average Percentage Correct for Follow-Up Survey by Model

This graph shows that the students exposed to the new model consistently answered the campaign questions correctly compared to students who were exposed to the other two models. With similar results shown in the on-site survey analysis, this shows that the new model was the most effective in increasing both campaign understanding and knowledge retention. The graph also follows the same trend as the on-site survey data with the educator-led model being the second most effective and the self-guided schools retaining the least amount of information. A comparison of these graphs can be seen below in Figure 29. Additionally, there is a definite pull of all three models towards the orang-utan in this graph. This trend can be explained by the endangered species and palm oil specific curricula that many of the schools were following. This is discussed further in the ensuing sections.

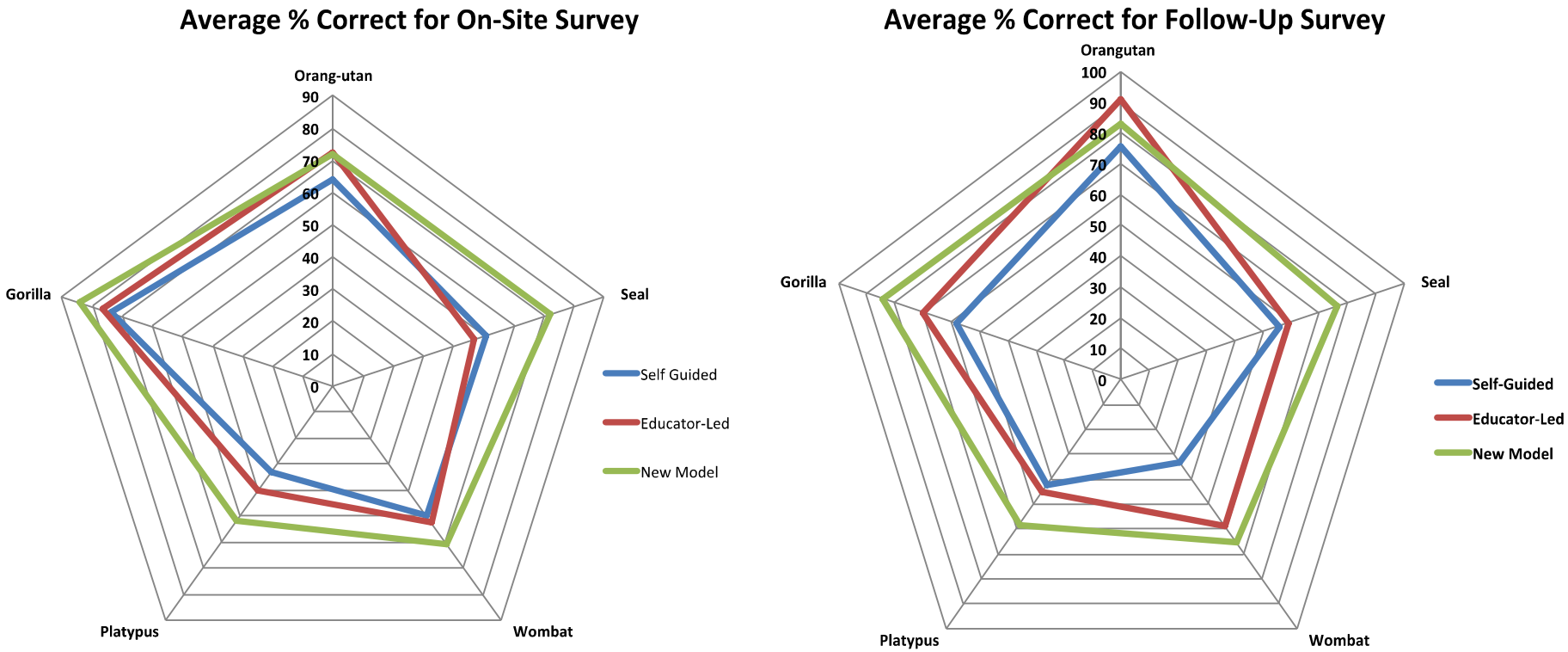

Figure 29: Comparison of On-Site and Follow-Up Surveys By Delivery Model

A final analysis that was done of the follow-up survey was the percentage of students that answered each of the ambassador animal questions correctly. These data can be seen below in Figure 30.

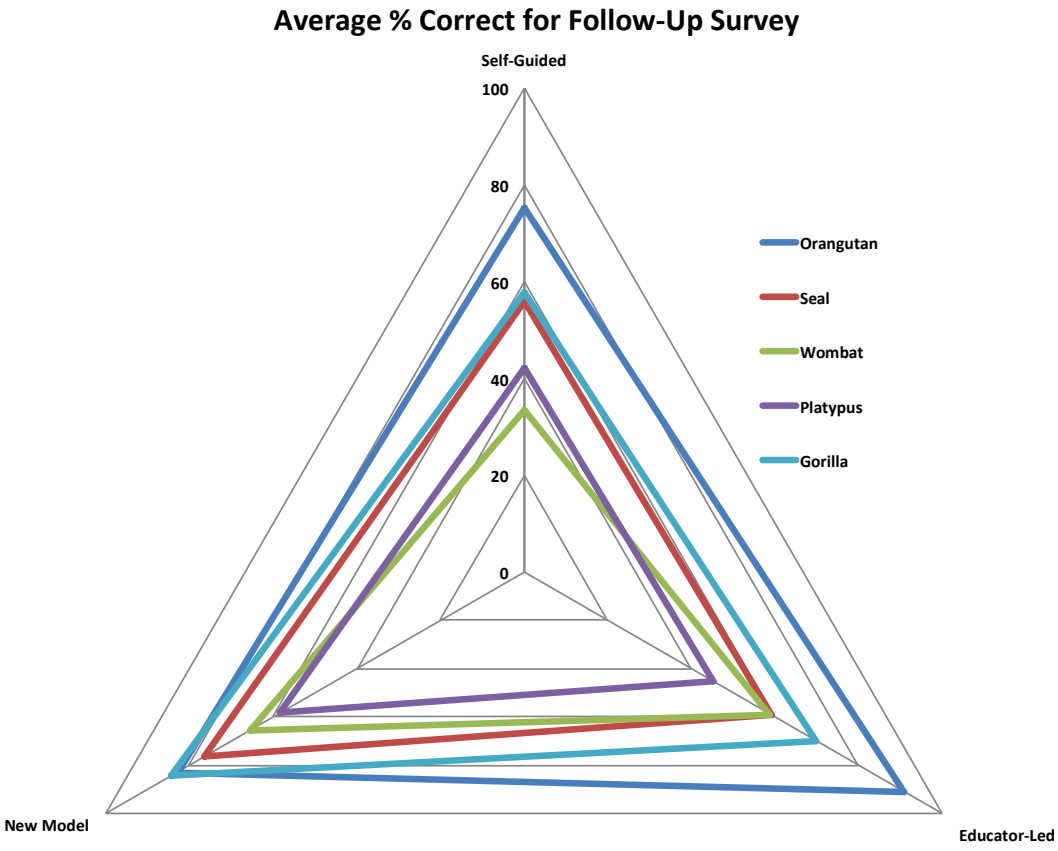

Figure 30: Average Percentage Correct for Follow-Up Survey By Ambassador Animal

From this graph, it can be observed that the question pertaining to the orang-utan was answered correctly most consistently. This differs from the on-site survey in which the gorilla was the most understood campaign. It is also interesting to note that the percentage correct for the gorilla campaign remained high for students who participated in the new model but dropped for the other students. Aside from this change, the order in which the other animals were understood remained relatively the same. This comparison can be seen below in Figure 31. The reasoning behind the increased knowledge of the orang-utan most likely has to do with the schools' curricula as many were continuing their study of endangered species and the *Don't Palm Us Off* campaign after returning from holiday, as was discovered during teacher interviews.

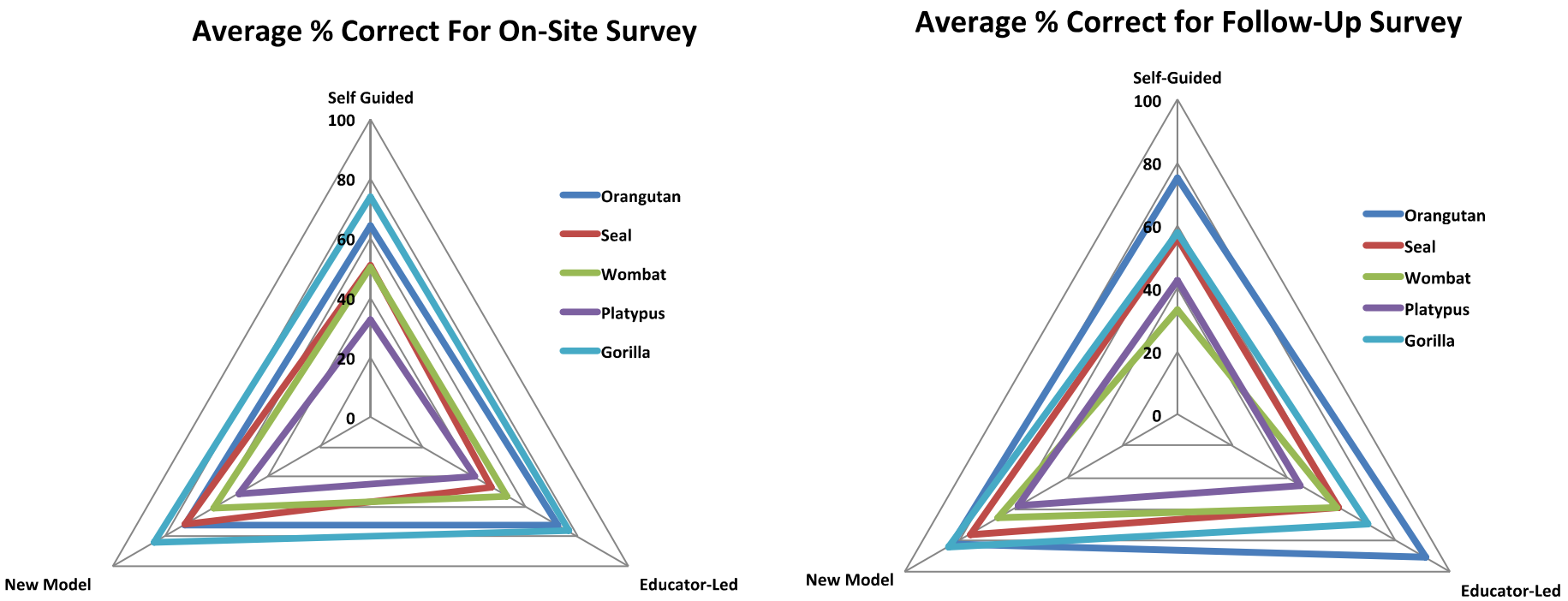

Figure 31: Comparison of On-Site and Follow-Up Surveys By Ambassador Animal

5.0 Discussion

After completing a quantitative analysis of all the information collected through observations and survey results, it was apparent that there were numerous underlying factors that may have influenced particular sets of data. These factors are important to recognise and explain as we look to understand the results and provide the most accurate and useful recommendations to the Zoos Victoria organisation. Many of these factors were noted during observations of the classes while others were unknown until the follow-up interviews with several of the teachers. We hope that by understanding which factors affected each schools' data, we will be able to provide better insight and reasoning behind the data analysis.

5.1 Factors with Potential Influence on Results

There are numerous factors that either directly or indirectly could have had an effect on the data collected and outcomes that developed as a result. Some of these factors were seemingly obvious while others were noted due to direct observations or information provided by the teachers. To better understand and correlate the factors to the data results, some factors will be evaluated individually in order to provide the most comprehensive analysis. The major factors that were noted included time on task, different types of curricula and extraneous factors such as demographics, weather, and group size. Each of these factors affected each school and the data results in different ways.

5.2 Time on Task

The time spent on a task and how that time is spent is very important to how the students learn at the zoo. When the students have a focus about an animal but are not in a classroom-like setting, they seem to learn as much or more than when the students are in a classroom setting for a long period of time. Time on task is an important factor that affected each delivery model.

5.2.1 Focused Time on Task

About two thirds of the HTL class (self-guided) made sure to get to the gorilla exhibit in time to participate in a discussion led by the zoo keeper. The zookeeper discussed not only interesting facts about the gorilla, but also informed the students of *They're Calling On You*

campaign. The group that went to the gorilla talk spent a total of 17 minutes at the gorillas compared to the other third of the class that did not go to the zookeeper talk and only spent four minutes at the exhibit. Figure 32 below clearly shows that this zookeeper session had a large impact on successfully conveying the campaign message to the students. This specific focus not only kept them at the exhibit longer, but also clearly had an effect on the results of the students' knowledge of the Gorilla campaign.

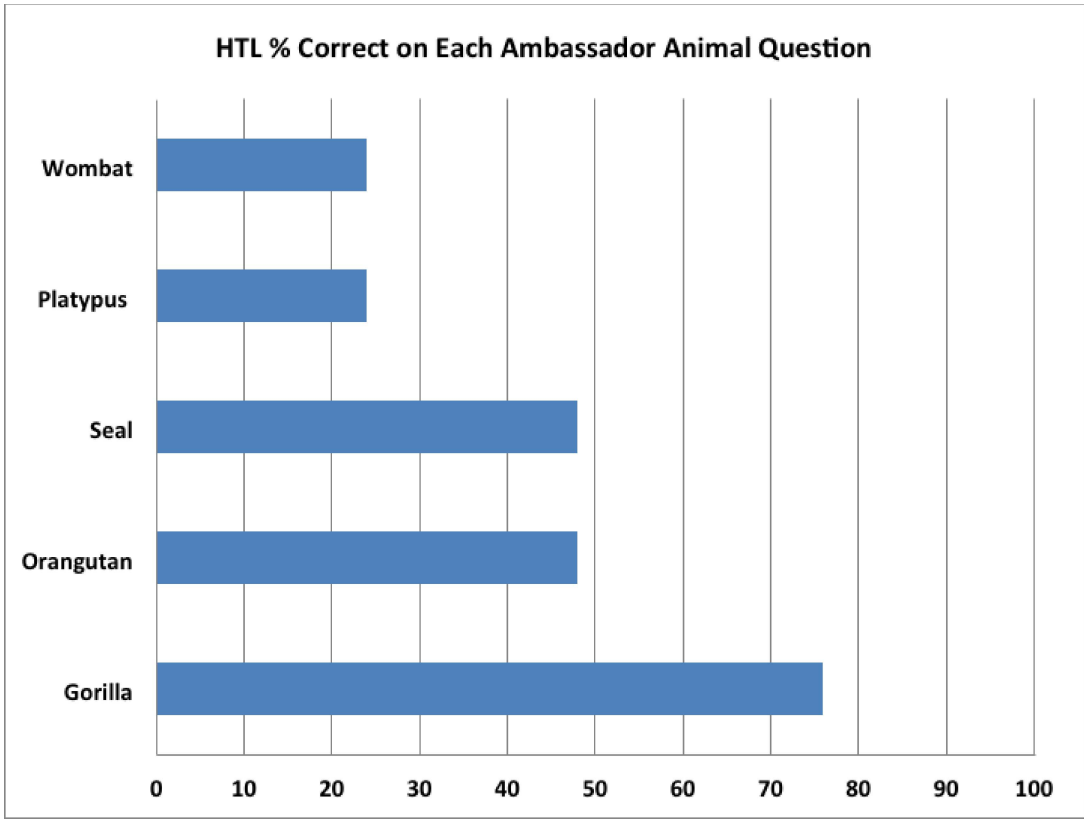

Figure 32: HTL's Average Percentage Correct for Each Ambassador Animal

MEC was the second school that came to the zoo for a self-guided visit. These students comprised an Indonesian class that was focused on the *Don't Palm Us Off* Campaign (see Appendix M for supplementary worksheet) and therefore spent an average of 19 minutes at the orang-utan exhibit and were most involved there. At the exhibit, their teacher emphasised information about that particular animal to them. She discussed the importance of using sustainable palm oil, explaining that it would reduce the destruction of the orang-utans' habitat. The students actively participated in the discussion with their teacher and had also previously learned about the topic at their school. Therefore, they showed the greatest proficiency of all the schools in answering the orang-utan matching question on the survey as

can be seen in Figure 20. This focused discussion about the orang-utans clearly affected the students' knowledge of the orang-utan campaign.

The first school observed in the new delivery model, SV stayed at the Urban Camp and came to the zoo from 12:00pm-4:00pm. This allowed for all the students to attend the *Seal the Loop* show at the seals exhibit at 1:30pm. The teachers made it a point to bring all of the students there. At this show, the *Seal the Loop* campaign is discussed through an exciting interactive show with the seals and zookeepers. Because the show was engaging for the students, our results show a large increase in the number of correct answers matching the seal to the corresponding action taken as seen in Figure 33**.**

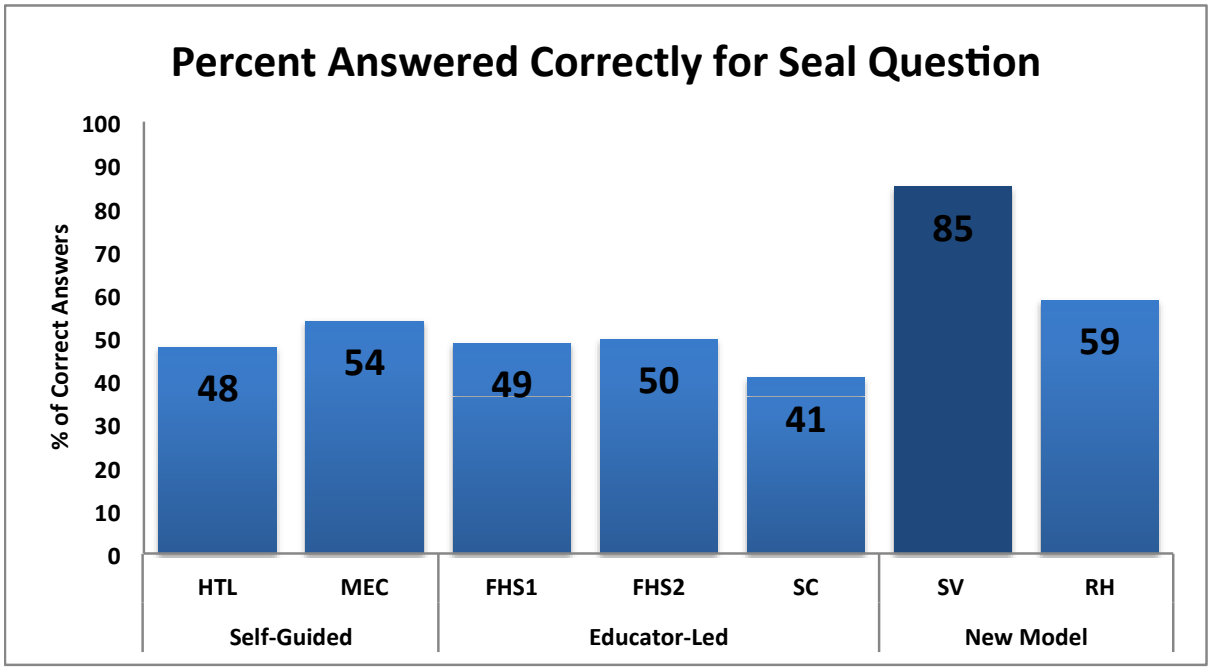

Figure 33: Percentage Answered Correct for Seal Question by School

This clearly shows that SV scored significantly higher (see Appendix E) on the seal question compared to the other six schools. Thus, the seal show had a large effect in conveying the conservation message. When each of these schools spent a large, but focused amount of time learning about each one of these animals, it affected the students learning. This focus on the campaign topics helped the students learn these campaigns and the longer times spent on these tasks helped the students remember the information.

5.2.2 Engagement Levels Compared with Equal Time on Task

The first observed educator-led session was FHS. On the day of their visit, the school arrived an hour late resulting in zoo educators having to shift around session times in order to

accommodate them for all the educator sessions. This led to less time being spent exploring the zoo and learning about other animals after their 45-minute session was over.

During their time with the educator, the individual students observed displayed positive attributes for the most part and seemed interested in the session. Figure 34 shows the behaviours of the students during the educator-led session as observed at three-minute intervals during the session. The coloured lines above the horizontal axis are all positive behaviours. The light blue line shown below the axis is a negative behaviour observed.

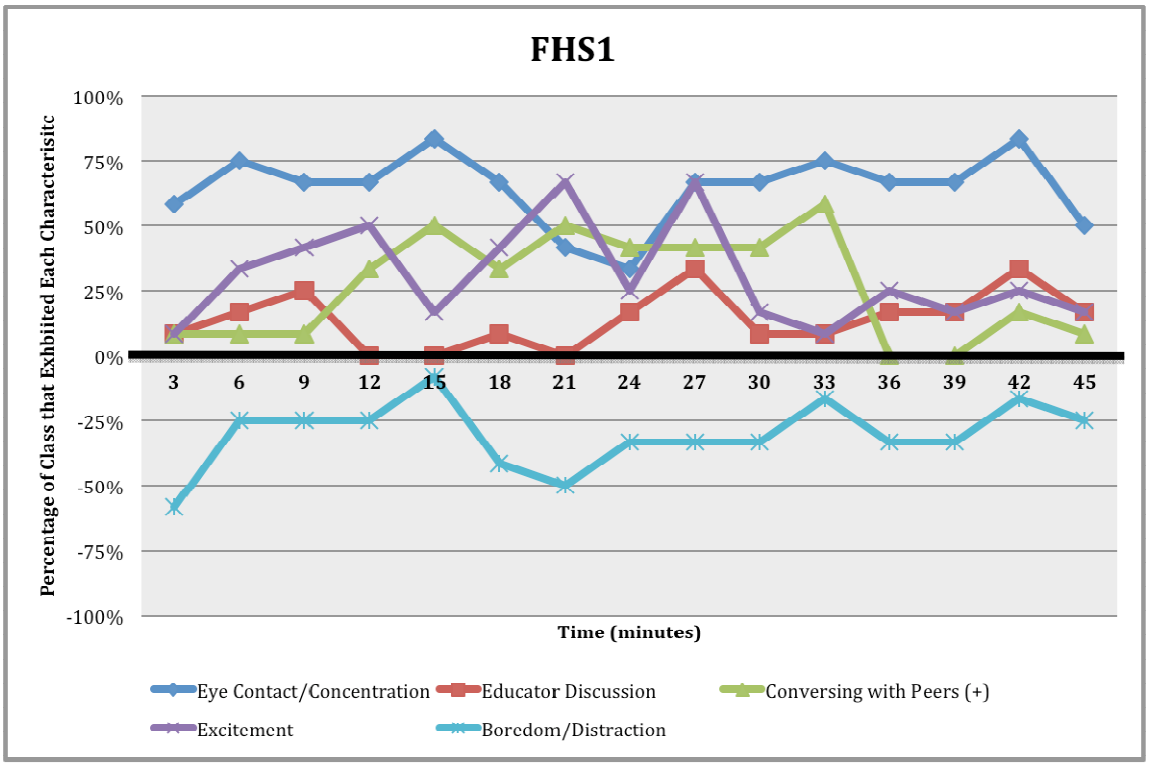

Figure 34: FHS1 Student Attributes for Educator-Led Session

Although during the session the students seemed to be focused and participating for the most part, after the session was over it could be clearly observed that the students were no longer interested in learning. The teacher gave each member of the class a worksheet (see Appendix M), but most of the students observed did not have any interest in completing it. After recording the time spent at each exhibit, it was calculated that the students observed from this group only viewed exhibits for an average of 33.5 minutes out of their approximate two hours of independent time, or about 28% of their time at the zoo spent at exhibits. This time can be compared to the other two educator-led classes to show which classes took the most advantage of their available time and were self-directed towards their learning.

The students who were observed on the second day of educator-led evaluations also came from FHS. This group performed similarly to the group on the first day and similar engagement and self-directedness behaviours were observed. However, during the 45-minute

educator-led session, this group had a very low level of excitement. The average per cent of time that students were observed as being excited for the first FHS group was 30.5% compared to only 10% for the second day of FHS. The chart of the observed attributes over the 45-minute session is shown below in Figure 35.

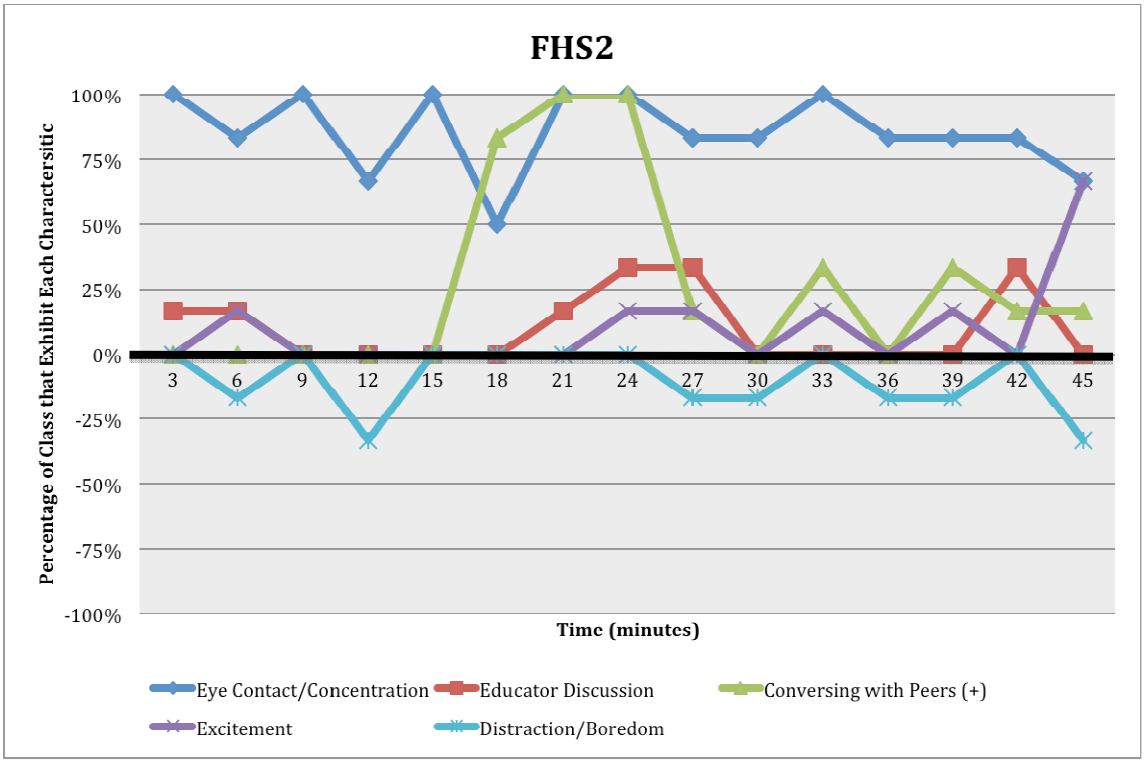

Figure 35: FHS2 Student Attributes for Educator-Led Session

Although the group arrived on time on day two, the amount of time the students had at the end of the session to explore the zoo was about a half an hour less than the previous educator-led group. The observed average time spent at all animal exhibits for this group was 31.5 minutes. This group spent about 35% of their day at exhibits compared to the first day students that spent only 28%. Students from both schools scored about 60% correct on the matching question at the conclusion of their visit.

The third day of educator-led observations was with an all-girls school; SC. The students arrived on time and the educator-led orang-utan session went according to plan. The class overall positive attributes and were recorded to be much less bored than the FHS sessions, as shown in the results of the individual observation attributes shown below in Figure 36. However, the second FHS showed less boredom than the first FHS group. This could be because only two people observed the second FHS group compared to the other two who had all four people observed those classes. The second FHS group could have had an observers biased which caused these results to occur. Also the SC was the last of the schools we observed. This could have affected our observations by having more time to have learned

our observation skills when observing previous schools. These different factors could have affected the results of these observations and explain why the second FHS group has different results from the first FHS group when the two groups from this same school had similar results everywhere else.

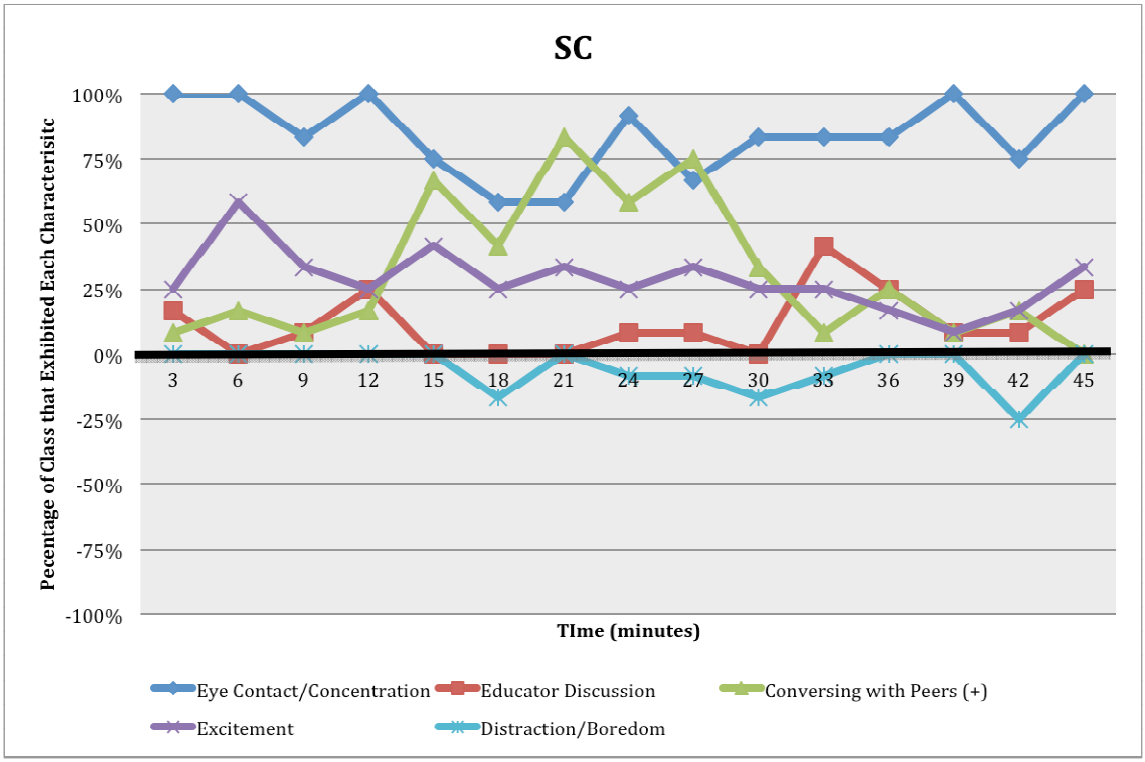

Figure 36: SC Student Attributes for Educator-Led Session

The girls had significantly more time than FHS to explore the zoo in their self-guided portion after the palm oil session ended. Out of a total of three hours the students had to see the zoo after the endangered challenge, the observed students spent an average time of 50 minutes observing the animal exhibits. Therefore, although the SC girls were observed to be well-behaved and attentive during their educator-led session, they behaved similarly to FHS High students during the independent portion of the day. The percentage of time spent at the exhibits during free time was about 28% for SC and an average of 31.5% for both FHS groups. This showed that though both sets of students showed different levels of engagement in the educator-led session, they reacted similarly in informal learning environments. The three schools also scored similarly on the matching question in regards to the orang-utan as seen in Figure 20. All three groups had the same time on task learning about orang-utans and the corresponding campaign and all showed similar results of their knowledge and how engaged they were for the rest of the day even though SC were more engaged in the session itself. More research should be done to find the optimum time on task to learn the same information.

5.3 Types of Curricula

The topics being taught in the classroom before and after each school's visit to the zoo could have influenced the level of the knowledge the students' had regarding the different conservation topics they were quizzed about in the on-site and follow-up surveys. Knowing the types of units the teachers were focused on and how much had been taught before they visited the zoo would help to understand trends in the data. Every school that was observed for this research focused on the common themes of conservation, sustainability and endangered species in the classroom. By analysing the on-site survey results of schools that had similar curricular objectives, we can better understand the effect of the delivery model on the students' understanding of the conservation campaigns and the level of behavioural changes.

5.3.1 Sustainability Curricula

HTL and SV were two schools that were of approximately the same age group who also shared similar educational focuses, but who were exposed to different delivery models. HTL was a science class that was focused on topics including conservation, adaptation, different environments, food webs, and sustainability but was only partially through their unit of study at the time of their visit. The class was visiting Melbourne Zoo as part of a self-guided visit. They were also staying at the Urban Camp located near the zoo. During an Urban Camp where the classes stay in Melbourne for several days because they live further away in the country. This allows the class to see many of the different attractions the city of Melbourne has to offer. This information was obtained through an interview with the group's teacher and helps explain why their visit to the zoo was designed to be a fun and social excursion instead of curriculum-based.

SV was also staying at Urban Camp but unlike HTL, participated in the new delivery model during their excursion to the zoo. At the time of their visit, they were just finishing up their unit on environment protection and sustainability. By comparing the results from both the on-site and follow-up surveys for these two schools, we will be able to see how much of an effect the delivery models had on the amount of conservation-knowledge obtained and retained by the students. Figure 37 shows the relationship between the percentages of each class that answered the matching question correctly on each survey.

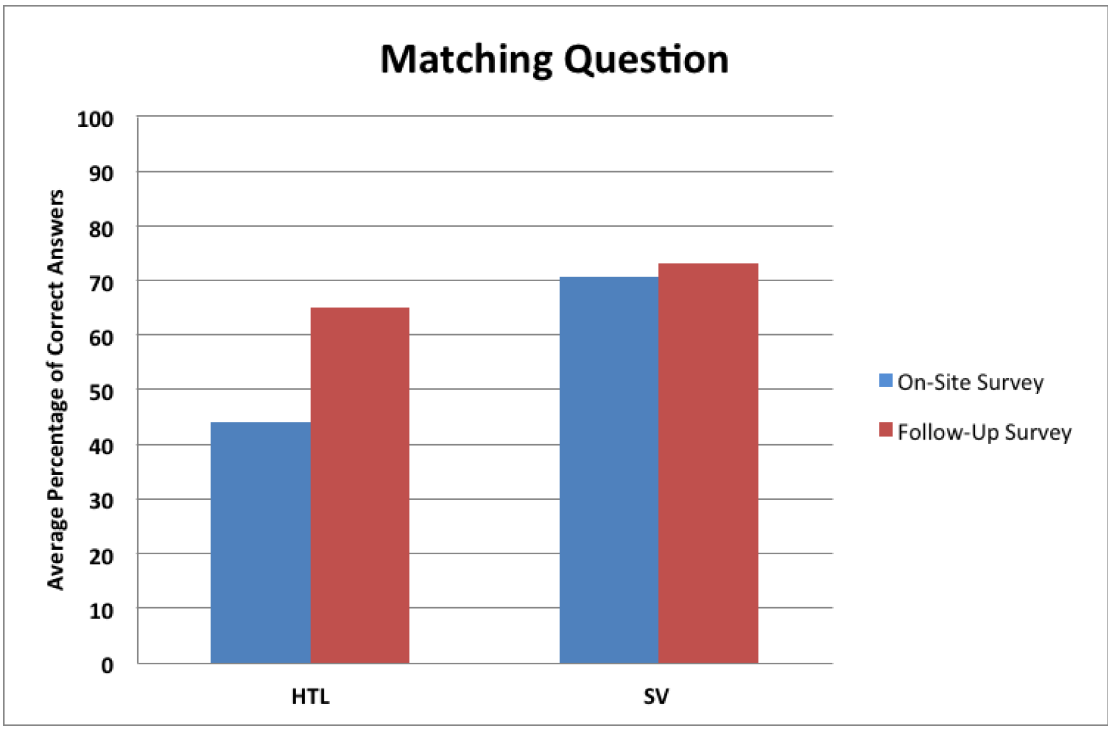

Figure 37: Matching Question Comparing HTL (self-guided) and SV (new model)

This graph shows that SV averaged a much higher score than HTL on the on-site survey-matching question. It can also be seen that HTL's scores improved significantly on the follow-up survey, with SV averaging about the same as their on-site survey scores. With HTL still focusing on the sustainability unit at the time the second survey was administered, it makes sense that their score would increase. Also, even with high scores on the first survey, SV was able to maintain their average even after moving on to a new curriculum focus. By comparing only the follow-up surveys, SV still scored higher, even if the difference was not of statistical significance. Therefore, the new delivery model was successful in helping students maintain a certain level of knowledge retention even after moving onto a different unit of study. A larger sample size would have to be evaluated to prove or disprove this hypothesis.

5.3.2 Palm Oil and Endangered Species Curricula

The four classes that were observed from MEC, FHS , and SC all had endangered species and palm oil focused curricula. While MEC was a self-guided visit and the other three participated in educator-led sessions, each class spent the independent portion of their excursions completing the worksheets provided to them by their teachers. Each of these worksheets contained general conservation questions and specific questions focused on palm

oil, orang-utans, and the *Don't Palm Us Off* Campaign (see Appendix M). Figure 38 shows that students from all these schools performed similarly on the orang-utan matching question. This means that although MEC students were on a self-guided visit, they did just as well as the students who participated in a 45-minute educator-led session. From the information that we have available, a viable explanation for this could be from the focus the teacher had emphasised and prepared for the zoo visit.

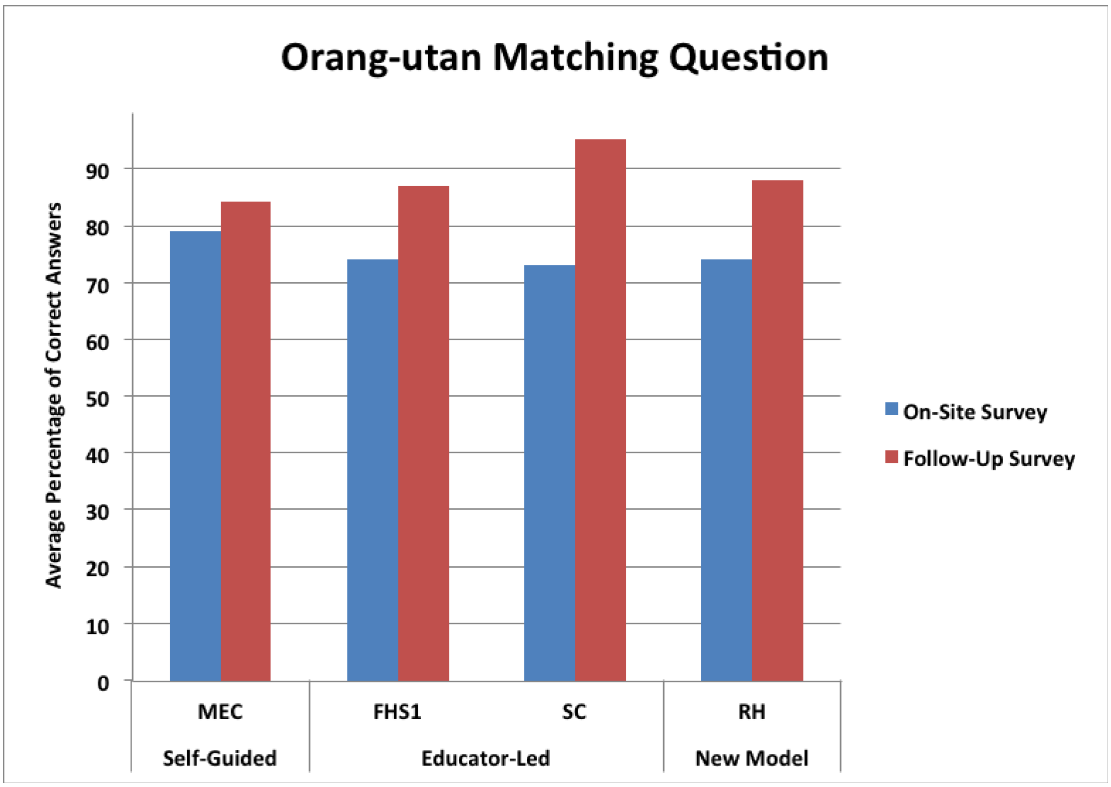

Figure 38: Orang-utan Matching Question From Both Surveys Comparison

The increase in the percentage of correct responses for all schools can be due in large part to each school only being partially through their unit of endangered species at the time of their visits. MEC had been focusing mainly on conservation and were just getting started with their palm oil study. Both classes from FHS were at the beginning of their unit and SC was only four lessons in when they came for their excursion (follow-up survey data was not received from FHS2 Day 2). As can also be seen from Figure 20, SV averaged 70% on the orang-utan question in the on-site survey; almost equal to those schools that had an endangered species focused curricula. The results from the follow-up survey also showed that 78% of students retained this knowledge and were able to correctly match the orang-utan to the action associated with the *Don't Palm Us Off* campaign. Based on the limited sample size, these data show that the new model was effective in helping students with different

curricular objectives retain the information associated with the ambassador species campaigns.

The last school in our research study was RH who participated in the new delivery model. Although this school was similar to the schools mentioned above, the main difference was the lack of focus on palm oil, orang-utans, and the *Don't Palm Us Off* campaign. Therefore, the fact that they scored almost identically to these schools on the orang-utan matching question (Figure 38) would suggest that the exhibit and advertising around the zoo was effective in increasing the students' knowledge of the conservation campaign. Also, being exposed to the new delivery model prompted them to pay closer attention to this exhibit, which they may not have done in a self-guided visit because it was unrelated to their curriculum and its objectives.

5.4 Other Extenuating Factors

There were many other factors that affected each school's day and the effectiveness of the delivery models. Some of these factors included weather, demographics of the class, and the age group of the students. These other factors were not consistent throughout the three delivery models, and could have affected the outcomes of each school individually and how the students performed and acted throughout their day.

5.4.1 Demographics of Each Class

The demographics of each class may have had an effect on how effective each delivery model was in teaching conservation topics. HTL and SV are both religious schools; the visiting students were year 5/6. These younger students were chaperoned by teachers or other adults at all times, which could have affected their behaviours throughout the day. Both FHS and MEC are public schools. FHS is known as being a lower socioeconomic neighbourhood compared to many of the other schools that we observed. The zoo educators also expressed that the school is generally known for its misbehaving students. The year 8 students observed from FHS were a mixture of both boys and girls. The year 8 MEC students were primarily girls. SC and RH are private schools. The class from SC, a prestigious all-girls school, consisted of year eight students. We observed year seven students from RH.

5.4.2 Weather

The weather can have an effect on the students' day in a positive or negative way. There were two schools that experienced extreme weather, RH and SV, who both participated

in the new model. The weather during RH's visit was incredibly windy. This made it hard for the students to hear the educator when he was giving his introduction and conclusion to the program, and also made it uncomfortable to explore the zoo throughout the day. SV had extremely hot weather, which also could have affected their behaviour throughout the day. Additional observations would be needed to analyse trends between weather and behaviour/engagement.

6.0 Conclusion

The main goal of this study was to determine which educational delivery model provided students with a better understanding of the five main conservation campaigns that Zoos Victoria created and advertises, while also promoting conservation-based behavioural changes. The use of observations, surveys, and key interviews provided us with data that compared both the effectiveness of the delivery models and the students' level of knowledge of each of the conservation campaigns. The data showed that engagement was independent of the type of learning model whereas the students exposed to the new model and self-guided models showed increased levels of self-directedness. The low level of self-directedness shown by the students who participated in *The Endangered Challenge* appeared to be due to a lack of interest and less exposure to the ambassador animals and their corresponding campaigns. This information will be useful to Zoos Victoria as they work to improve upon the effectiveness that the current educator-led model has in encouraging conservation-based learning and behavioural changes associated with the different campaigns.

The analyses showed that the new model was the most effective in accomplishing this segment of Zoos Victoria's mission. The schools who participated in the new model maintained a higher percentage on the matching question than students exposed to the other two models, leading us to conclude that the new delivery model was the most effective in increasing students' understanding of the conservation campaigns, based on our limited sample size.

Analyses also showed that students from schools that had a specific educational focus during their visit were more likely to participate in the campaign actions. Recycling was the most frequent response, as it is also the easiest campaign action for students of this age level to make.

What was ultimately discovered throughout the course of this research project was that the new model is more "effective" than the other two delivery models in accomplishing Zoos Victoria's mission. To further improve the level of learning and behavioural changes in student visitors, it is very feasible for the Zoo to make improvements to all of the models. Our recommendations provide future steps that can be taken to make the educational delivery models as successful as possible in helping Zoos Victoria fulfil their mission of becoming the world's leading zoo-based conservation organisation.

7.0 Recommendations

Through our research, we have developed multiple recommendations for Zoos Victoria and the Melbourne Zoo to improve all of their delivery models, especially the new model. When we observed the new delivery model, we discovered a few changes that the zoo could make to increase the quality of the students' education. We also found through our observations and surveys that certain ambassador animals were better known and understood than others. We hypothesise that this trend is because some of the ambassador animals' signs and visuals are more noticeable and easier to understand than others. Our last recommendation is for the zoo to continue this research and include several additional factors that we have noted that were not included in this research study. Due to a limited sample of classes we were able to observe and survey, more research must be done do receive more accurate results. Through our recommendations, we hope that Zoos Victoria and the Melbourne Zoo can successfully educate all students that come to visit the zoo to learn about these important conservation topics.

7.1 New Model Improvements

In order to improve the effectiveness of the new delivery model, we have identified some minor yet vital improvements.

- **Move the workshop to a more central location**

We believe that it would be beneficial to move the workshop from its current location at the Ranger Station to a more central location. We noticed that many of the students participating in this model found it difficult to get to the Ranger Station, especially if they had already been to the Orang-utan Sanctuary. The ranger station is located in the middle of the Elephant and Orang-utan trail, which is a long walk if the students have already been through the path. If it were moved to the main drive of the zoo, students may be more inclined to visit it because of easier accessibility.

- **Offer the workshop for a longer period of time**

Having multiple workshop times in the morning and afternoon may make it easier for the students to attend. Also, implementing different workshops for other ambassador animals may be helpful in conveying conservation topics that may be difficult for the students to grasp by themselves. For example holding a workshop for the platypus, which was the consistently least known campaign, would help the students to learn about the *Wash for*

Wildlife campaign. Furthermore, it may be worth offering different workshop topics that would cater to particular subjects that teachers are covering in the classroom.

- **Integrate the zookeeper talks associated with the seal and gorilla into the new model**

Extra zookeeper talks will be good additions to the new model to help the students learn about the five campaigns. If the zookeeper talk and seal show are to have more impact in the new model, they should be moved to times that are more convenient for school groups to attend. With the seal show currently being shown at 1:30 in the afternoon, it is hard for many schools to attend it because they are normally nearing the end of their visit at that time. We suggest it be moved to an earlier time possibly between 10am and 12pm. Also, the gorilla zoo keeper talk should be moved to a more convenient time for students as 9:30am is too early for most schools to arrive at the zoo. By moving these talks to more convenient times and encouraging students and classes to attend, more people will be exposed to the campaign-related information sessions.

- **Flip the orientation of the map**

As most students enter from the Rail gate entrance, it may be useful to flip the orientation of the map that is handed out to them upon their arrival. During our observations we noticed that the map was confusing to the students because they did not realise they did not enter at the main entrance. The rail gate depiction should be at the bottom of the map rather than the top, so students can better understand the map. This may be an easy alteration to the new program that will make a large difference for the students to find their way around the zoo and be able to see as many exhibits as possible, including the five ambassador species.

7.2 Campaign Signs and Displays

During our observations of the students' visit to the zoo, we discovered that there could be alterations to the signs about each animal to help the students better understand the campaigns.

- **Improve the platypus display and signage**

As discussed earlier in section **4.4.3**, the platypus signs are not effective in teaching the students about the *Wash for Wildlife* campaign. The large washing machine, located outside the platypus enclosure, caught many of the students' attention, yet it didn't convey the message about switching to a phosphate-free detergent. We suggest that improvements be made to the signage in the platypus exhibit to better explain the action the students can make

and easily catch their attention. The gorilla had the most effective signs because of the prominent connection of recycling mobile phones to helping the gorillas. Changes to other campaign signs, specifically the platypus, can be made to help not only students but all visitors learn how to help these ambassador animals.

7.3 Future Research to Validate Findings

Further research can be used to validate that the new delivery model is more effective than the other two models and also give some more insight on why it is more effective.

- **Study a larger sample**

Our team observed varying class sizes of 22-97, with each school having different factors affecting their visit such as weather, class size, class demographics, and other factors that could have impacted their day or results. A larger sample size needs to be observed and surveyed to receive accurate results on the effectiveness of the new delivery model.

- **Refine the observation methods**

An alteration can also be made to our method of observations and future research can be done on the exhibits the students attend throughout their visit. Our team only recorded the duration of time spent at exhibits, but did not record the actual time of day that the students were at each exhibit. This further research can tell if the students level of interest declined throughout the day, or any other trends that can arise.

Further research also needs to be done to see if the students are receiving a similar quality and quantity of knowledge from the ten-minute workshop as they are from the 45-minute session. If the students are getting a great deal more knowledge from the 45-minute session in the educator-led session focused on the Orang-utan and their habitat than the ten minute workshop focused on the same topic, then the new model is not more effective than the educator-led model. In this case the educator-led session may not be able to be completely taken out of the education opportunities offered to the schools, or the new model will have to be altered for schools that are looking for a larger depth of knowledge on one specific animal. This research can be done by giving more in-depth surveys to the students about the knowledge they took away from both the workshop and the educator led session. Another possible method to gain this information is to interview a random sample of students who were exposed to each model to determine the amount of knowledge the students took away from their visit.

- **Evaluate the effect of program offering times**

There were certain characteristics of the educator-led session that we observed that were the same. All three sessions we observed occurred as soon as the students arrived at the zoo, and then had the rest of the day to explore other exhibits. It would be useful to know if the time of day of the session, whether it is the beginning, middle, or end of visit, affects the knowledge taken from the session, possible behaviour changes, or engagement levels throughout the day. By repeating our methods with different times of day, we would be able to measure if the time of day of the educator-led session has an effect on its overall effectiveness.

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Appendix A: Observation Instrument

Observation of Student Visitors

MELBOURNE ZOO, ZOOS VICTORIA

Delivery Model:

☐ Zoo Educator-Led, *The Endangered Challenge*

☐ Challenge-Based Model

☐ Self-Guided

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

Observers:

_____ _____

_____ _____

Weather:

Temp:_____

☐ Rain (_____) ☐ Wind ☐ Sun ☐ Other _____

_____

_____

_____

Demographics:

Class size: _____ Males: _____ Females: _____

Name of School: _____

Type of School:

☐Public ☐ Private ☐Religious

Location of School: _____ Distance from zoo: _____

Grade/average age of students: _____

Average Income of School's Location: _____

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 3 minutes during the educator-led program, *The Endangered Challenge.* 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:	**Is the student exhibiting the characteristic?**
0	No
1 (or X)	Yes
Campaign Involvement	
P	Pledged
L	Literature
R	Reading Signs
A	Listening to Audio/Video
Zoo Keeper	
	Keeper is present
X	No keeper present

Percentage of the class in which the educator was speaking:

_____%

The Endangered Challenge

Zoo Educator: _____

	Student Identifier	Eye Contact/ Concentration	Educator Discussion (Questions)	Conversing with Peers (+)	Excitement	Distraction/ Boredom
3 minutes	**1**					
	2					
	3					
6 minutes	**1**					
	2					
	3					
9 minutes	**1**					
	2					
	3					
12 minutes	**1**					
	2					
	3					
15 minutes	**1**					
	2					
	3					
18 minutes	**1**					
	2					
	3					

	Student Identifier	Eye Contact/ Concentration	Educator Discussion	Conversing with Peers (+)	Excitement	Distraction/ Boredom
21 minutes	**1**					
	2					
	3					
24 minutes	**1**					
	2					
	3					
27 minutes	**1**					
	2					
	3					
30 minutes	**1**					
	2					
	3					
33 minutes	**1**					
	2					
	3					
36 minutes	**1**					
	2					
	3					
39 minutes	**1**					
	2					
	3					
42 minutes	**1**					
	2					
	3					
45 minutes	**1**					
	2					
	3					

Additional Notes:

_____

_____

_____

_____

_____

_____

Observation of Melbourne Zoo's Animal Exhibits

	Student Identifier	Time Spent	Reading Animal Signs	Campaign Involvement	Zoo Keeper	Questions	Excitement	Conversing with Peers (+)	Conversing with Peers (-)	Distraction/ Boredom
Hamadryas **Baboon**	**1**			X						
	2									
	3									
Brown **Bear**	**1**			X						
	2									
	3									
Eastern **Bongo**	**1**			X						
	2									
	3									
Brush Turkey	**1**			X						
	2									
	3									
Cairns Birdwing **Butterfly**	**1**			X						
	2									
	3									
White-nosed **Coati**	**1**			X						
	2									
	3									
Philippines **Crocodile**	**1**			X						
	2									
	3									
Asian **Elephant**	**1**			X						
	2									
	3									
Emu	**1**			X						
	2									
	3									
Long-tailed **Finch**	**1**			X						
	2									
	3									
Corroboree **Frog**	**1**			X						
	2									
	3									
Aldabra **Giant Tortoise**	**1**			X						
	2									
	3									
White-cheeked **Gibbon**	**1**			X						
	2									
	3									

	Student Identifier	Time Spent	Reading Animal Signs	Campaign Involvement	Zoo Keeper	Questions	Excitement	Conversing with Peers (+)	Conversing with Peers (-)	Distraction/ Boredom
Giraffe	1			X						
	2									
	3									
Western Lowland **Gorilla**	1									
	2									
	3									
Pygmy **Hippopotamus**	1			X						
	2									
	3									
Kangaroo	1			X						
	2									
	3									
Koala	1			X						
	2									
	3									
Ring-tailed **Lemur**	1			X						
	2									
	3									
Snow **Leopard**	1			X						
	2									
	3									
Lion	1			X						
	2									
	3									
Mandrill	1			X						
	2									
	3									
Meerkat	1			X						
	2									
	3									
Sumatran **Orang-utan**	1									
	2									
	3									
Small-clawed **Otter**	1			X						
	2									
	3									
Collared **Peccary**	1			X						
	2									
	3									
Australian **Pelican**	1			X						
	2									
	3									
Little **Penguin**	1			X						
	2									
	3									

	Student Identifier	Time Spent	Reading Animal Signs	Campaign Involvement	Zoo Keeper	Questions	Excitement	Conversing with Peers (+)	Conversing with Peers (-)	Distraction/ Boredom
Nicobar **Pigeon**	**1**			X						
	2									
	3									
Platypus	**1**									
	2									
	3									
Australian Fur **Seal**	**1**									
	2									
	3									
Serval	**1**			X						
	2									
	3									
Broad-headed **Snake**	**1**			X						
	2									
	3									
Lord Howe Island **Stick Insect**	**1**			X						
	2									
	3									
Black-necked **Stork**	**1**			X						
	2									
	3									
Cotton-top **Tamarin**	**1**			X						
	2									
	3									
Sumatran **Tiger**	**1**			X						
	2									
	3									
Southern Hairy-nosed **Wombat**	**1**									
	2									
	3									
Plains **Zebra**	**1**			X						
	2									
	3									

Additional Notes:

_____

_____

_____

_____

Additional Notes, Comments, & Observations

Appendix B: End of Visit Student Surveys

SURVEY 1

1) Which of the following exhibits did you visit (check all that apply)?

☐ **Orang-utans** ☐ **Seals** ☐ **Gorillas** ☐ **Wombats** ☐ **Platypus**

2) What does conservation mean (circle one)?
a) The protection of human's homes and businesses
b) The protection of wildlife and their habitats
c) The protection of laws
d) The protection of extinct species

3) What does endangered mean (circle one)?
a) There are none of these species left on the planet
b) The animal is dangerous
c) There are a limited number of the species left
d) Both b and c

4) Match the animals on the left with the conservation action YOU can do on the right.

Orang-utan	Switch to Phosphate Free Cleaning Products
Seal	Switched to 100% recycled toilet paper
Wombat	Use only sustainable palm oil
Platypus	Recycle old mobile phones
Gorilla	Recycle Plastic

5) What do you pledge to do to help conservation and fight extinction?

_____
_____
_____
_____

6) Where does palm oil come from?

_____

Appendix C: Post-Visit Student Surveys

SURVEY 2

1) What does conservation mean (circle one)?
a) The protection of human's homes and businesses
b) The protection of wildlife and their habitats
c) The protection of laws
d) The protection of extinct species

2) Did you take any actions to help endangered animals (check all that apply)?
☐ Recycle old mobile phone
☐ Write letter to favourite food manufacturer about using Certified Sustainable Palm Oil
☐ Only use sustainable palm oil
☐ Recycle plastic
☐ Switch to phosphate free cleaning products
☐ Switched to 100% recycled toilet paper

3) Did you complete the action that you pledged?
☐ Yes
☐ No
☐ Not yet, but I will

4) Match the animals on the left with the conservation action YOU can do on the right.

Orang-utan	Switch to Phosphate Free Cleaning Products
Seal	Switched to 100% recycled toilet paper
Wombat	Only use sustainable palm oil
Platypus	Recycle old mobile phones
Gorilla	Recycle Plastic

5) Where does palm oil come from?

_____

Appendix D: Post-Visit Teacher Interviews

Teacher Interviews

Q1: Are zoo visit a regular part of your educational routine?

Q2: Why do you feel that the zoo visits are a valuable component of the students' education?

Q3: What conservation topics did you teach in the classroom before the class' zoo visit?

Q: At what point in this unit were you at when you visited the zoo?

Q4: What level of interest did students express in the conservation campaign (gorilla, orang-utan, seal, platypus, wombat) following your visit to the zoo?

Q5: How has students' level of conservation understanding changed since their trip to the zoo?

Q6: What efforts have been made by the students to take the behavioural actions that they learned about?

Q: Was this a class activity or an individual action?

Q7: Did you provide a worksheet for your students to fill out during their visit?

Q: If so, did the questions have a particular focus?

Q8: We noticed that your class did very well on the survey question pertaining to gorillas and mobile phones. We were wondering if they had learned about this is class or if you could provide any additional insight that might explain these results.

Q9: (If exposed to educator-led or new model) How helpful was the information session that your class was exposed to?

Q: Have you implemented any of the information you talked about in these sessions into your lessons?

Q10: Would it be possible for a zoo staff member to follow up with you and your students in about a month's time?

Just a reminder: Please distribute survey 2 to your students and send it back to us as soon as possible. Also, just to make sure our data isn't skewed, please make sure they work on it individually.

Appendix E: Statistical Analysis to Test the Significance of the Data

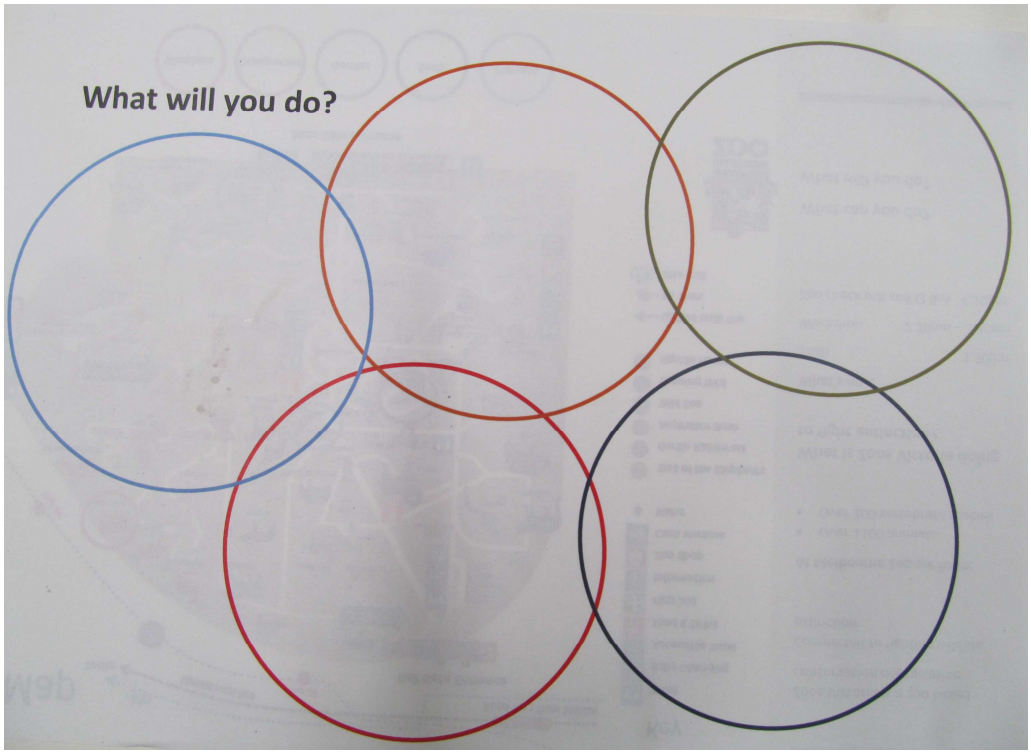
The statistics in these tables show if there is any significance to the data by utilizing a chi-square test. The first table combines the self-guided and educator-led models into one group and gives the combined data for the campaign question and displays it by the combined category and the new model. The rows labelled "actual" show the true numbers regarding the number of students from each model who each answered correctly. The rows labelled "expected" are calculated values that show what the data would be if there were no difference between the two model groups and the students who answered from each group were the same proportion. The "chi-square" row shows the value of the "Pearson Chi-Square" for each question, displaying weather the difference between the actual and expected is a significant difference. If the number is close to or under 0.05, the values are unexpected and there is a notable difference in the data between the two model groups. The highlighted values are those that display possible significance due to the chi-square value. The last row in the table is the phi value, which shows the size of the data difference. The higher the number is, the greater the difference, and the higher chance the data is significant.

The second table shows significance in the data with the three models compared individually. The "actual" and "expected" columns have the same meanings as the first significance table, but there is an extra column called "adjusted" for when comparing more than two models. If this value is greater than 2 or less than -2, there is a sizable difference in the actual data between models. The chi-square value is calculated the same as it is in the first table and the row called "Cramer's V" is similar to the phi value. The data worth noting is highlighted.

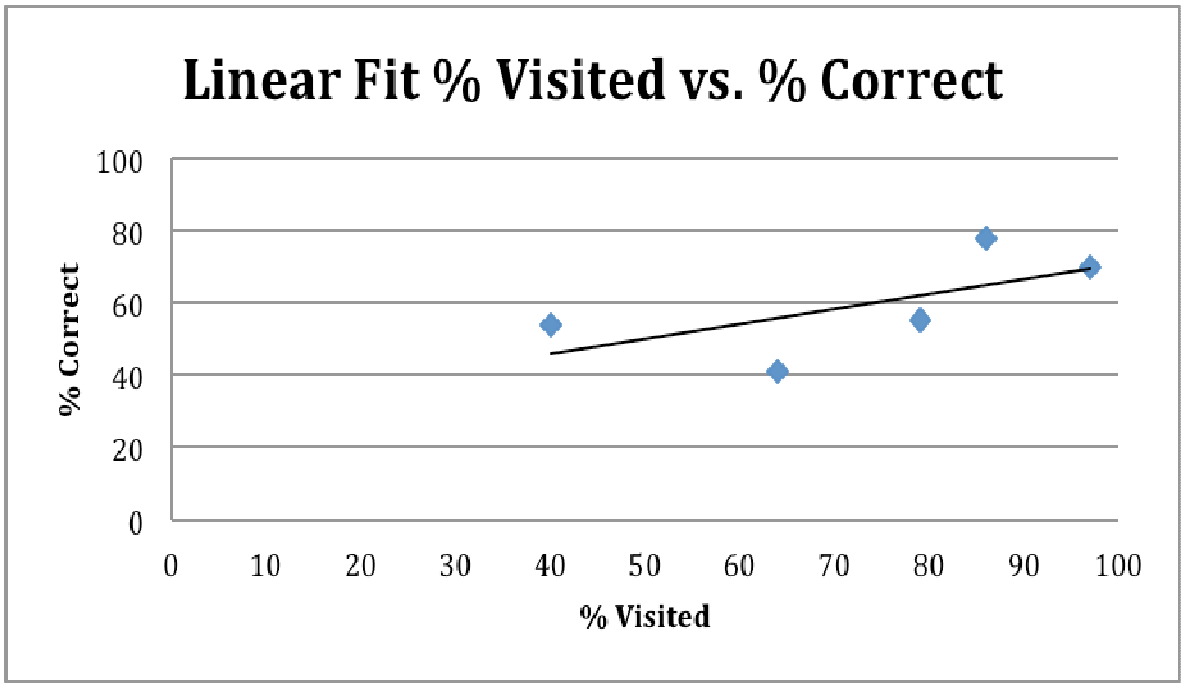
		Orang-utan		Gorilla		Seal		Wombat		Platypus	
		Wrong	Correct	Wrong	Correct	Wrong	Correct	Wrong	Correct	Wrong	Correct
Self-Guided + Educator-Led	actual	48	112	38	122	82	78	75	85	98	62
	expected	45.9	114.1	31.3	128.7	66.1	93.9	69.1	90.9	88.3	71.7
New model	actual	43	114	24	133	49	108	62	95	77	80
	expected	45.1	111.9	30.7	126.3	64.9	92.1	67.9	89.1	86.7	70.3
	total	91	226	62	255	131	186	137	180	175	142
	chi-square	0.607		**0.058**		**<0.001**		0.185		**0.029**	
	phi	0.029		0.107		0.203		0.075		0.123	

		Orang-utan		Gorilla		Seal		Wombat		Platypus	
		Wrong	Correct	Wrong	Correct	Wrong	Correct	Wrong	Correct	Wrong	Correct
	actual	18	31	13	36	24	25	25	24	33	16
	expected	14.1	34.9	9.6	39.4	20.2	28.8	21.2	27.8	27.1	21.9
Self-Guided	adjusted	1.4	-1.4	1.3	-1.3	1.2	-1.2	1.2	-1.2	1.9	-1.9
	actual	30	81	25	86	58	53	50	61	65	46
	expected	31.9	79.1	21.7	89.3	45.9	65.1	48	63	61.3	49.7
Educator-Led	adjusted	-0.5	-1.4	1	-1	2.9	-2.9	0.5	-0.5	0.9	-0.9
	actual	43	114	24	133	49	108	62	95	77	80
	expected	45.1	111.9	30.7	126.3	64.9	92.1	67.9	89.1	86.7	70.3
New Model	adjusted	-0.5	0.5	-1.9	1.9	-3.6	3.6	-1.3	1.3	-2.2	2.2
	total	91	226	62	255	131	186	137	180	175	142
	chi-square	0.401		0.138		0.001		0.324		0.054	
	Cramer's V	0.076		0.112		0.205		0.084		0.136	

Appendix F: Educational Tool Used for New Model



Appendix G: Linear Correlation of Per cent Visited vs. Per cent Correct



Appendix H: Comparing Percentage of Students Visiting Ambassador Animals and Percentage of Students Answering Campaign Questions Correctly

HTL		
# of Surveys	25	
Ambassador Exhibits	**Percentage of Students who visited Exhibit**	**Percentage of Students who Answered Question Correctly**
Orang-utans	96%	48%
Gorillas	96%	76%
Seals	56%	48%
Platypus	60%	24%
Wombats	0%	24%

MEC		
# of Surveys	24	
Ambassador Exhibits	**Percentage of Students who visited Exhibit**	**Percentage of Students who Answered Question Correctly**
Orang-utans	100%	79%
Gorillas	54%	71%
Seals	71%	54%
Platypus	42%	42%
Wombats	13%	75%

FHS1		
# of Surveys	65	
Ambassador Exhibits	**Percentage of Students who visited Exhibit**	**Percentage of Students who Answered Question Correctly**
Orang-utans	100%	74%
Gorillas	95%	78%
Seals	60%	49%
Platypus	57%	43%
Wombats	25%	58%

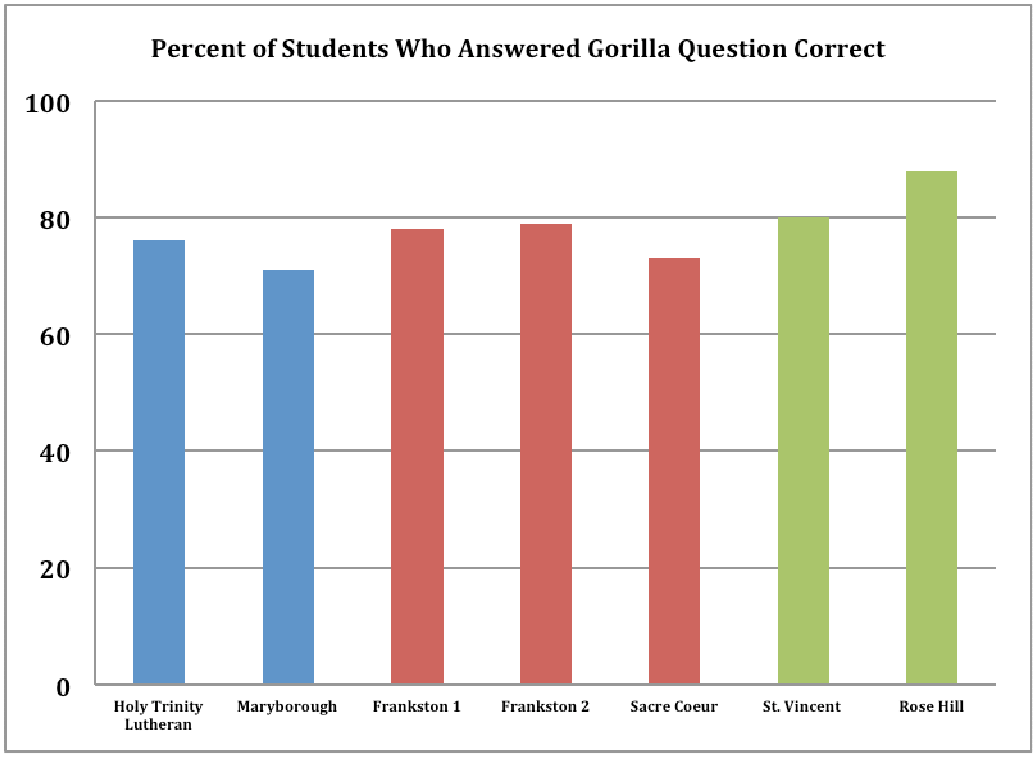
FHS2		
# of Surveys	24	
Ambassador Exhibits	**Percentage of Students who visited Exhibit**	**Percentage of Students who Answered Question Correctly**
Orang-utans	100%	71%
Gorillas	100%	79%
Seals	92%	50%
Platypus	42%	46%
Wombats	63%	50%

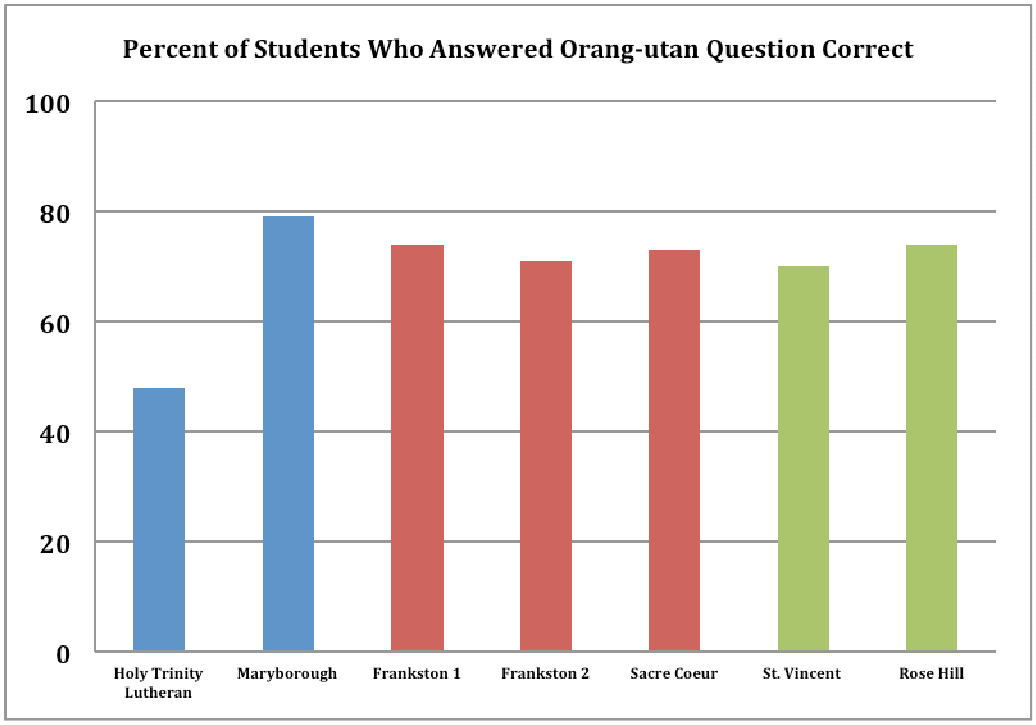
SC		
# of Surveys	22	
Ambassador Exhibits	**Percentage of Students who visited Exhibit**	**Percentage of Students who Answered Question Correctly**
Orang-utans	100%	73%
Gorillas	77%	73%
Seals	77%	41%
Platypus	86%	32%
Wombats	41%	50%

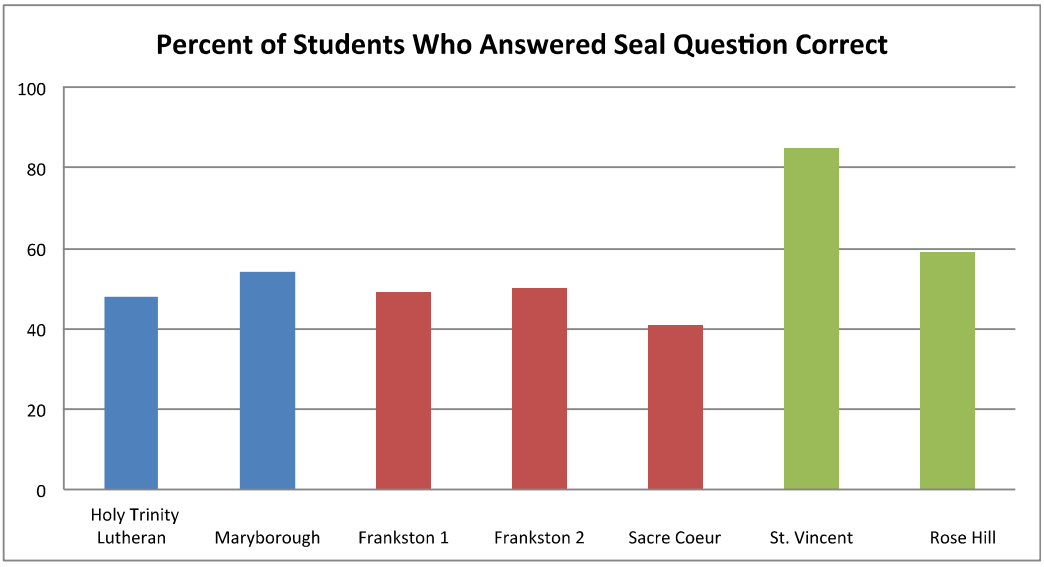
SV		
# of Surveys	60	
Ambassador Exhibits	**Percentage of Students who visited Exhibit**	**Percentage of Students who Answered Question Correctly**
Orang-utans	92%	70%
Gorillas	93%	80%
Seals	98%	85%
Platypus	65%	55%
Wombats	53%	63%

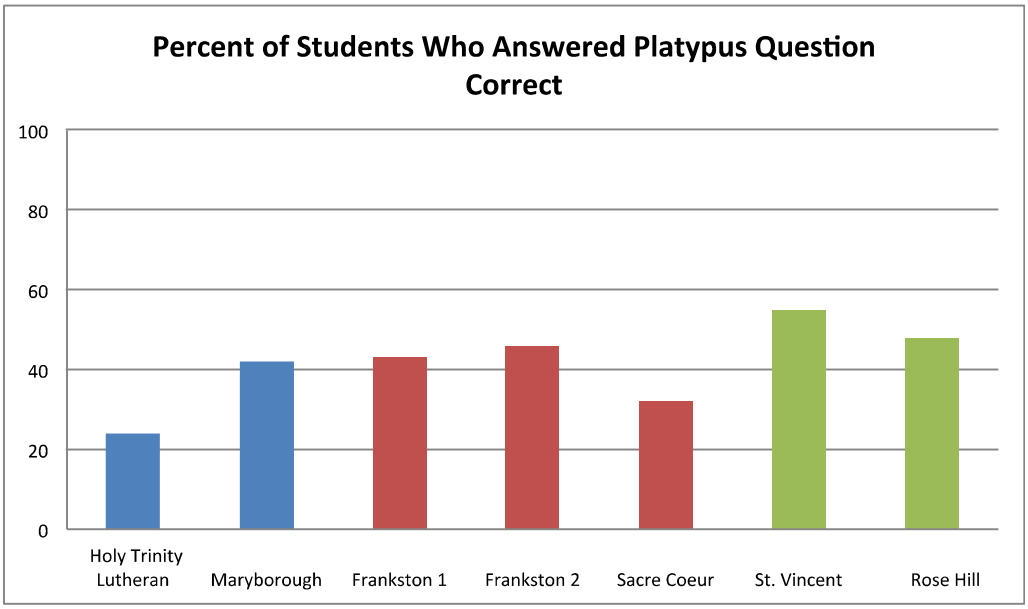
RH		
# of Surveys	97	
Ambassador Exhibits	**Percentage of Students who visited Exhibit**	**Percentage of Students who Answered Question Correctly**
Orang-utans	92%	74%
Gorillas	84%	88%
Seals	99%	59%
Platypus	94%	48%
Wombats	87%	59%

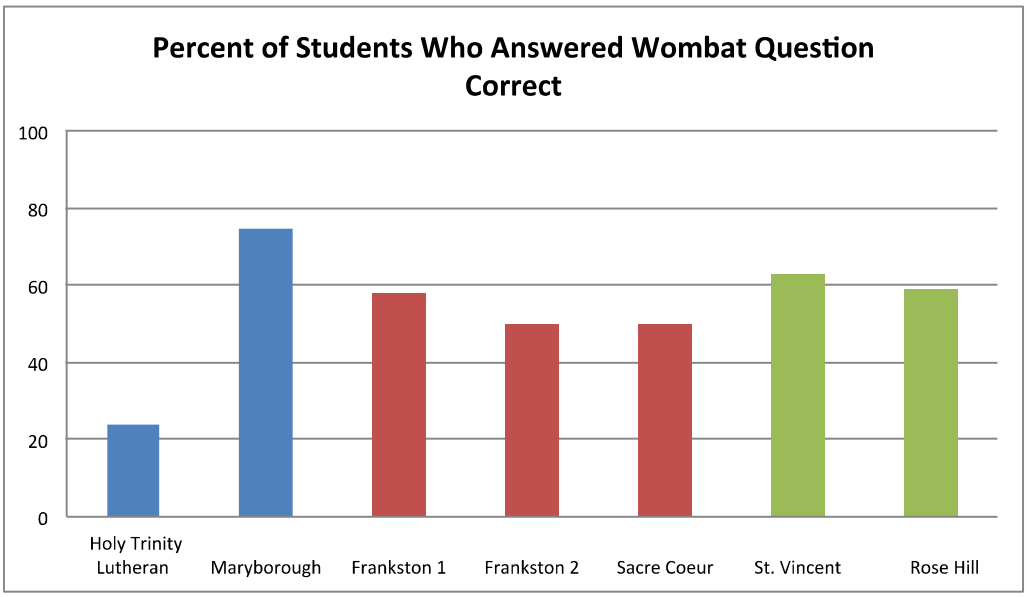
Appendix I: Percentage of Students Who Answered Each Matching Question Correctly by School



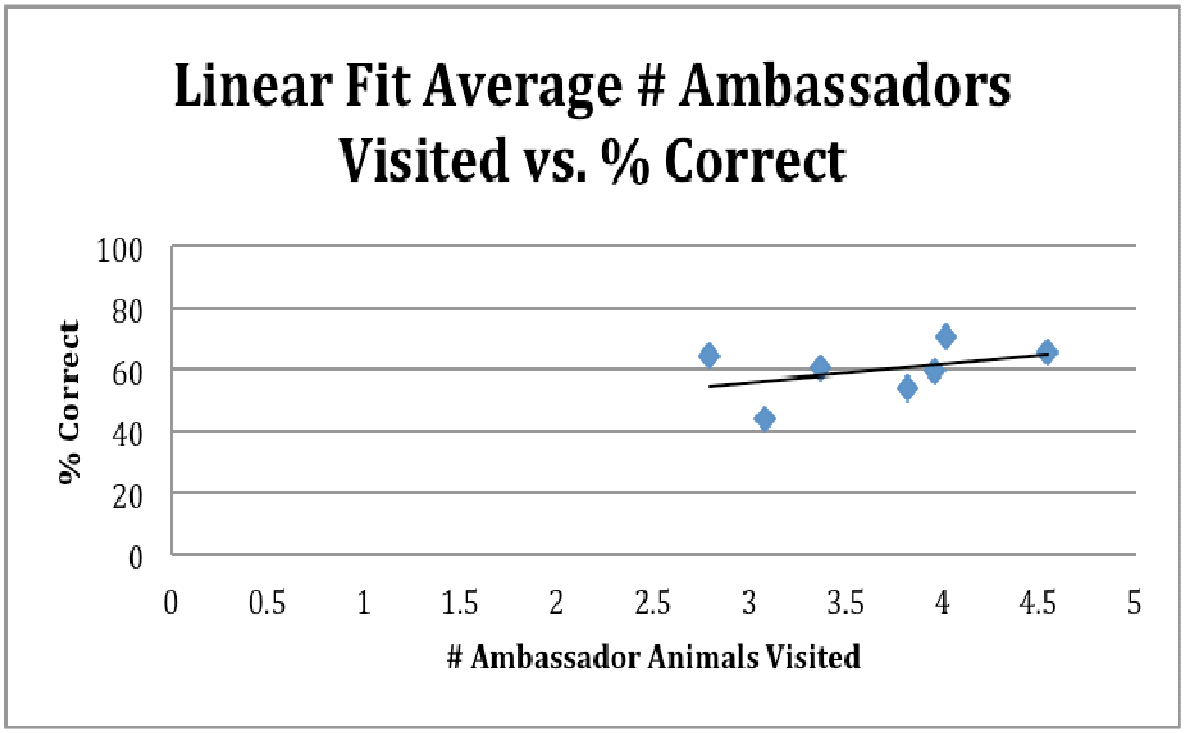



Percent of Students Who Answered Seal Question Correct
100
80
60
40
20
0
Holy Trinity Lutheran
Maryborough
Frankston 1
Frankston 2
Sacre Coeur
St. Vincent
Rose Hill

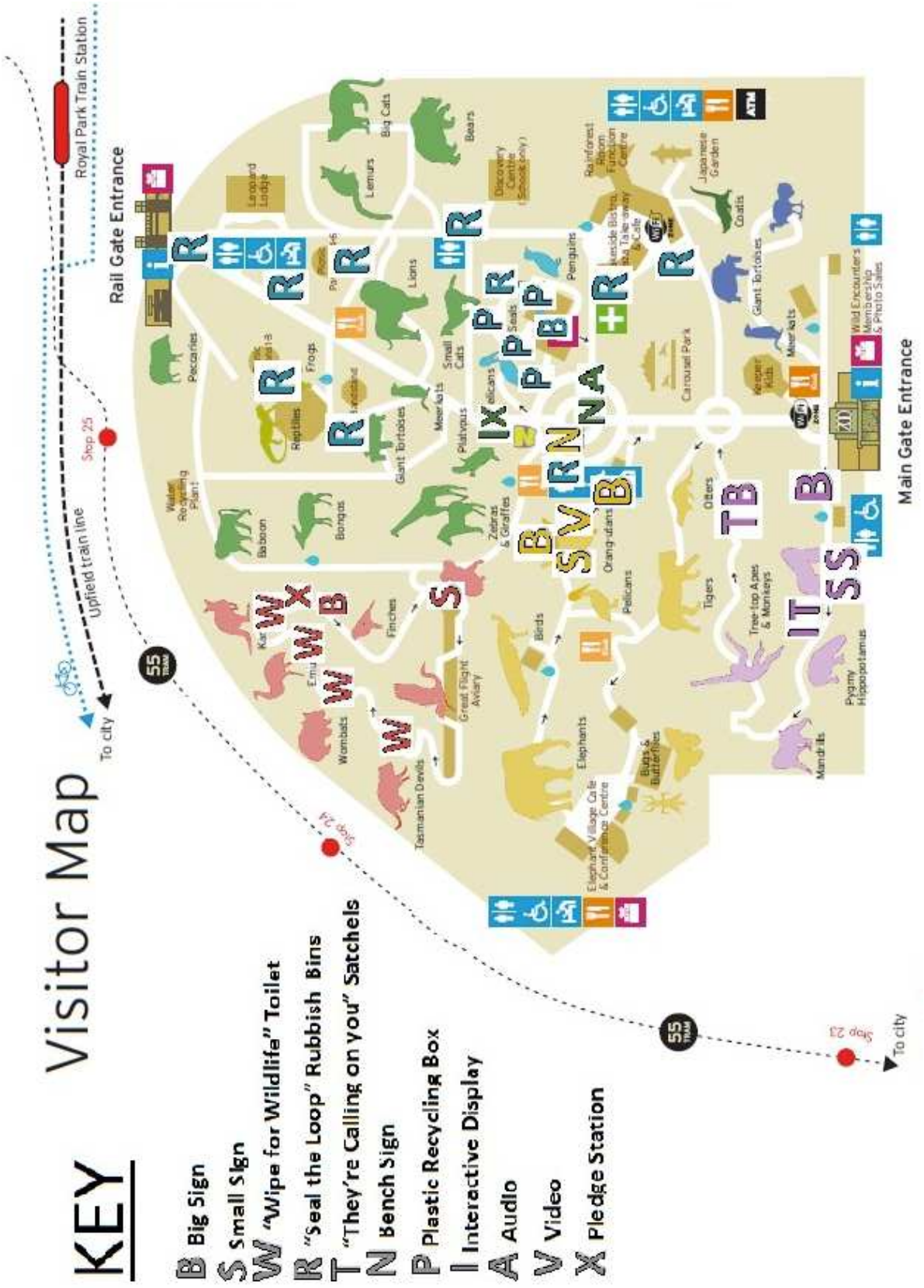

Percent of Students Who Answered Platypus Question Correct
100
80
60
40
20
0
Holy Trinity Lutheran
Maryborough
Frankston 1
Frankston 2
Sacre Coeur
St. Vincent
Rose Hill


Percent of Students Who Answered Wombat Question Correct
100
80
60
40
20
0
Holy Trinity Lutheran
Maryborough
Frankston 1
Frankston 2
Sacre Coeur
St. Vincent
Rose Hill

Appendix J: Linear Correlation of Average Number of Ambassador Animals Visited vs. Per cent Correct



Appendix K: Map of Campaign Signs and Displays



Appendix L: Time Spent at Exhibit Compared to Average Percentage Correct for Ambassador Animal Questions

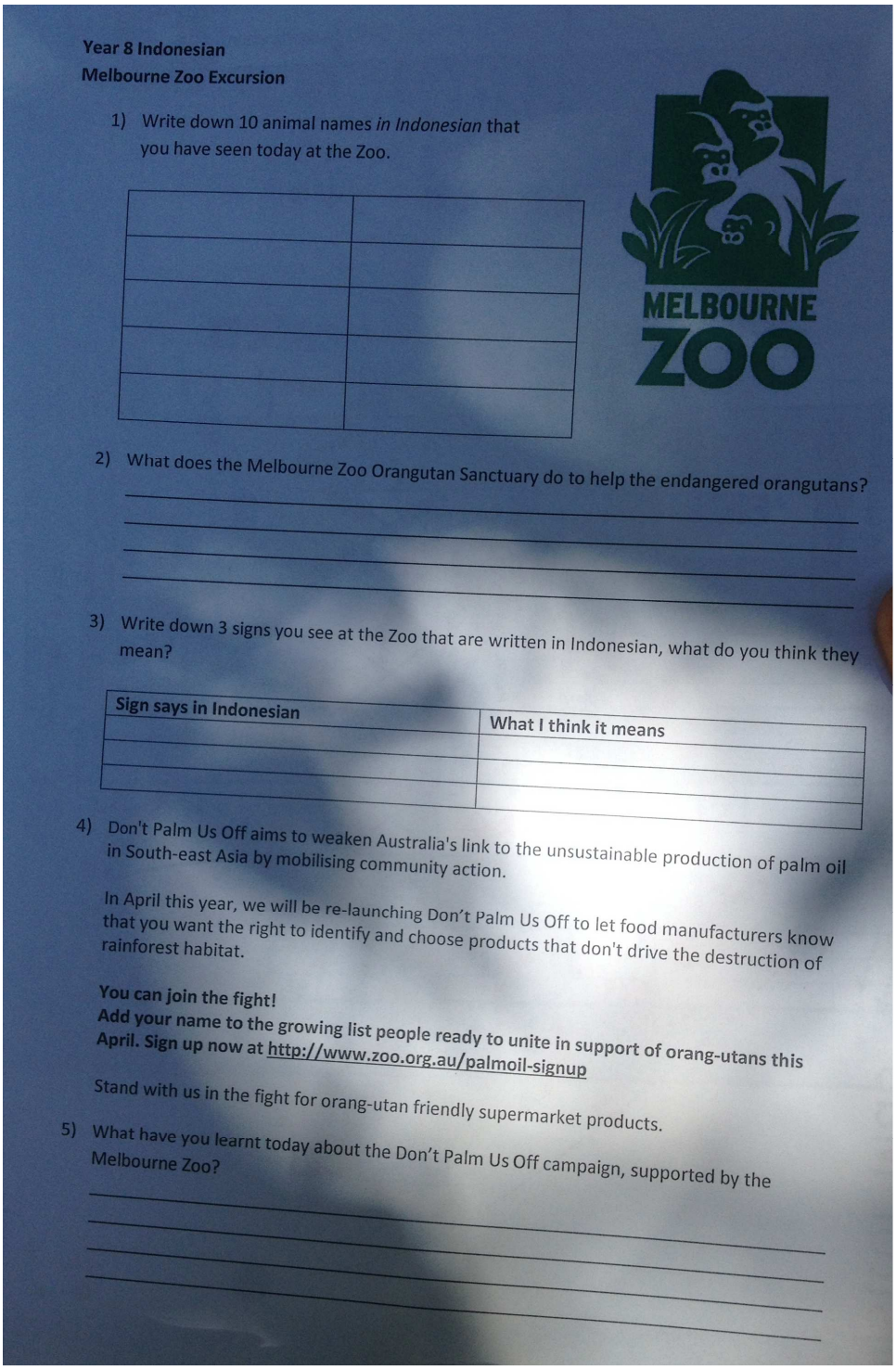
HTL			MEC		
Self-Guided Model			Self-Guided Model		
Avg. Time (min)	% Correct	Exhibit	Avg. Time (min)	% Correct	Exhibit
10.5	76	Gorilla	19	79	Orang-utan
10	48	Orang-utan	4.75	54	Seal
3	24	Platypus	2	42	Platypus
1.5	48	Seal	0.75	71	Gorilla
0	24	Wombat	0	75	Wombat

FHS1			FHS2			SC		
Educator-Led Model			Educator-Led Model			Educator-Led Model		
Avg. Time (min)	% Correct	Exhibit	Avg. Time (min)	% Correct	Exhibit	Avg. Time (min)	% Correct	Exhibit
3	78	Gorilla	3.5	50	Seal	4.5	41	Seal
0.25	74	Orang-utan	1	79	Gorilla	2.5	73	Gorilla
0.25	58	Wombat	0.5	50	Wombat	1.25	73	Orang-utan
0	49	Seal	0.5	46	Platypus	1.25	32	Platypus
0	43	Platypus	0	71	Orang-utan	0	50	Wombat

SV			RH		
New Model			New Model		
Avg. Time (min)	% Correct	Exhibit	Avg. Time (min)	% Correct	Exhibit
15	85	Seal	9	59	Seal
4.25	80	Gorilla	4	88	Gorilla
2.5	70	Orang-utan	3.25	48	Platypus
1.625	55	Platypus	2.5	74	Orang-utan
1.5	63	Wombat	1.125	59	Wombat

Appendix M: Supplementary Worksheets Provided to Students by Teachers

MEC



Year 8 Indonesian
Melbourne Zoo Excursion

1) Write down 10 animal names *in Indonesian* that you have seen today at the Zoo.

MELBOURNE ZOO

2) What does the Melbourne Zoo Orangutan Sanctuary do to help the endangered orangutans?

3) Write down 3 signs you see at the Zoo that are written in Indonesian, what do you think they mean?

Sign says in Indonesian	What I think it means

4) Don't Palm Us Off aims to weaken Australia's link to the unsustainable production of palm oil in South-east Asia by mobilising community action.

In April this year, we will be re-launching Don't Palm Us Off to let food manufacturers know that you want the right to identify and choose products that don't drive the destruction of rainforest habitat.

You can join the fight!
Add your name to the growing list people ready to unite in support of orang-utans this April. Sign up now at http://www.zoo.org.au/palmoil-signup

Stand with us in the fight for orang-utan friendly supermarket products.

5) What have you learnt today about the Don't Palm Us Off campaign, supported by the Melbourne Zoo?

MELBOURNE ZOO

GEOGRAPHY FIELDWORK PROJECT

NAME:

MEMBERS OF YOUR GROUP:

SCHOOL MOBILE NUMBER:

SCHOOL CONTACT NUMBER:
03 9783 7955

TRAIL # 1

Upon entering the Gorilla Rainforest you will see an inspiring quote. The incomplete version is written here. Fill in the blanks. [4]

'The rainforest is an _____ element on Earth. Its trees _____ the oxygen we breathe. People get _____ from its plants. And it gives different _____ a place to live. We should do anything we can to save it.'
Janice Licare, aged 13
Co-founder, Kids Saving the Rainforest.

Would paths normally exist in a rainforest? [2]

1

Use the map to shade in the countries of five rainforest animals found at the zoo, and list these animals using a key / legend. [6]

There are three races of gorilla, all found in the tropical forests of central Africa. Name the three races.

[3]

How do rainforests 'cool our globe'?

[2]

'Rainforest Plants' [Fill in the blanks] [6]

'Thousands of plant _____ flourish in a rainforest. Over ___ hundred different kinds of tree can grow on a single hectare. This variety of growth is sustained because _____ within the forest are constantly recycled.

The _____ are returned to the soil from the decaying vegetation which falls to the forest floor and is broken down by millipedes, termites, _____ and organisms such as bacteria and _____.'

How do plants and animals 'benefit from each other'?

[2]

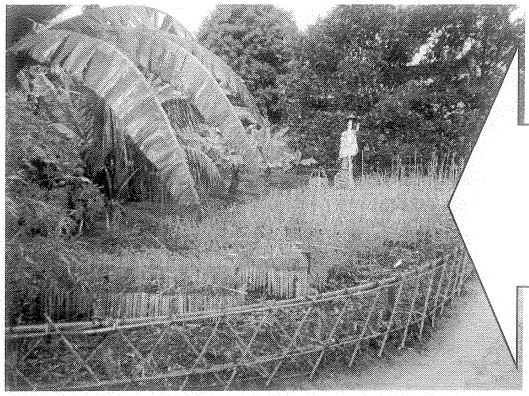
What are arboreal animals? [1]_____

What does Sir David Attenborough say on the sign 'IT'S UP TO US'?

[2]

TRAIL # 2

This land is an example of forest clearance. Why do you think this might occur? [2]



Find the butterfly enclosure. The climate of the butterfly house is similar to a tropical rainforest. Explain how you might feel if you were to spend an hour or so in there. [2]

Finish the following sentences using the buttons that you will find upon exiting the butterfly enclosure.

1. Rainforest trees provide... [1]

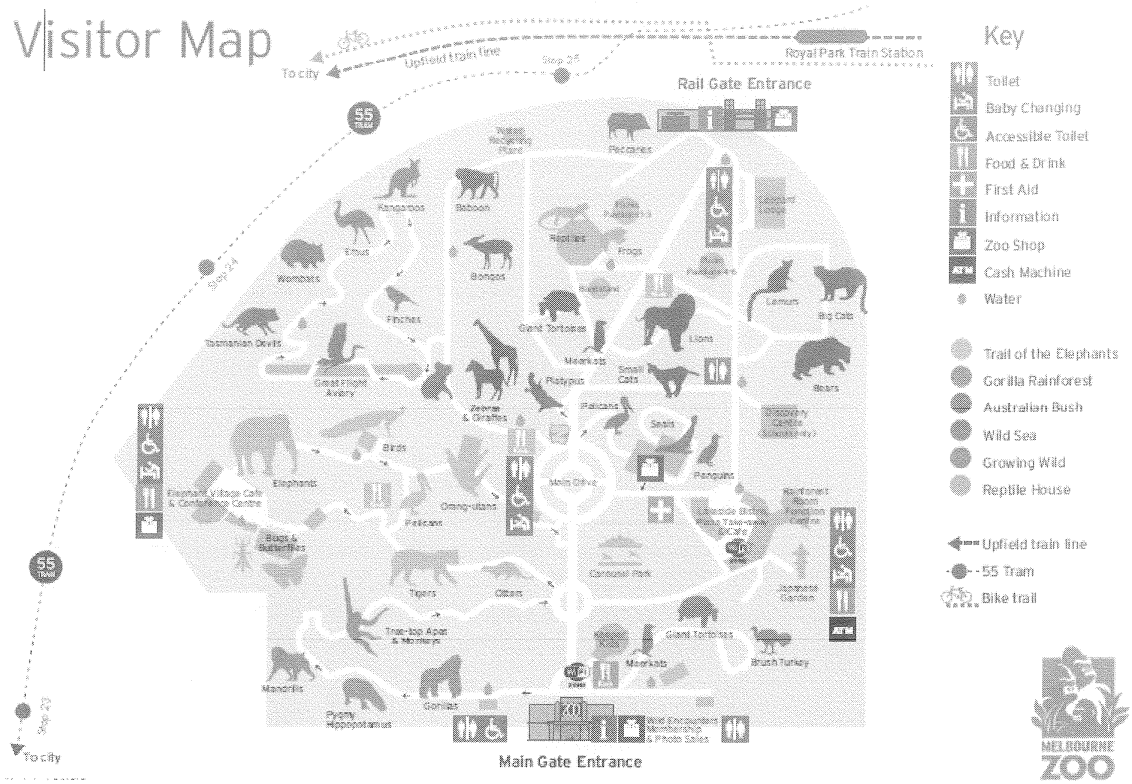
2. The forest floor is a source of... [1]

In your own words, what does this set of signs mean? [2]

Orang-utan/gorilla report (100 words minimum) [4]
Explain how one of these animals is being affected by habitat loss and what is being done to help stop it.

The zoo tries its hardest to be environmentally friendly. How might this help flora and fauna in rainforests around the world? (50 words minimum)[3]

5



FHS expectations, guidelines and requirements

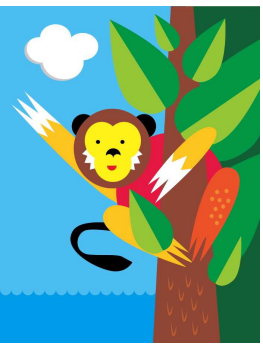
1. Full school uniform.
2. Behaviour appropriate to being in public.
3. A 'nude' lunch – the Melbourne Zoo hopes that in the interests of the environment students will pack a lunch that requires little to no packaging, e.g. a plastic lunch box with a tightly packed sandwich, blueberry muffin and water bottle would mean that no cling wrap or paper bags would be necessary.
4. Pens, grey leads, eraser, clip board, coloured pencils.
5. A camera. This is not a compulsory requirement, but students may find it useful and fun to have a camera. At all times a student is responsible for their own possessions and teachers cannot be held liable for loss or damage of such equipment.
6. Students will be given meeting times to which they should strictly adhere – for this reason it is expected each student will form part of a group that has at least one watch.
7. Students will be provided with a map of the Melbourne Zoo. Students should make themselves familiar with the exits and first aid zone.
8. While at the zoo, please keep to pathways and stay behind safety barriers.
9. Do not feed the animals or free-range birds. All animals are on special diets.

Warning: You must receive a mark of 40% or more to successfully pass this fieldwork task.

43-40	39-34	33-29	28-36	35-17	16-0
Ex	VG	G	S	C	NS

SC

ENDANGERED SPECIES WORKSHEET



NAME_____ CLASS_____

As you walk around the zoo and attend the education session complete the following. Each student must submit the completed sheet in the next Geography lesson.

1) What role do zoos play in the protection of animals that may be endangered?

_____

_____

2) Listed are the classifications given to animals by organisations such as CITES to indicate how close to extinction they are. Explain each.

a) Extinct_____ _____

b) Extinct in the wild __ _ _____

c) Critically endangered ____ _____

d) Endangered ____ _____ _____

e) Vulnerable _____ _____

3) List 3 animals that you see today. Include their country of origin and their classification. You may need to look this up on www.redlist.org

ANIMAL	COUNTRY	CLASSIFICATION- Approximate numbers remaining
1)		
2)		
3)		

4) List 5 things that have contributed to the growing number of endangered species.

_____

_____

5) Study the enclosures that the animals are kept in.

a) How are they designed to be similar to their native habitat?

_____

_____

.

b) Detail the ways in which they are very different from their native habitats.

_____

_____

6) In what ways are zoos acting at a Local scale to help the endangered species on a Global scale?

_____

_____

_____

7) Introduced Species can pose a threat to our native wildlife. What steps are taken by customs to minimise that threat? Do zoo authorities have links to customs?

_____

_____

_____

8) Detail 2 things of interest that you learnt in today's education session. Explain why each was significant to you.

_____

_____

_____