PLASTIC RECYCLING BEHAVIOR OF SHANGHAI STUDENTS:

A SCHOOL-BASED ACTION RESEARCH RECYCLING STUDY

by

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Abstract

China's increasing population of urban dwellers in mega-cities such as Shanghai and Beijing are consuming beverages in PET plastic containers at alarming rates. Recycling education in China's schools is nascent compared to schools in Western nations. Recycling habits to a lesser degree are either ingrained within a person's daily routine with awareness or not practiced at all. Can positive recycling habits be shaped within adolescents? In addition, can these recycling habits change, as a result of environmental education over the course of a semester, coupled with more easily accessible recycling receptacles? A school-based action research study was conducted in Shanghai, China to measure and track the recycling habits of PET plastic bottles at Jin Cai International Division School. The student respondents (n=240) initially completed a recycling habits entry-survey. The students, during the 2011 spring semester, were then exposed to a recycling program that included different recycling education lessons, new recycling receptacles and positive reinforcement. At the end of the semester an exit-survey (n=197) was conducted to gather insights into whether the students' recycling habits had changed, along with measuring the effectiveness of the recycling program. Results indicate that gender, age, place of birth and parents' influence are factors which affect the intention to recycle. Conditions within China, such as the numerous plastic scavengers and governmental policy are also shaping these habits within China. Recommendations for an effective recycling program include requiring recycle boxes within each classroom and a recycling receptacle easily accessible to the larger student population.

Keywords: Action Research, circular economy law, China, consumable item, high density polyethylene (HDPE), Jin Cai International Division, polyethylene terephthalate (PET) plastic bottle, plastic scavenger, recycling, recycling receptacles, 12th Five-Year Plan

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Introduction

China Overview

China's rise to power after Deng Xiaopeng proclaimed in the 1970s "to get rich is glorious" spurred entrepreneurs, state-owned enterprises and developers to create non-stop, resilient economic growth for 20 years. China's Gross Domestic Product (GDP) growth has averaged 10.5% over the past 10 years, compared to the United States paltry 1.7% GDP growth (Kenny, 2011). This growth has led to China's rapid urbanization and consumption of consumable items that are largely plastic based. After massive migrations from villages to urban centers, China is now mirroring the West in terms of consumption habits. Hyper-markets, malls, and convenience stores are now ubiquitous in most metropolitan areas, which create large amounts of plastic-based recyclable trash. China now is the largest plastics consumer in the world, accounting for over one-quarter of the total world consumption, which was 240 million tons in 2009, and the per-capita plastic consumption in the country was 46 kg, exceeding the world average of 40 kg (Zong, 2010). These figures suggest that China needs more policy, research and education about recycling in order to develop a more sustainable society, for the betterment of itself and the rest of the world.

The 12th Five-Year Plan

The Chinese Communist Party bases their policies on a plan named the Five-Year plan. The current 12th Five-Year Plan (TFYP) of 2011-2015 has six major areas. Included within the TFYP is the energy-saving plastics initiative that will mold policies on how plastics are made, recycled and handled (ChinaPlas, 2011). This plan will also transform, upgrade and bring new development to the plastics industry (Zong, 2010). The plastics industry needs to form a healthy relationship with new Chinese consumers concerning the importance of recycling in relation to

the environment. In conclusion, the Chinese government is signaling to the plastics industry that the recycling of plastics is now a priority and should be addressed.

Recycling Industry Overview

The Chinese government's low oil reserves make them a key player in the market for recovered plastics. The most popular types of plastic are high-density polyethylene (HDPE), polyethylene terephthalate (PET) and polyvinyl chloride (PVC). Chinese demand for recovered plastics grew from 4 million tons in 2000 to 15 million tons in 2007, and again from 17.5 million tons in 2009 to the projected estimate of 19 million tons in 2010 (Scrap-Ex News, 2011). Plastic news reported in 2005 that about 320 million pounds of the 840 million pounds of PET collected from within the USA going overseas mainly went to China. Regarding HDPE, about 100 million pounds of the 820 million pounds collected went to foreign markets, with China being the receiving the largest amount of these plastic articles (Toloken, 2005). According to the United Kingdom's Guardian (Vidal, 2004), China is the largest importer of recovered plastics and receives about 67% of the UK's plastic for processing. Shipping containers that leave Chinese ports filled with Chinese made products reach destinations all over the world. These containers are then refilled with recyclable materials and sent back to China, since freight rates are reasonably low, and China does not have enough resources to create virgin plastic material. To satiate their thirst for plastic, this is how the global markets have been operating for the past decade. Often, Hong Kong is the entry point for plastic to be cleaned, and processed into small pieces known as flaking, before entering into the nearby Guangdong province in China where the recycling industry is sizable. Here, low wage workers can easily process the discarded plastic. The plastic is then inspected by licensed officials, who are often the end-users of the plastic, and remade into other plastic-based consumer products for consumers all over the world. According

to CNF China, in 2011, high quality, dry, and processed PET flaked plastic, had the estimated price of $1,100 USD per metric ton (Cheng, 2011). This circular materials cycle is repeated year in and year out, but recently the Chinese government has been getting stricter. The TFYP is aiming to prevent the import of waste plastics, which need sorting before they can be reprocessed. However, this has not always been strictly enforced (Uctas, 2007).

Plastic Scavengers

Waste management is different in China compared to the rest of the world. A whole sector of society, known as scavengers, rummage, sort and collect trash and valuable materials. Scavengers work all day with their flat-bed bicycles to collect trash, appliances and recyclables. An estimated 160,000 scavengers live in Beijing that make a living from recycling plastic; many of these collectors left the farm for the streets because they can make more money there (Hays, 2008). These collectors sift through trash and recycle bins. Plastic bottles thrown on the street are picked up just minutes after they are strewn about on the ground.

The policies of the TFYP, the huge global plastics industry, and the plastics collectors on the streets of China motivate the research behind this paper. Do these scavengers, since they are so efficient, have an effect on recycling habits in Shanghai?

Research Topic

As a result of the rise of consumerism in China, the focus of recycling in the TFYP, and the breadth of the plastics industry, this research is based on the social habits of recycling. The first generation of Chinese children are being recently exposed to recycling awareness and this is a pivotal time within China to research the recycling habits of this new generation. Furthermore, it will be interesting to research international students behavior within China.

This study aims to develop a keen understanding of the following questions: What are the social attitudes toward plastic recycling in Shanghai? Does a Western or Chinese background have any correlation with this social attitude? What are the consumption patterns of plastic usage within one week? After educational workshops on recycling, is there a positive, negative or null correlation with more frequent recycling? Another important aspect pertains to the high prevalence of plastic collectors. Does the existence of these scavengers affect the recycling habits of people living in China?

Furthermore, encouraging recycling through marketing efforts and education is crucial for a successful recycling program. These efforts to promote recycling have been studied before, and recommendations from the study are that "consistent and accessible recycling infrastructure must be in place, an improvement in adolescents' knowledge of what is and what is not recyclable is important, and finally adolescents may be more globally minded and future-oriented than adults may presume them to be" (Prestin & Pierce, 2010, p. 1017).

The type of research conducted for this thesis is known as action research, which is typically done within a school setting. Action research specifically refers to a disciplined inquiry done by a teacher with the intent that the research will inform and change his or her practices in the future. This research is carried out within the context of the teacher's environment—that is, with the students and at the school in which the teacher works—on questions that deal with educational matters at hand (Ferrance, 2000).

Key Terms Defined

Action Research: Typically, action research is undertaken in a school setting. It is a reflective process that allows for inquiry and discussion as components of the research (Ferrance, 2000).

Circular Economy (CE) Law: Passed during the 11th Five-Year Plan, the function of the CE law is to mitigate or remove the conflicts among economic growth, resources and environment, as well as to change traditional production and consumption patterns leading towards a sustainable one. The circular economy also refers to the balancing of economic development with environmental and resource protection.

Consumable Plastic Item: A product that may be used up or consumed. This product is usually packaged and sold in a plastic container, holding liquids or something easily consumed by humans.

High-Density Polyethylene (HDPE): This is a plastic made from petroleum and is resistant to many solvents. It is commonly used for refillable bottles, bottle caps, milk jugs, distilled water, large vinegar bottles, liquid laundry, dish detergent, fabric softener, and folding chairs. It is characterized by being a thick and durable type of plastic. The recycling code of HDPE is the number 2.

Jin Cai International Division (JCID): A school located in the Pudong New Area of Shanghai, China. The campus has an elementary school and a secondary school, from grades 6-12, with about 400 students from over 20 countries in attendance. The Chinese section is taught in Mandarin and the English section is taught in English; the International Baccalaureate (IB) curriculum is employed.

Polyethylene Terephthalate (PET): This is the thinner type of plastic, when compared to the HDPE type of plastic. PET is in the polyester family, commonly used in making most plastic beverage containers that contain liquid. The recycling code of PET is the number 1. Within this paper, the PET bottles or PET plastic bottles mentioned refer to PET plastic beverage bottles.

Plastic Scavenger: Refers to the people who roam the streets and collect plastic for their living. Many of this large population in China, known as scavengers used to be farmers.

Recycling: The act of processing used or abandoned materials for use in creating new products. This includes plastic, paper, electronics or E-waste, appliances, and metals.

Recycling Receptacle: Commonly known as a recycle bin, but can take many forms. A plastic tube and cardboard boxes were used as recycling receptacles in this research study.

12th Five-Year Plan (TFYP): The Communist Party of China (CPC) develops one plan every five years. It is established for the entire country and normally contains detailed economic and social development guidelines for all its regions. The new TFYP of 2011-2015 is now being implemented and emphasizes infrastructure development, monetary and environmental controls.

Literature Review

Environmental Education (EE)

Every country has different recycling programs within the household and various recycling education curriculums. The importance on recycling education at the school and household level varies based on the circumstances within each country. Recycling is usually a component within Environmental Education in secondary education, and helps reinforce positive awareness on reasons to practice recycling. According to Prestin and Pearce (2009), studies find that children acquire a good deal of environmental knowledge by the time they reach junior high school (as cited in Mahmud & Osman, 2010). Reviewing literature based on recycling education will help to better illustrate how this education can shape behavior within students.

Smith, Rechenberg, Cruey, Magness and Sandman (1997) explores the impact of recycling education on knowledge and attitudes of students from grades three through six attending public and private schools in Cincinnati, Ohio in the United States. Their findings suggest that older school children exhibit more pro-recycling attitudes and behavior than younger children do. This indicates that there may be a critical period just prior to adolescence in which students are most responsive to the efforts of environmental educators. The fact that private school students exhibit more pro-recycling attitudes and behaviors than public school students may reflect a broader socioeconomic difference. Smith et al. (1997) also identify that a field trip to landfills illustrating the consequences of not recycling is a more effective way of increasing recycling behavior, while a classroom discussion lends itself more to increasing student knowledge. Education on recycling and recycling habits was the driving force for this research, developing a broader sense of how age and socioeconomic status (commonly known as SES factors) reinforced these behaviors.

A research study of Malaysian school students to determine recycling intention behavior was carried out by Mahmud and Osman (2010), and their findings propose that environmental education plays a major role in encouraging recycling awareness among Malaysians. The researchers investigate the antecedent of recycling intention behavior among secondary school students. Their research motives include deciphering if increased knowledge would translate into behavioral changes. According to East (1993) the framework of the investigation is based on the Theory of Planned Behavior (TPB) studies (as cited in Mahmud & Osman, 2010). TPB assumes that people behave rationally when they consider the implications of their actions. The TPB also holds that environmental activism can be engaged in, if support for the activism is available and it is easy to engage in the activism.

Mahmud and Osman (2010) define intention as being influenced by three factors: i) specific attitude (SA), the individual's favorable or unfavorable evaluation of performing the behavior, ii) subjective norm (SN), based on an individuals perception of whether important people in their lives would want them to perform the behavior and iii) perceived behavior control (PBC), reflects the extent to which individuals perceive the behavior to be under volitional control. The results of this study show that the strongest predictor of intention to recycle is PBC, and SN is the second strongest predictor of intention to recycle. In other words, the results showed that PBC—or the act of willpower to recycle—was the greatest factor for students to participate in recycling. The SN factor—that influential people in their lives reinforce positive recycling attitudes—is important as well. This literature regarding recycling educational shows that older children and willingness to recycle are major factors EE has on recycling.

Recycling Behavior

Students absorb knowledge and behaviors like a sponge from adults and peers during their adolescent years. This literature can help pinpoint if certain demographics, behaviors or external factors influence recycling behavior.

Knussen and Yule (2008) carried out a community study in Scotland within a geographical area with poor recycling facilities. They investigated two potential measures of recycling behavior: past recycling behavior and perceived lack of habit, as a reason for previous failure to recycle. Results indicate that both past behavior and lack of habit made significant independent contributions to the variance of intention to recycle, suggesting that past recycling behavior was not an adequate measure of habit. This suggests that those who failed to recycle because of lack of habit may have had the habit of treating recyclables as garbage.

A study on recycling habits in metropolitan Wuhan, China's fifth largest city, find that gender, age, and household income are the top three factors affecting individual recycling behavior (Li, 2003). For economic incentives, households with different incomes did take different actions, and individuals in lower income households were more active in recycling. Furthermore, females, especially older women, play a crucial role in recycling household waste.

Asian-British attitudes towards recycling reveal that "recycling participation tends to be higher among more affluent and older people, but lower among less affluent and younger households, probably due in part to the availability of both storage space and time" (Martin, Williams & Clark, 2006, p. 357). On the contrary, Li's (2003) research is inconsistent with these findings of Martin, Williams and Clark (2006), because Li concludes that these behaviors may be caused by the socioeconomic, cultural, traditional and other differences among the studied populations.

The dependent variable in Li's (2003) study is the economic incentive to recycle. In comparison, the dependent variable in Martin, Williams and Clark's (2006) study is storage space and time, and these two variables in both studies coincidentally influence recycling behavior. Motivations for Chinese and British populations to recycle are different and after reviewing these articles, a good perspective of the differences between Eastern and Western society's motivations to recycle emerged.

Recycling Policy

Institutions, schools and municipalities all have recycling programs that differ to some extent. This literature review section explores some different waste management programs and their benefits and shortcomings.

A study exists in reducing solid waste on a higher education campus at Prince George University of Northern British Columbia (UNBC) in Canada. The community at UNBC intention behind this research is due to the absence of a formal waste management and recycling policy, explicit coordination of a recycling program and the relatively small number of poorly labeled, unevenly distributed campus recycling receptacles (Smyth, Fredeen, & Booth, 2010). After collecting and characterizing waste, during two separate five-day sampling periods, research results show that 991 kilograms could have been diverted from the landfill on the campus of UNBC through composting, recycling and waste reduction activities. Smyth, Fredeen and Booth (2010) conclude that a formal policy with source reduction education and awareness measures are instrumental in moving UNBC beyond recycling. The researchers also address single-use beverage containers, and conclude that a simple packaging surcharge of $0.10 CAN should be added if one uses a single-use container. In addition, a $0.10 CAN discount should be given for those using reusable containers, in hopes of shifting consumer behaviors to use reusable bottles for liquids. This study is relevant because the research conducted at JCID had no formal recycling policy or programs prior to the one introduced for this research. Recycling policies will be recommended after this research data analyses.

National level policy is crucial in directing enterprises into a more environmentally sustainable direction. The circular economy (CE) promotion law of the People's Republic of China was passed in the previous 11th Five-Year Plan on August 29, 2008 and is an official national development goal to promote sustainability. The scope of the CE law tries to develop new economic patterns with circulation of materials, covering production and consumption (Miao, 2008). The law also provides for the central government to allocate funds and capital to enterprises to encourage innovation in recycling technologies. It also provides tax breaks to

enterprises introducing and using energy-efficient technologies and equipment (Xinhua News, 2008).

After directives from Beijing of new dramatic laws such as the circular economy (CE) law came into effect for industry and the general population, the effectiveness of this implementation on the provincial level is a guiding question in the research of Xue et al. (2010). Xue et al. (2010) carried out a survey of six cities between September 2008 to July 2009 in Northwest China in the Gansu and Shaanxi province to research the provincial level official's attitudes towards CE laws and performance toward promoting the new CE laws. The participants of this survey are all local officials put in charge of implementing the new CE laws. Their research concludes that:

> "Nearly 16.70% of the interviewed officials had just heard of CE, indicating that there is still a need for government officials to further improve their CE awareness. The main barriers on CE development were weakness of public awareness and lack of financial support. Furthermore, the 61.11% of all respondents officials considered that CE development is to execute compulsory regulations on industry; and this contradiction suggests that the officials currently focus much more on the CE development of industry than on public participation" (Xue et al., 2010, p. 1301).

The CE law has good intentions and is a step forward for sustainability on a larger scale in China, but officials are having a hard time implementing this new policy with the general public. The passage above suggests that larger industries are the entities mainly following the CE laws. The Chinese proverb "heaven is high and the emperor is far away" still holds true in the countryside of China in regards to enforcement of the new CE laws.

Chinese Recycling Practices

With 1.3 billion people and counting within China, the importance of understanding recycling practices and systems of the Chinese people is increasing. China also represents the largest potential recycling capacity in the world (Li, 2008). The practices of the common people,

industries and government should be understood in order to develop effective recommendations for recycling practices in the future. The following literature will discuss recycling of plastic bags, tires, and industrial waste (i.e. E-waste, iron ore and copper) to discover common research findings across the spectrum of recyclable materials.

Global research think tank Synovate unveiled their 2011 Global Green Habits Study, findings show 39% of mainland Chinese respondents recycled at home during the week of April 7, 2011. Older consumers (aged 56-65) show they recycle more than the younger segment (aged 16-25). Furthermore, Synovate conducted a comparison between Hong Kong consumers and the People's Republic of China (PRC) consumers and results show a difference of 13% of consumers recycled more in Hong Kong. Synovate suggests that mainland China is still building the infrastructure to facilitate green behavior, which is a cause of parity between Hong Kong and the PRC's recycling habits. This study also states that women and older consumers are often the household decision makers. These statistics are similar to Li's research in 2003, whom also shared the same observation that women and older consumers recycled more often within mainland China.

The automotive and transportation industries are growing rapidly within China and tire recycling is now an important issue. The fastest growing segment in China's recycling industry is recycled tires and reclaimed rubber, with 2.2 million tons recycled in 2008. This figure is expected to reach 4.2 million tons in 2013 (Li, 2008). Other researchers, Wang, Xu and Xuan (2009) reviewed waste tire reuse and recycling within China and findings show that the recycling rate of tires to be 10%, far lower than in developed countries. These waste tires called "black pollution" are hard to decompose and if in open spaces can harbor mosquitoes that carry diseases to the general public. In addition, Wang et al. (2009) recognize that waste tire reuse and

recycling in China lacks a specific method to control the recycling or disposing of waste tires. There are also no specific industrial policies controlling the waste tire and recycling industry in China. The researchers conclude that the waste tire reuse and recycling industry has high economic and environmental benefits and is very important for the circular economic development in China.

China is now mitigating another type of pollution, conversely named "white pollution" in the form of banning plastic bags. The ban is imposed on ultra-thin plastic bags that measure less than .025 mm thick and the ban also prohibits all retailers from providing their customers with free plastic bags, instead requiring that they sell the bags to their customers for a nominal fee. This policy, known as the "plastic limit order" was established in 2009 after the circular economy law was passed. It is aimed at conserving China's oil resources. The Chinese use up to 3 billion plastic bags daily—using about 37 million barrels of crude oil to produce these plastic bags—and every bag takes up to 1,000 years to decompose (O'Loughlin, 2010). A Western based researcher on a Fulbright scholarship grant[1] O'Loughlin (2010), conducted a 10-month long research trip in Wuhan, China and traveled throughout the country to observe China's plastic bag distribution policy. She observed the implementation of this new policy, discovering that almost all foreign-owned brand name chain stores and most major chain stores adhered to the plastic bag policy. Moreover, the main violators of this policy were small-scale retail operators in the vegetable markets, and street vendors that were unwilling to implement this policy because it is unsustainable for their business model (O'Loughlin, 2010). An important recommendation for improving the plastic limit order in relation to this research was "to ensure

Footnote: [1] A Fulbright scholarship is an International Educational Exchange Program sponsored by the U.S. Department of state: Bureau of Educational and Cultural Affairs. These grants are competitive, merit-based grants given to students in the United States wanting to study abroad or within the United States for a year.

that students learn about the risks of plastic bag refuse in school by incorporating the topic into the regular environmental education curriculum" (O'Loughlin, 2010, p. 19). This research is another illustration of how policies fail to trickle down to the common people of China, and that industries are the only entities that follow the new mandates handed down by the government.

The World Bank (as cited in Ye, 2010) reported China has an army of scrap collectors or scavengers numbering 2.5 million. These collectors ride bicycle carts for long hours to collect ferrous metals (iron and steel), non-ferrous metals (copper, aluminum, lead, zinc, plastic and paper) and rubber to make an average of $150 USD per month. A study in Suzhou, by Mo, Wen and Chen in 2009, focused on the current recycling system's structural characteristics of recyclable resources of iron, steel, copper and electronic waste known as E-waste. On the main collection routes were waste pickers, itinerant waste buyers and collection shops. The recyclable materials were then sent to collection and recovery enterprises that had to pay a value added tax of 13-17%, which resulted in tax fraud and low profit margins (Mo et al., 2009). The main impact factors of the recycling system within this study turned out to be recovery value and large generation scale. Within the residential collection system, the main collection system is the unsupervised individual collection business, because it is most practical for collecting recyclable resources within a small generation scale. The findings within Suzhou indicate that the residential level recycling is maintained by individual collection businesses and then handed over to larger scale enterprises, which illustrates a clear picture of how residential recycling operates within China.

Some common findings suggest that many progressive environmental laws have passed recently within China, but the implementation of these laws have not seeped into the daily life of the common Chinese people yet. However, the laws have regulated industry more effectively to

reduce harmful environmental practices, for example the Plastic Limit Order law has declined plastic bag usage 66% at major foreign and domestic supermarkets. This research suggests that China should take a cue from Ireland's environmental policy model by having a combination of rigorous enforcement and an effective awareness campaign (O'Loughlin, 2011).

Environmental education, recycling behavior, recycling policies and Chinese recycling practices are different factors that influence recycling decisions within China. The youth within China are a key piece to the puzzle for the new circular economy laws to be successful. This research took place in China's most successful and modernized area, the Pudong New Area of Shanghai and in regards to the student responses, the next question becomes "what will their recycling behavior be"?

Research Design and Methodology

Research Approach and Tools

The purpose of this study is to understand the social attitudes towards plastic recycling, and the consumption patterns of the participants of the study. The participants were all students at Shanghai's Jin Cai International Division (JCID) School ranging from grades 6-11 during the 2010-2011 school year.

Another goal of this thesis was not to only uncover behavioral aspects of students recycling habits, but the underlying and overall goal was to transform these students' recycling behavior through various educational components planned by the researcher. This type of research, known as action research, usually occurs within an educational setting. In more detail, action research is as follows:

> "Action research is a process of deep inquiry into one's practices in service of moving towards an envisioned future, aligned with values. Action research is a way of learning from and through one's practice by working through a series of reflective stages that facilitate the development of a form of "adaptive" expertise. Over time, action researchers develop a deep understanding of the ways in which a variety of social and environmental forces interact to create complex patterns" (Riel, 2010, n.p).

For this thesis project, the students were exposed to different educational components, and took an entry and an exit-survey throughout the course of the 2010-2011 school year to understand the social and environmental forces that influenced students' recycling habits. Both surveys contained quantitative questions with the exception of four qualitative questions in the entry-survey (Appendix A). The entry-survey consisted of demographic questions, nine closed-ended questions with a Likert-scale response from 1 *(Completely Disagree)* to 9 *(Completely Agree)* and four open-ended questions. The demographic questions consisted of: gender, birthplace, age, grade level, parents' country of origin, length of stay in Shanghai, parents' salary, and parents' educational level. The demographic questions were the independent variable. A causal relationship between the demographics of the students and their recycling habits is sought. The Likert-scale questions were ordinal questions regarding their habits on recycling and frequency of their plastic usage. They measured the students' social behavior to understand if they were more willing to make rational choices about recycling in the future. The open-ended questions were qualitative attitudinal questions towards recycling that went through open coding, where the data was categorized to preliminary analytic codes (Neuman, 2006). The exit-survey (Appendix B) consisted of seven questions with a Likert-scale response from 1 *(Completely Disagree)* to 9 *(Completely Agree).* The first question had categories of disagree, neutral and agree and asked:

Have your recycling habits changed because of the JCID recycling program?

The next six questions rated the strength of different parts of the environmental education (EE) and the last question probed which component of the EE was the most effective.

Subjects and Sampling

The research site was located at Jin Cai International Division (JCID) in the Pudong New Area district of Shanghai. JCID is the international division of Jin Cai School district. To gain a sense of the type of neighborhood this school is situated in, the entire Shanghai region's GDP in 2010 was ¥1.69 trillion RMB (Shanghai.gov.cn, 2010) and according to the Pudong government (2010), the GDP of Pudong New Area in 2010 reached ¥470 billion RMB, 27.8% of the total Shanghai GDP. The majority of the students come from wealthy Chinese families or are children of business sector expatriates. The JCID student body covers 22 different countries ranging from China, Japan, Korea, the United States, Thailand, Canada and Russia. The JCID campus has grades K-12, along with English as a Second Language (ESL) classes of mixed grades, separated into elementary and secondary classrooms. From grades 6-12, classes are taught in English or Chinese, known as the English section or the Chinese section. Furthermore, the English section grades 8, 10 and 11 and the Chinese section grades 11 and 12 have two class levels based on the respective language proficiency level they are in. JCID follows an International Baccalaureate (IB) middle-years program curriculum that challenges students to make connections between traditional subjects and the real world, to become critical and reflective thinkers (IB organization, 2005).

The participants in this research study, during the 2010-2011, school year were both from the Chinese and English section grades 6-12. A total of 240 student respondents completed the entry-survey and 197 student respondents completed the exit-surveys and then went through an environmental recycling program during the spring 2011 semester.

Execution Plan

As noted earlier, this was an action research study. The following figure explains the action research steps that consisted of completion of surveys and environmental education (EE).

Figure 1. Action Research Steps

Study and Plan → Take Action → Collect & Analyze Evidence → Reflect

These four action research steps together are known as cycles and the research can go in many cycles. This cycle is referred to as progressive problem solving with action research. The subject of action research is the actions taken, the resulting change, and the theory of change that is held by the persons enacting the change (Riel, 2010).

Only one cycle of action research was completed with the student respondents for this research project. A nonlinear path was used for this research because it is more suited for tasks such as translating languages, in which delicate shades of meaning, subtle connotations, or contextual distinctions can be important (Neuman, 2006).

The entry-survey research instrument was created during March 2011, and then was pilot-tested with two students to get feedback and fine tune the survey questions. The final English entry-survey was then translated into Mandarin by a Chinese colleague, then followed-up with a final revision of Chinese grammar translation correction done by the school librarian. The same process of translation occurred for the exit-survey during May 2011.

Recycling Program

JCID is an IB school that utilizes holistic education approaches such as appreciation for the environment, therefore beginning a recycling program was proposed during the fall of 2010. The recycling program was approved with funding by the school principal, Mrs. Sally Zhang, in December 2010. The recycling program was a school-wide initiative supported by the staff, student council and administration. In addition, it was introduced to the students via a school

assembly in a 15 minute, 13 slide power point presentation by the researcher in January 2011, which overviewed the recycling program.

The researcher held a spring semester recycling project elective period once a week for students to volunteer. During this elective period between February and March 2011, the students along with the researcher planned and constructed a PET bottle recycling tube receptacle. After receiving the entry-survey, many responded that laziness and no easy access to recycling were primary reasons for poor recycling habits, thus the easily accessible recycling tube was built. The recycling tube was placed along an outside wall 10 feet from the stairway, giving students easy access through an open window to insert a PET bottle. The recycling tube had bottle inserts on the second, third and fourth floors. Once inserted, the bottles dropped directly into a recycling waste bin on the first floor. The plastic tube built in March was destroyed in May by some students, but was rebuilt by the school's janitorial staff a week later with stronger HDPE materials. At the time of writing, the recycling tube was still in use. The student council helped by creating recycling posters and posting them on walls around campus to raise awareness about the recycling project and tube.

Another collection method was available for students in the form of recycling boxes in each classroom. These cardboard boxes were located in the corner of each classroom next to the door. Data tracking of the PET bottle collection in the classroom boxes occurred from March 28-June 13, 2011. Weekly PET bottle counting was conducted by the recycling elective class and as punishment for students with disciplinary issues. Each class had a separate count and the class with the highest recycling rates was rewarded by their teachers. The data tracking is used in the data analysis section and displays any changes in recycling habits over the course of the

semester. Procedures to track individual PET bottle contributions into the recycling tube were not developed.

The first entry-survey was completed during the week of April 9-13, 2011, in both the Chinese and English section during their 20-minute morning homeroom period. The English section was surveyed one day, then the Chinese section the next day. The researcher was available for questions during the survey process and the homeroom teacher was also available for Chinese translation.

Action research calls for a reflective process in which participants continually learn and utilize progressive problem solving skills (Riel, 2010). The researcher invited a non-profit that specializes in environmental education, named Roots & Shoots[2], to do a lecture during a school-wide IB assembly on June 1, 2011. The lecture lasted an hour, with topics ranging from planting trees, carbon footprints and volunteering. Following the lecture, the researcher showed a 5-minute documentary about the *Pacific Trash Vortex* (2010) in the ocean[3]. This video discussed how plastics, if not recycled, could end up in the Pacific Ocean gyre, accumulating in a garbage patch the size of the United State of Texas. The film also included graphic pictures of animals that had died from eating plastic. These EE components were important to the action research study because the lecture covered topics other than recycling plastic and the video reinforced the importance of recycling plastic prior to filling out the exit-survey.

Footnotes:

[2] Roots & Shoots is a non-profit operating worldwide in over 120 countries sponsored by the Jane Goodall Institute. The programs help young people identify problems in their communities and take action through youth-led service projects.

[3] This video was produced by the Planet Green Network located in the U.S. The video is titled: *Planet 100: The pacific trash vortex explained* and is one of a series of videos within the Planet Green Videos.

Next, the exit-survey was conducted in the same manner as the entry-survey, with the students during the week of June 13-17, 2011. The surveys were completed in their homerooms and also during computer class time. If any subjects were not present at the start of the project, then they also completed the entry-survey simultaneously. Lastly, the participants throughout the semester in the recycling program were presented with a certificate and award plaque during the end-of-the-year awards assembly to instill positive reinforcement. Notably, the students with discipline issues that received this award were proud of the recognition they received.

Results of Data Analysis

The sample (n=240) of student respondents from JCID during the 2010-2011 school year completed the initial entry-survey. The exit-survey sample (n=197) was then distributed after the recycling program. The lower exit-survey completion rate of 82% was attributable to grade 12 not completing the exit-survey due to time constraints and graduation. The data collected from both surveys were analyzed using the program SPSS 15.0 (Statistical Package for Social Sciences) for Windows Integrated Student Version. Microsoft Excel version 2007 was also used to analyze the data utilizing its pivot-table functions. Both surveys were analyzed on one codebook and one datasheet.

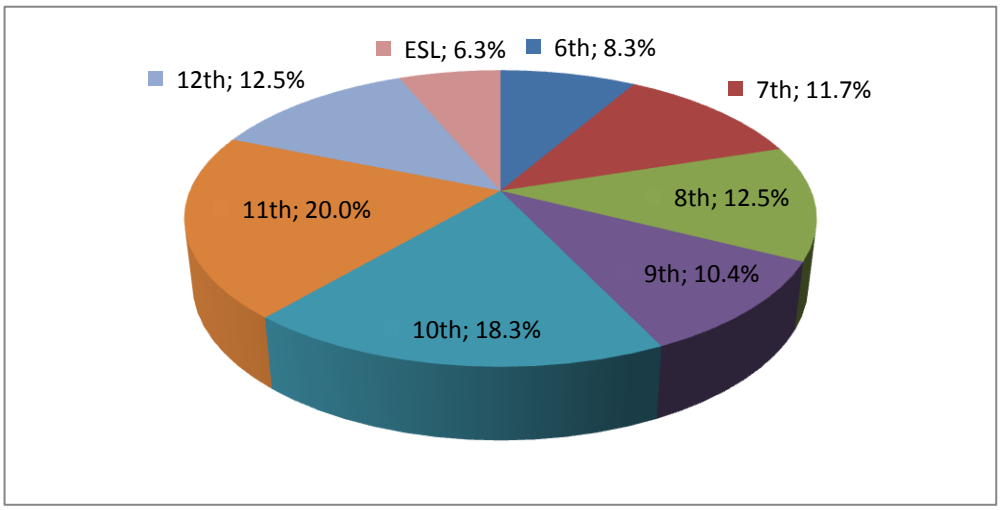
Descriptive statistics of the samples demographics (n=240) were reported. A chi-square analysis was conducted to see if the demographics of the students have any correlation with any variables present within the Likert-scale questions from the entry-survey. A paired *t*-test was conducted between the Chinese Section and the English Section to compare the means of the responses within the entry-survey. The open-ended questions went through manifest coding,

where the frequency of certain words or phrases in the respondents' answers was counted, with graphs representing these findings (Neuman, 2006). The exit-survey was analyzed using chi-square tests to compare groups to determine statistical significance. Furthermore, exploratory data analysis on the hard data was done to check for outliers, missing data and inputting errors. Lastly, all the confidence levels were set at 95%, with the statistical analysis being significant when alpha and $p < .05$.

Demographics

The sample (n=240) consisted of students that attended Jin Cai International Division from grades 6-12 with an age range of 11-19 years and a mean age of 15.23 years. Males and females were evenly distributed with 51% male and 49% female. *Figure 2* shows the breakdown of grade levels at JCID.

Figure 2. Students Grade Levels



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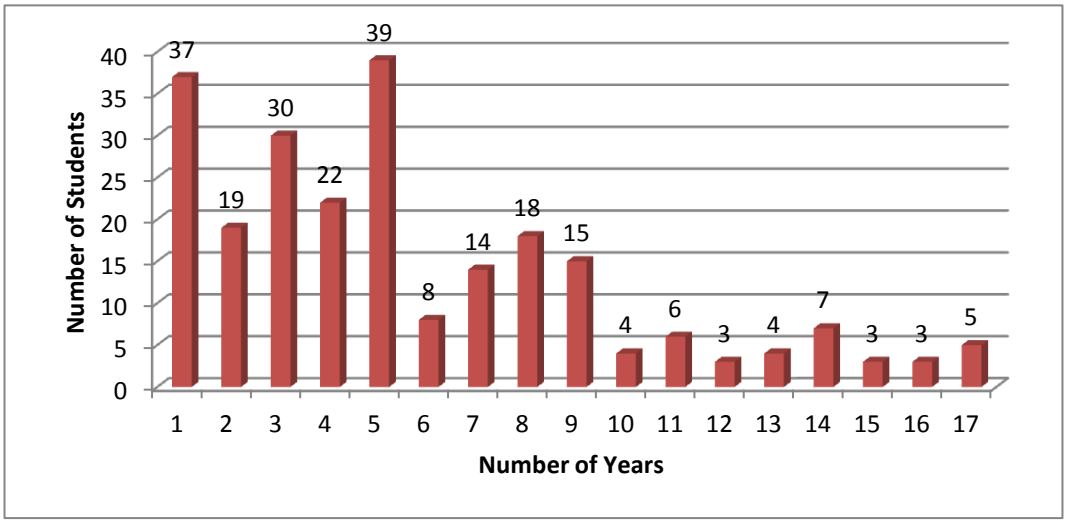
The school had a large percentage of grade 10 (18.3%) and 11 (20%) students, with grade 12 (12.5%) and grade 9 (10.4%) consisting almost a quarter of the student population. Note that the ESL class consists of different grades and ages of students due to the level of their language abilities.

The subjects had been living in China or Shanghai for different lengths of time, and 15% of students had arrived within the past year. Since this is an international school, they were familiar to different recycling programs depending on which country they are from, thus affecting their recycling habits. This correlation will be explained later in the data analysis. The following figure shows the amount of time the subjects had been living in China, the mean time living in China was 4.7 years.

Figure 3. Students Time Living in China

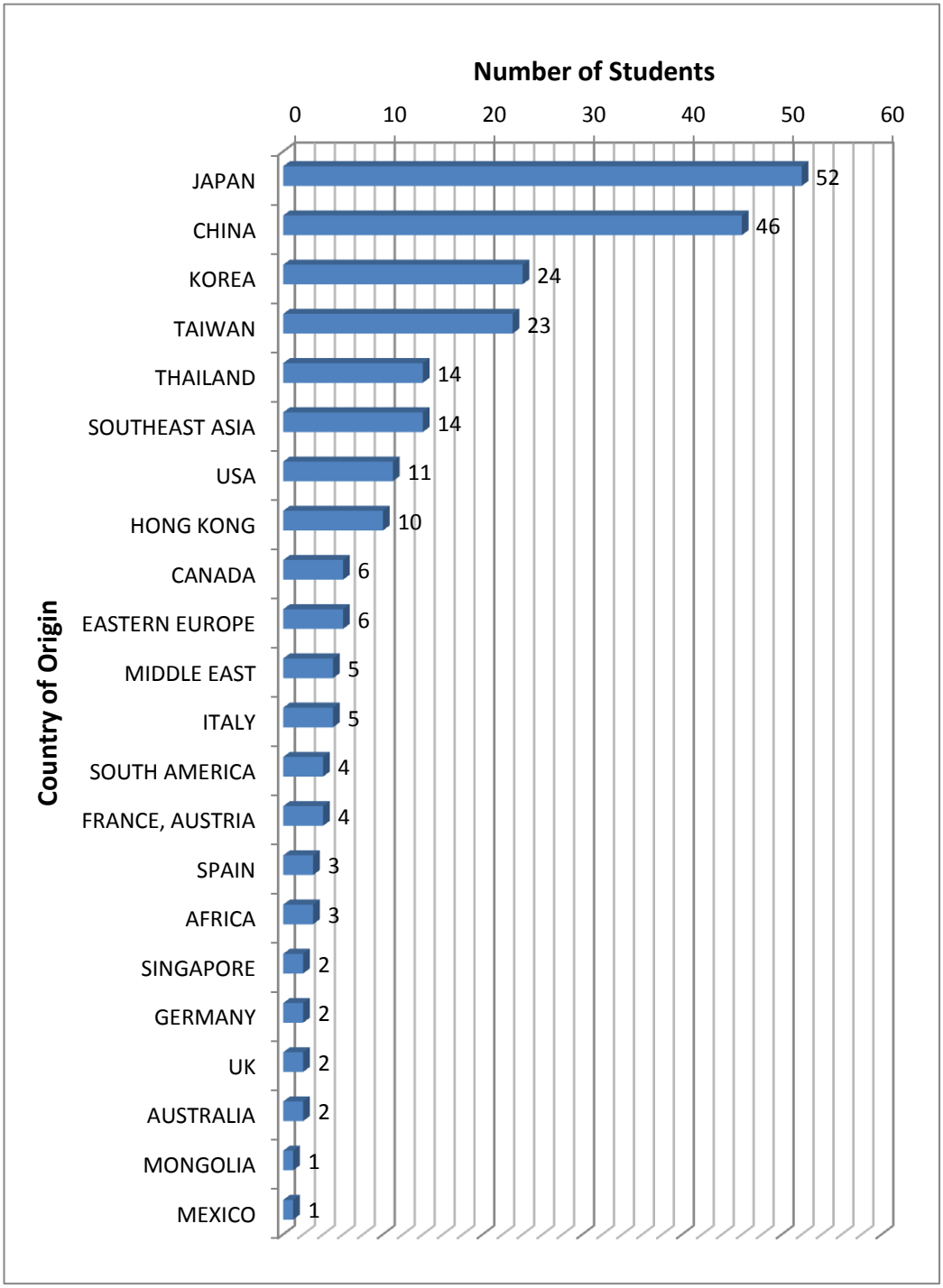


The respondents originated from 22 different countries representing five different continents. The researcher recorded the parents' country of origin and students' country of origin separately, however the data from both variables matched up exactly when counted. The country of origin data was collected from one parent, not both, because some parents were from different countries.

In the following *Figure 4* it is seen that the majority of students are from industrialized Asian nations. The top five groups in order of greatest to least come from Japan, China, Taiwan, Korea and Thailand, respectively. Taking into account the students' country of origin, as stated

earlier, each student had become accustomed to their country's recycling practices; they were then exposed to China's recycling practices and could behave differently.

Figure 4. Students' country of origin



Parents' Yearly Salary

The respondents stated 5.4% made less than ¥100,000 RMB per year, 4.6% made less than ¥500,000 RMB per year and a higher percentage stated that 9.7% of parents made less than ¥1,000,000 RMB per year. With 79.6% of respondents stating they did not know their parents' yearly salary. With the unknown salary data being so high, the parents' yearly salary was an unreliable variable when considering correlations between salary habits and recycling habits.

Parents' Education Level

The respondents were also asked the highest level of education between both parents. The results showed 32.5% of parents had completed a bachelor's degree, 17.5% completed a master's degree, 5.8% completed a PhD degree, 2.5% received a high school diploma and 41.3% did not know or were unsure about their parents' education level.

Entry-Survey Data Results

Questions Measuring Recycling Habits

The following Likert scale questions on a scale of 1 *(Disagree)* to 9 *(Agree)* were designed to understand the students' perspectives on recycling. *Table 1* displays measures of central tendency of mean, median and standard deviation (SD).

Table 1. Mean, Median and SD of Questions Measuring Recycling Habits

Questions Measuring Recycling Habits	Mean	Median	SD
1. Recycling is important for the environment	7.8	9.0	1.9
2. It is easy to recycle plastic bottles in Shanghai?	5.4	5.0	2.5
3. Do you think you will participate in the new school recycling program?	6.4	7.0	2.3
4. Recycling at home is important	6.9	7.0	2.3

5. The country you were born has influence on your recycling habits	6.6	7.0	2.3
6. Your parents' habits has influence over your your recycling habits	6.2	7.0	2.6
7. You care about the future of the environment and will make decisions in life to help the environment	7.1	8.0	2.0

All the questions had negative skews attached to the data results, resulting in the data having relatively few low values.

A chi-square goodness-of-fit test was carried out with the categorical variables of gender, place of birth, parents' country of origin and parents' yearly salary with the questions above and some significant results were found. The gender variable was found to be statistically significant, χ^2 (8, N=240) = 317.17, p= .022 to the question of "Is it easy to recycle bottles in Shanghai?"

The students' birthplace had strong statistical significance with three questions in the entry-survey regarding recycling habits. First, the question "Recycling is important for the environment" was significant, χ^2 (147,N=240) = 178.40, p= .04; the second significance, χ^2(168,N=240) = 317.17, p= .022, was for "parents' habits have influence over recycling habits; and the third significance, χ^2(168,N=240) = 211.12, p= .013 was with the question "do you care about the future of the environment?" This shows strong evidence that a student's birthplace has a relationship when students think more highly about the importance of the environment, care more about the future of the environment and parents recycling habits are more influential towards a students own habits. The demographics of the parents had various significant relationships with questions in the entry-survey. The parents' country of origin was statistically significant, χ^2(160,N=240) = 217.34, p= .002, with the statement "recycling is important at home". Also, "country of origin has influence over recycling habits" showed a relationship

$\chi^2(160,N=240) = 196.20$, $p= .027$. Furthermore, the parents' level of education had a relationship with the statement "school recycling program participation" with $\chi^2(40,N=240) = 58.27$, $p= .006$.

Questions Measuring Frequency of Plastic Bottle Use

Another set of seven questions was developed in the entry-survey to measure frequency of PET plastic bottle use to attempt to understand PET recycling behavior. In regards to the question that asked "what days you bought plastic bottles more", originally had answers choices for each day of the week Monday-Sunday. However, issues with analyzing and coding this variable arose, so it was decided to code according to weekdays and weekends. The question asking "what type of materials do you recycle other than plastic" had answer choices of none, glass, E-waste, paper or aluminum cans. The following table shows the mean, median and SD of this question.

Table 2. Mean, Median and SD of Questions Measuring Frequency of Plastic Bottle Use

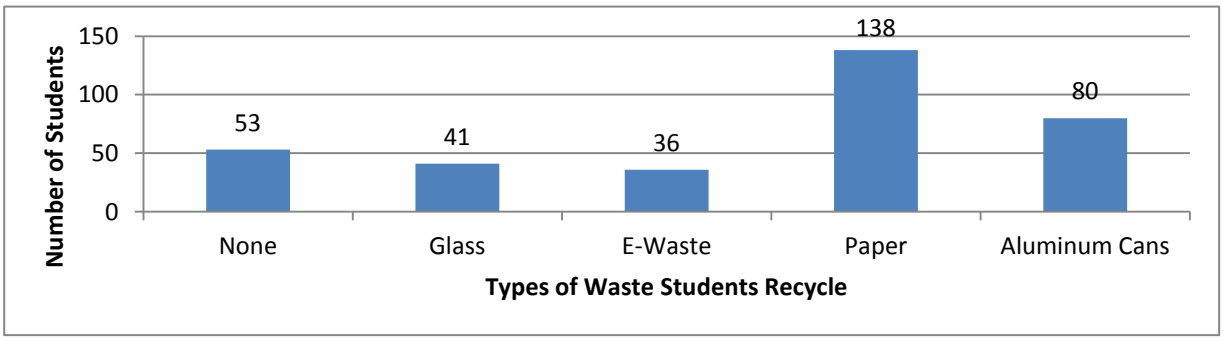
Questions measuring Plastic Bottle Use	Mean	Median	SD
8. How many plastic bottles do you buy every day?	2,3	2	0.9
9. Out of these plastic bottles, how many do you recycle properly?	2.4	2	1.2
10. Out of these plastic bottles how many do you not recycle?	2.2	2	1.3
11. How many people a day in Shanghai do you see collecting plastic bottles on the street?	2.8	2	1.6
12. How many plastic bottles do you reuse per day? (reuse=use more than once)	2	2	1.1

Questions 8-12 had a rational scale for respondents to choose from of: 0, 1-2, 3-4, 5-6, 7-8, and 9 or more. These five questions all had positive skews. In question 8, 57.9% of the respondents answered that they bought 1-2 PET bottles per day. Question 9 asked if they recycle the PET bottles they buy and 50.8% answered they recycle 1-2 PET bottles per day. The next

question asked how many PET bottles they did not recycle; 33.3% responded 0 bottles and 41.7% responded 1-2 bottles. The next question asked about how often the students saw plastic scavengers in the street per day and only 21.3% responded 0, while 33.3 % answered seeing 1-2 plastic scavengers and 12.5% saw 9 or more per day. Furthermore, the number of plastic scavengers seen per day was positively correlated, $r(240) = .16$, $p = .01$,with the number of plastic bottles not recycled. This correlation shows that students who do not recycle see more plastic scavengers daily. Lastly, students were asked "how many plastic bottles do you use per day?" and 43.8% of respondents mentioned they reused 1-2 PET bottles per day.

Another question in the survey examined the consumption patterns of plastic beverage bottles bought at school with "do you buy plastic bottles more frequently on the weekends or weekdays while at school?" The results showed that 56.7% of students purchased PET plastic bottles on weekdays and 43.3% bought more on weekends. *Figure 5* illustrates the responses to the question asking "what type of other recyclable materials did the students recycle?"

Figure 5. Do You Recycle Other Materials?



The students reported recycling paper and aluminum cans most often. E-waste is electronic waste, which had the lowest frequency, but is very damaging to the environment, due to the acids and metals that can seep into the ground and eventually into the drinking water.

Another chi-square goodness-of-fit test was carried out with the categorical variables of gender, place of birth, parents' country of origin and parents' yearly salary with the questions above; statistical significance was found. The tendency to recycle paper had two demographic variables significant, first with gender, $\chi^2(1,N=240) = 10.07$, $p= .002$; second with place of birth, $\chi^2(21,N=240) = 34.52$, $p= .032$. The tendency to recycle E-waste was found to have a statistical relationship with parents' country of origin, $\chi^2(20,N=240) =31.65$, $p= .047$ and place of birth, $\chi^2(40,N=240) = 58.27$, $p= .031$. Since E-waste recycling is introduced in countries with more advanced recycling programs, these significances suggest that countries outside of China have more advanced recycling programs.

The parents' level of education was related to the number plastic scavengers students saw daily, $\chi^2(40,N=240) = 58.27$, $p= .031$. Furthermore, a strong correlation exists between subjects that thought recycling is important for the environment and if they thought it was easy to recycle plastic bottles in Shanghai, $r(240)= .194$, $p<.01$. This correlation suggests that awareness of recycling is related to more frequent recycling.

Open-Ended Questions Probing Recycling Opinions

The last four questions on the entry-survey consisted of open-ended questions that probe and assess recycling opinions and explore unknown phenomena that could arise while using this method. Each question has a different sample size due to the unwillingness of students to answer these types of questions. Furthermore, the Chinese section answers were translated from Mandarin into English by a Fudan University Chinese research assistant. Table 3 displays the five most frequent answers from the student respondents, the sample size, and the valid

percentage of each response. Some responses have been combined due to the similarity of the verbiage.

Table 3. Top Five Open-Ended Responses in Recycling Entry-Survey

Question	*n*	*%*	*Response (5)*
13	184	34.2	Save and/or good for the environment
		11.3	I don’t know
		8.0	To recycle more
		8.0	No recycling project in school yet
		6.6	To learn more about recycling
14	158	29.6	None/I don’t know
		23.6	Two types of bins at home in country of origin
		12.1	No recycling programs
		9.5	Collect garbage by type
		4.5	Exchange for money
15	156	47.0	Yes
		19.7	Maybe
		12.6	No, can’t change
		4.5	I already know about recycling
		4.0	Impossible or not possible to change
16	168	21.1	Lazy or forget to recycle
		14.2	I don’t know
		10.3	Too busy or waste of time
		9.8	Not my habit or not used to it

Note. Sample sizes are different due to language barriers and no responses. Questions: 13) Why do you think we started this new project at school; 14) Please explain any type of recycling programs available in your home country, if any; 15) Do you think it is possible to change your recycling habits after learning about recycling?; 16) What are some reasons why it is difficult to practice recycling on a daily basis.

Regarding why the new project was started, 34.2% of subjects mentioned that recycling helps to save the environment and is good for the environment. Respondents also stated that having two types of bins at home (23.6%) was the most popular recycling program outside of China. Nearly half (47%) of students thought it was possible to change recycling habits after the recycling program. Lastly, "being lazy or forgetting to recycle" was the most quoted reason for not recycling.

Exit-Survey Data Results

Question Measuring Change of Recycling Habits

The sample size (n=197) differed from the entry-survey due to the grade 12 students not participating. A defining question asked in the exit-survey to determine if habits changed after the recycling project was "Have your recycling habits changed because of the JCID recycling program?" Results showed that a moderate change of recycling habits occurred (M=5.04, SD=2.5) and this variable had a negative skewness attached to it.

An independent sample *t*-test was conducted to compare means of change in recycling habits between the English section and the Chinese section students. There was a significant difference in change of recycling habits for the English section (M=4.75, SD=2.56) and the Chinese section (M=5.99, SD= 2.02); t(197) = -3.01, p=.003. These results show between the two groups that the Chinese section was more receptive to change in recycling habits. A paired samples *t*-test was conducted to compare the change of recycling habits between the younger adolescents in grades 6-8 and the older adolescents in grades 9-12. There was a significant difference in recycling habits for older students (M=5.3, SD=2.4) and younger students (M=4.47,

SD=2.56); t(84)=2.3, p=.02. This reveals that the older students' habits changed more after the recycling project.

The two variables "change in recycling habits" and "country of origin" influences recycling habits are strongly correlated, r(240)=.221, p=0.002. This signifies that country of origin has a positive correlation with determining change in recycling habits.

Questions Measuring Recycling Project Effectiveness

The recycling project described in detail earlier had four different elements, including a recycling tube, recycling boxes in the classroom, education workshop by the non-profit Roots & Shoots and the video *Pacific Trash Vortex* (2010). *Table 3* below displays the mean, median and SD of the different components of the recycling program.

Table 4. Mean, Median and SD of Questions Measuring Recycling Project Effectiveness

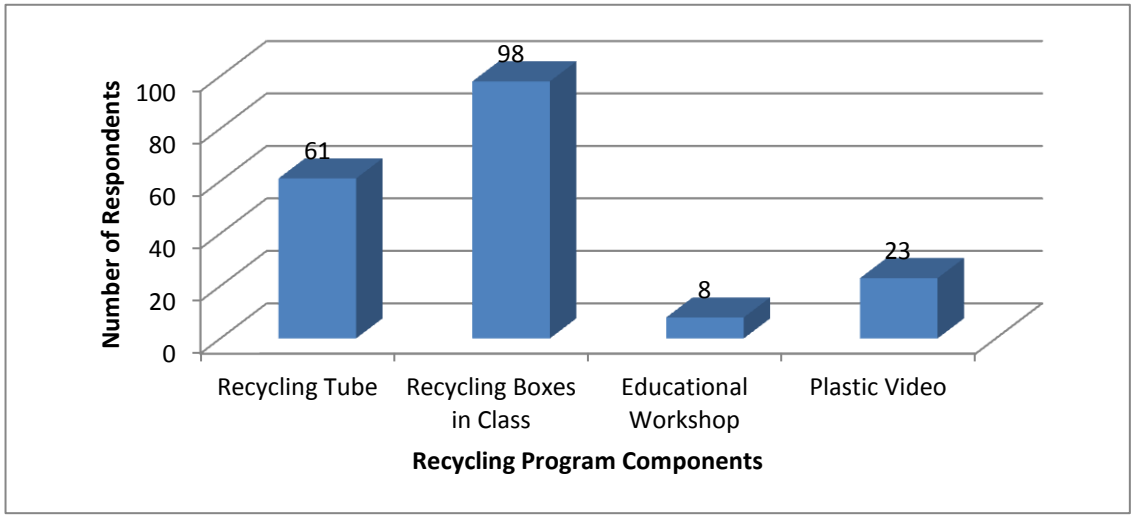
Questions measuring Recycling Project Effectiveness	Mean	Median	SD
Presence of newly built recycling tube	5.5	6	2.4
Location of tube to make recycling easier and more convenient	5.8	6	2.4
Presence of recycling boxes in classroom	6.3	7	2.5
Roots & Shoots workshop	5.2	7	2.5
Pacific Trash Vortex in Ocean video	5.5	6	2.5

The results show that the classroom recycling boxes and plastic tube were the most effective in this recycling program, while the educational workshop was the least effective.

The exit-survey's last question was "which one was the most effective part of the recycling program that changed your recycling habits?" The answer choices were: the recycling

tube, recycling boxes in the classroom, the Roots & Shoots educational workshop and the *Pacific Trash Vortex* (2010) video. The following figure shows the frequency of each response.

Figure 6. Most Effective Component of Recycling Program



Discussion and Conclusion

With China being thrust into consumerism more quickly than any other nation in the modern world, a major rise in PET plastic bottle use is occurring, while environmental education has not caught up with the pace of modernization. The policies by the Chinese government with the implementation of the 12th Five-Year Plan and the habits of the Chinese people are increasingly at odds with each other, due to the fact that the CE laws established by the government have low public participation (Xue et al., 2010). With an influx of people from all over the world studying in China, this paper has developed some understanding of students' recycling habits.

This school-based project gained momentum within Shanghai that led to media coverage. At the end of the semester, the Chinese staff and the researcher were interviewed by a prominent

TV station, Shanghai Education TV[4], regarding the innovative recycling practices that were occurring on the JCID campus. This segment was broadcast on June 10, 2011 on public television to 20 million people living within Shanghai. A potential 5-10% of the population, or 1 to 2 million people, could have viewed this segment. A JCID co-worker's relative stated they viewed this segment on television. This moment validated the importance of my research topic as an issue of high interest within the current modernizing Chinese society.

This action research project went through one progressive problem solving cycle, with the last stage being the reflection stage. This research study was a hands-on, school-wide and staff supported study. The researcher was in a unique situation to carry out this type of recycling project and experiment with different methods of environmental education. The year-long project was planned and executed because one of the basic tenets of action research is a process of living one's theory into practice (Riel, 2010). The intent to observe recycling habits and measure effectiveness of the recycling program using two surveys delivered some interesting findings.

Recycling Habits Key Findings

Gender. The gender ratio of the sample (n=240) was almost 1:1 with an even distribution of 51% male and 49% male. The only significant conclusion with gender was males felt it was easier to recycle plastic bottles in Shanghai, compared to females. When looking at the data on how many plastic bottles were recycled and reused, the frequency was higher with females, which agrees with Li (2003), that women recycle more.

[4] Shanghai Education TV (www.setv.sh.cn) established in 1994 in Shanghai attempts to facilitate the exchanging of education information and disseminating scientific knowledge within Shanghai, and mainland China.

Age. Within the JCID population surveyed, 61.2% were in senior high school (grades 9-12) and 38.8% of them were in middle school (grades 6-8). Mahmud and Osman (2010) concluded that older children were more willing to recycle, while Martin, Williams and Clark (2006) also found in their research that older segments of the population had higher tendencies to recycle. Within this study the prior researchers' hypotheses held true and the older adolescents (M=5.3, SD=2.56) were more receptive than the younger adolescents (M=4.47, SD=2.4) to changing their recycling habits after the recycling program.

Country of origin. Approximately 57% of subjects lived in Shanghai five years or less, meaning they were not native Chinese. The students' birth place strongly influenced their recycling habits. The foreign students also placed significantly higher importance on recycling, caring for the environment and having their parents' influence their recycling habits.

Parents' influence. Mahmud & Osman (2010) found that influential people in their lives was the greatest factor influencing students to recycle. These influential people could potentially be teachers or parents. According to the data, strong evidence supports that if parents made recycling important at home this factor had influence over the students recycling habits. Interestingly, 96 respondents answered with the highest Likert-scale option (9*)* to the statement "recycling is important at home". Out of the respondents, 31%, (the largest group) were from China and 18% were from Japan. Thus, Chinese parents are active in encouraging positive recycling habits that are developed within the household. Apparently, the parents' level of education was a factor in the student's willingness to participate in the recycling program.

Plastic scavengers. A growing number of plastic scavengers or collectors are a common sight in urban cities. Students' reported sightings of plastic collectors showed 33.3% saw 1-2 daily, 20%

saw 3-4 daily and 12.5% saw 9 or more daily. The number of plastic bottles not recycled and the number of plastic scavengers seen were correlated, so it can be said that students that saw more plastic scavengers had fewer tendencies to recycle. The students' habit of littering the streets with plastic bottles, because they know a plastic collector will pick it up moments after, can help explain this correlation. In hindsight, a question should have been added to the entry-survey if students thought "giving a plastic bottle to a plastic scavenger is considered recycling".

PET plastic bottle usage. The campus cafeteria sold various types of water and beverages in PET plastic bottles. Motivated to figure out if the students bought more of these beverages during the weekdays, the data showed that 13.4% more students bought more during the weekdays compared to the weekend.

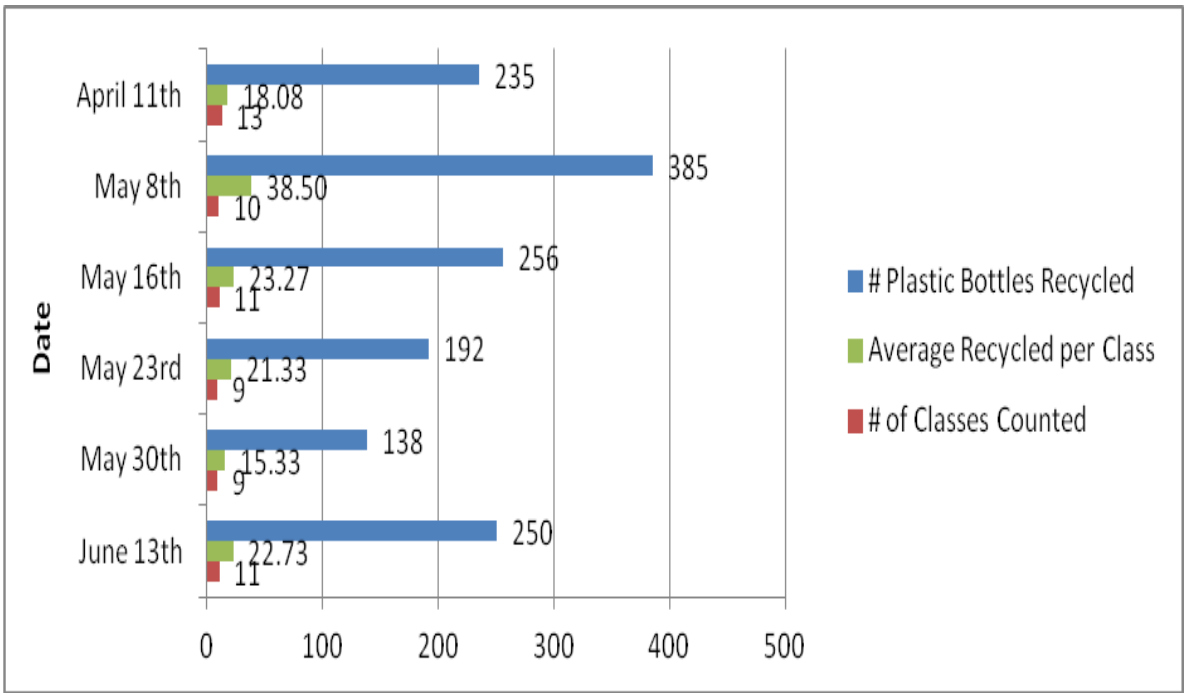
Recycle other materials. With paper being the most common type of recyclable material, the open-ended questions revealed that many students participated in paper recycling drives in schools they attended previously. Gender and place of birth was significant to recycling paper, with females recycling 14% more paper than males. Of the students that did recycle paper more, 48% of them were born outside of China. Electronic waste recycling is common in most countries with advanced recycling programs, and the parents' country of origin was a factor in students' recycling E-waste, thus concluding that these students living in countries with more advanced recycling programs tended to recycle E-waste more.

Recycling Program Effectiveness Key Findings

Class recycling tracking. During JCID's spring semester 2011, after the recycling receptacle was built, the bottles collected in the classroom recycling boxes were counted for six weeks starting April 11 and ending June 13. This effort was made possible by Mrs. Michelle, the co-

chair of the recycling program; students on the recycling committee and in the recycling elective class that all took part in the collecting, counting and recording the data. The following *Figure 7* displays the results of the class recycling tracking, along with the average recycled per class and the number of classes counted that week.

Figure 7. Six-week Class Recycling Tracking



The table displays that the number of plastic bottles recycled jumped after the second week of collection. The gap in time from April 11 to May 8 was due to a school vacation. The recycling activity tapered down, then increased again in the last week. Looking at the average number of bottles recycled per class starting on April 11 (M=18.08) and ending on June 13 (M=22.73), a slight improvement in the recycling habits of the classes over the semester can be seen.

Change of habits. Knussen and Yule (2008) found that lack of habit was a variable in not recycling. Their finding coincided with this study's finding as the top response when students were asked "why it was difficult to practice recycling". Being lazy, forgetting or being too busy were also responses to the open-ended question "why it is difficult to practice recycling on a daily basis". To counter the "being lazy" or "too busy" comments, the recycling receptacle was placed in a convenient location where the general school population passes after each of their six periods and at least 10 times per day. When asked if it was possible to change recycling habits, 47% responded "yes" while only 4% responded "impossible to change". After being exposed to a semester of environmental education paired with additional avenues to recycle, the exit-survey completed during the last week of school (June 13, 2011) asked "have your habits changed because of the recycling program?". The remaining student sample (n=197) responded with a moderate change of habits (M=5.04, SD=2.5), indicating that the recycling project was not ineffective, but also not as effective as the researcher had wanted it to be. Students that prioritized recycling importance had higher recycling patterns. When exploring the difference of recycling habits between the English and Chinese section students a *t*-test was carried out to compare the means of the two groups. The significance of the *t*-test revealed the mean of the Chinese section was higher than that of the English section, concluding the Chinese section students' habits improved more than the English section students' after the recycling program.

Most effective recycling program component. Out of the recycling tube, recycling boxes, educational workshop and plastic video, the subjects responded most to the recycling boxes in the classroom. The boxes are convenient, easy to access, raise recycling awareness and need to be emptied out once per week. We recommend for the box to be made out of a strong HDPE plastic, because liquids deteriorate the cardboard and make a mess of the classroom. The

recycling tube was the second most popular component, and needs to be constructed with strong PVC tubing in an area that's easy to access. It functions like a garbage tube that empties into a recycling bin outside. Additionally, when initiating a recycling program I agree with the recommendation of Smyth, Fredeen and Booth (2010) that education and awareness are instrumental for success. Having the backing of the administration and student council also furthers success of any recycling program.

Limitations of Study

Limitations will always exist with a research study, because a researcher can only do so much within a certain timeframe. Not having the 12th graders finish the exit-survey was a setback for my research; this data could have shown different results. Furthermore, the exit-survey should have been the same as the entry-survey to compare more means and have various paired *t*-tests to measure changes in habits or attitudes more accurately. In addition, the research was conducted at an international school and with students from different parts of the world who had been living there for varying amounts of time. Therefore, this research is not representative of Chinese students. This study did serve the purpose of showing how international students recycled and reacted to conditions within China. Furthermore, having limited Mandarin speaking skills created a language barrier, which could have resulted in not connecting with my Chinese speaking respondents better. Lastly, the sample within JCID was limited because it only covered one school, but this is the result of an action research study. The data results of the survey could have been biased with the presence of the researcher within the classroom.

Suggestions for Future Research

Suggestions for future research include having the research site at an all Chinese public school in multiple cities across China, compared to an International private school where this study occurred. Also, the entry and exit-survey should have been the same, so more dependent sample *t*-tests could have been carried out in order to discover stronger or weaker relationships between the independent variable (students) and the dependent variable (environmental education). Additionally, if interested in the topic of plastic scavengers within China, researchers could ask if students consider littering on the street or throwing bottles in the regular trash bin recycling, because of the large presence of these plastic scavengers within China. During the data collection process a third party, not the teacher of the students should carry out the data collection to prevent any biased responses. The reason behind this tactic is because some students could alter the results of their answers in front of their teacher to not embarrass the teacher or to make a good impression upon the teacher. Lastly, more information on the demographics of the parents could have been developed in the form of a take home survey.

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Appendix A:

Recycling Entry-Survey

PLASTIC RECYCLING BEHAVIOR OF SHANGHAI STUDENTS

Shanghai, China 2011

Personal Information **Student ID: _ _ _ _**

Gender : ☐ Male ☐ Female Age: _____

Place of birth: _____ Email : _____

School:_____ Grade Level:_____

What country are your parents from? If both parents are from different countries please list both countries:_____

How long have you lived in Shanghai? _____

How much does your parents make a year?: ☐ <100,000 RMB ☐ <500,000 RMB <1,000,000 ☐

What's the highest level of education of your parents?

☐ College Graduate ☐ Masters Degree ☐ PhD ☐ High School ☐ Do not know

On a scale of 1-10 how do you feel about these questions regarding recycling. Please circle clearly

Disagree **Neutral** **Agree**

1. Recycling is important for the environment?

1 2 3 4 5 6 7 8 9

2. It is easy to recycle plastic bottles in Shanghai?

1 2 3 4 5 6 7 8 9

3. Regarding the new school recycling program. Do you think you will participate in it?

1 2 3 4 5 6 7 8 9

4. Recycling at home is important?

1 2 3 4 5 6 7 8 9

5. The country you were born has any influence on your recycling habits?

1 2 3 4 5 6 7 8 9

6. Your parents habits has influence over your recycling habits

1 2 3 4 5 6 7 8 9

7. You care about the future of the environment and will make decisions in your life to help the Environment.

1 2 3 4 5 6 7 8 9

The following questions will ask about the frequency (# of times) you use plastic bottles

8. How many plastic bottles do you buy every day?

1-2 3-4 5-6 7-8 9 or more

9. Out of these plastic bottles, how many do you recycle properly? Recycling properly means, putting the bottle into a recycle bin/basket, instead of on the ground or a regular trash bin.

1-2 3-4 5-6 7-8 9 or more

10. Out of these plastic bottles how many do you not recycle? (Please put a number)

1-2 3-4 5-6 7-8 9 or more

11.How many people a day in Shanghai do you see collecting plastic bottles on the street?

1-2 3-4 5-6 7-8 9 or more

12.How many plastic bottles do you reuse per day? (Reuse=use more than once)

1-2 3-4 5-6 7-8 9 or more

13. Do you think there are certain days that you buy more plastic bottles in a day? For example, Monday which is a school day vs. Saturday which is a weekend?

Weekdays Weekends

11. What other type of materials other than plastic do you recycle? (circle more than one, if necessary.)

Plastic Glass E-waste Paper Aluminum cans

Please answer the following questions. Write neatly.

1. The recycling project at JCID is new? Why do you think we started this new project at school?
2. JCID has many people from different countries around the world. Please explain any type of recycling programs available in your home country, if any? For example, did you have a large recycling bin just for recycling not trash along with a regular trash bin at your house?
3. Do you think it is possible to change your recycling habits after learning about recycling?
4. What are some reasons why it is difficult to practice recycling on a daily basis?

Appendix B:

Recycling Exit-Survey

Please write name in Pinyin Name: _____ *Grade:* _____

This is an exit survey regarding the JCID Recycling Project 2011 and your recycling habits.

Disagree Neutral Agree

1. Has your recycling habits changed because of the JCID recycling program?

1 2 3 4 5 6 7 8 9

The recycling project consisted of the newly built recycling tube, recycling boxes, a lecture by Roots & Shoots and the Pacific Trash Vortex video.
On a scale of 1-9 rate how strong these different parts of the program made your recycling habits better.

2. Presence of newly built recycling tube

1 2 3 4 5 6 7 8 9

3. Location of tube to make recycling easier and more convenient

1 2 3 4 5 6 7 8 9

4. Presence of recycling boxes in classroom

1 2 3 4 5 6 7 8 9

5. Roots & Shoots workshop

1 2 3 4 5 6 7 8 9

6. “Pacific trash vortex in ocean” video

1 2 3 4 5 6 7 8 9

7. Out of these different parts of the recycling program which one was the most effective or you liked the best to change your recycling habit

Recycling tube Recycling box in class Roots & Shoots workshop Pacific Trash Vortex in Ocean Video

Appendix C:

Photos of Students & Recycling Project

Photo 1: During the Shanghai Education TV interview this photo shows students emptying out the cardboard box filled with PET plastic beverage bottles into the recycling receptacle on the fourth floor. Students pictured are Aommy and Okyanus from English Section Grade 11-1.

Photo 2: This photo shows the researcher Ralph Santos and recycling program Co-Chair Mrs. Michelle (Lu Yumin) being interviewed in front of the recycling tube by Shanghai Education TV.

Photo 3: The recycling tube had openings to insert bottles on the first, second,third and fourth floors.

Photo 4: Close-up of the recycling tube and the trash bin that collects the PET plastic bottles. The tube on the left side was the first tube constructed and the tube on the right side was the second tube constructed.