

Chapter 8

Waste Management Education: Chinese Perspective and Experiences



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Abstract This chapter examines education for waste management practices in China. The chapter first entails the introductory section, which outlines the kinds of waste followed by the discussion of waste management policies in some developed countries such as the United Kingdom, Germany, and Japan. Then the current situation of waste management in China is described. Three case studies of ecological schools with practices of waste reduction from various parts of China are analyzed. Overall speaking, waste management and education are strongly supported by international trends of sustainable development, education for sustainable development, sustainable consumption, and education for sustainable consumption. China's waste education is currently subject to the level and needs of waste management, with a focus on waste reduction and classification. The pilot project Waste Reduction Schools as a part of Eco-school project in China shows successful practices on promoting reducing, recycling, and harmlessness of domestic wastes. But in terms of waste education, there is much room for improvement and more measures are suggested for implementation in the future. With the development of Chinese society, waste education can be further promoted to building citizenry behavioral norms and environmental ethics.

Keywords Waste management education · Waste reduction project · Eco-school · Case study · China

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8.1 Introduction

For the past few decades, the management of waste has increasingly become a central global issue related to environmental protection and the realization of sustainable development which necessitates insights and inputs from multiple disciplines and collaboration of different stakeholders. Moreover, the success of waste management counts on not only the advancement of technology, the legislation of policies and measures of reducing waste but also on the cultivation of environmental citizenry and the role of school in promoting education for waste management. Waste refers to the disposal of any garbage that is valueless and unrecyclable to the society which is generated from human consumption, social activities and construction work. Wastes are largely discharged from municipalities, industries, and urban construction projects. They can be grouped and classified in terms of its sources, shape, and degree of hazard. Urban wastes are mainly generated from garbage disposals of households, hospitals, business enterprises, and constructions. Each urban citizen on average disposes of 1–2 kg of wastes per day. The amount of wastes disposals is responsive toward citizens' living standard, habit, sense of waste recycling, and social construction work. This chapter mainly focuses on urban waste as well as its management and education. This chapter draws upon international trends of waste management including experiences from the United Kingdom, Germany, Japan, and China. Then the status of school rubbish reduction project in the People's Republic of China would be examined. Finally, case studies of Eco-Schools with practices of waste reduction are discussed in the paper.

Eco-Schools is a growing phenomenon, which encourages young people to engage in their environment by allowing them the opportunity to actively protect it. It starts in the classroom, it expands to the school and eventually fosters change in the community at large. Through this program, young people experience a sense of achievement at being able to have a say in the environmental management policies of their schools, ultimately steering them toward certification and the prestige which comes with being awarded a Green Flag. The Eco-Schools programme is an ideal way for schools to embark on a meaningful path toward improving the environment in both the school and the local community while at the same time having a lifelong positive impact on the lives of young people, their families, school staff, and local authorities.

Other than urban waste, there is an agricultural waste. Using agricultural engineering as an example, the utilization of organic waste (OW) has become an important agenda in worldwide waste management as it is closely linked with the dynamics of the agricultural system (Soliva et al., 2007). For the support of the development of the agricultural system and land management toward equity, stability, and sustainability (Conway, 1985), it requires multidisciplinary research and agricultural education. Farmers and related stakeholders, such as environmental protection bureau officers, students, agricultural co-operative members, industrial production officers, need to get acquainted with new knowledge of plant growth, soil science, and waste transformation technology as well as novel practices of waste reduction, composting, and environmental actions in combating agricultural pollution.

As waste management industries are growing globally, more personnel are involved in the processes of waste collection, treatment, and management (Davis, 2008; Davis & Read, 2007). Therefore, there is a demand and call for education and training. There have been waste management programmes designed by experts and associations. An “integrated waste management (IWM) curriculum” proposed by the National Recycling Coalition in the United States (Conn, 1993) entails four main objectives: developing college or university students’ “environmental literacy”; educating IWM specialists; enhancing the training of IWM skills; and providing IWM experiences to nonspecialists. In the United Kingdom, in addition to accredited university courses and modules by the Chartered Institutions of Wastes Management (CIWM), the CIWM offered training courses ranging from “Underpinning knowledge—implications of waste legislation,” “The management of refuse collection and kerbside recycling,” “Practical management and control of landfill gas,” and “Integrated recycling and waste management operations” (Davis, 2008, p. 1871).

Higher education institutions where higher education and research takes place have tremendous potential to promote sustainable development and foster social transformation (Stephens, Hernandez, Román, Graham, & Scholz, 2008). Zhang, Williams, Kemp, and Smith (2011) reviewed why sustainable waste management has become the focus of Higher Education Institutions (HEIs). They took the University of Southampton (UOS), one of the largest universities in Southern England, as an example to illustrate how a four-stage waste management strategy has been developed for more than 15 years for a safe, sustainable, and practically staged solution to manage the waste and protect the environment. At each stage, political, economic, social, technological, legal, and environmental (PESTLE) issues are thoroughly analyzed following the ISB models (infrastructure (I), service delivery (S), and behavior change (B)) proposed by Timlett and Williams (2011). Based on the PESTLE analysis, the ISB model and the waste hierarchy, the strategy for sustainable waste management was developed for HELs to encourage reducing, reusing and recycling.

In basic education, Giovanni (2005) states that a wider spread of environmental education can foster the enhancement of waste management. He further suggests integrating waste education into the current preschool or primary school curriculum. Not only can the 3R education (Reduce, Reuse, and Recycle) encourage children to take part in waste management; it can also raise the awareness of taking up social and civic responsibility to protect the environment by energy conservation and recycling and reducing waste. It is believed possible to become the children’s lifelong responsibility and daily practice.

At an international level, the concept of, sustainable consumption and production (SCP) was brought about at the Oslo Symposium in 1994. SCP was referred to the minimization of the use of resources primarily for meeting basic needs as well as the reduction of toxic materials, waste emission, and pollutants “so as not to jeopardize the needs of further generations.” (Sustainable Development Goals, n.d.). In 2015, the United Nations (2015) announced the report “Transforming our world: The 2030 agenda for sustainable development” (《新的征程和行动——面向2030》). That report mainly explained the planning and prospects of global development for

2015 and thereafter and in particular “Sustainable Development Goals and targets.” There was Goal 12. Ensure sustainable consumption and production patterns under which it is aimed toward “By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse” (United Nations, 2015, paragraph 12.5). Therefore, different countries could consider implementing waste management and reduction policies and at the same time launching initiatives on education for waste management so as to achieve the future sustainable development goal.

8.2 International Trends of Waste Management

8.2.1 *United Kingdom: Leading “Duty of Care” into Waste Management*

As one of the top waste-producing countries, the United Kingdom led “duty of care”, which originated from the tort law, into Environmental Protection Act of 1990, becoming one of the regulations in waste management, leading the U.K. to become a pioneer which adopted “duty of care” as a regulation in waste management. Regulated by the Environmental Protection Act of 1990 of the U.K., any importers, producers, carriers, keepers, treaters, or disposers of controlled waste are given “duty of care” to manage the waste properly. After that, “duty of care” was renewed in The Environmental Protection (Duty of Care) Regulations 1991 (The Environmental Protection (Duty of Care) Regulations of 1991), and recently the revised Waste Duty of Care Code of Practice: Statutory Guidance (Department for Environment, Food & Rural Affairs and Environment Agency, 2018)

“Duty of care” in respect of waste imposes a duty on any person, who is involved in controlled waste management to take all measures to make sure the waste is treated recycled safely and sensibly, preventing harmful effects on the environment and human health. “Duty of care” is involved in every part of waste management, from waste production to treatment. Respective parties in different processes, such as collection, storage, recycling, transport, and treatment, are obliged to bear the duty. Overall, “duty of care” is bidirectional, imposing duty on both waste holders and waste receivers.

Basic obligations of waste holders involve the following, namely, identifying controlled waste and providing detailed descriptions on the nature of specific waste, ensuring safety of waste and transporting waste to authorized receivers; meanwhile, basic obligations of waste receivers include making separate collection of recyclable waste, obeying the waste management regulations, and obeying the hazardous and special waste regulations.

In the U.K. waste management system, “duty of care” leads waste management in the U.K. to a sequential and structural development, laying the foundation for structuring and establishment of other systems in waste management. First, “duty of care” prevents contravention of specific provisions of the Pollution Prevention and Control

Regulations, aiming at clean production, which is related to the Environmental Protection Act 1990, regulating waste management problems in financial development. As circular economy promotes in the U.K. waste management legislation, “duty of care” can be refined without contracting to the existing legislative system, leading the U.K. to transform from terminal handling to recycling, from pollution control to pollution prevention, manifesting compliance and vitality.

Second, “duty of care” strengthens the foundation of extended producer responsibility, “duty of care” of different parties involved in the waste management, including producers, importers, carriers, treaters, agents, and traders, is reasonably distributed in terms of waste production, waste transfer, waste recycling, and waste treatment, depending on their effects on environment and human health caused in the process of controlling waste. The rationale of distributing responsibility allows every possibly hazardous party to bear their own responsibility.

Lastly, “duty of care” promotes the collaboration of different parties’ involved in waste management, reflecting the principle of collaborative management. On one hand, the market players fulfill their duties to waste management regarding the regulations of “duty of care”. Administrative control is not heavily involved when the parties are fulfilling their duties. On the other hand, to set a minimal control by laws for market players and reserve the authority of establishing correction measures and direct intervention when self-regulation and public welfare targets cannot be achieved, the Environment Agency promulgated a number of regulations, such as setting standards of waste recycling and circulation and ways to enduing administrative authorization. With these, proper regulation to market players fulfilling their “duty of care” can be achieved. As regards education for waste management, some organizations or schools have initiated programmes and activities. For example, the project recycling our waste and reducing our landfill was implemented in a school in the U.K. which involved parents, staff, and students and covered the range of measures from providing colored bins for paper, plastic, tin, and card to organizing curriculum-related activities and school assembly as well as using noticeboard and an e-book. The results showed that the annual payment of £15,000 for waste to go to landfill was reduced to £3,500 a year (UNESCO, n.d.a).

8.2.2 Germany: Characteristics and Operation of Electronic Waste Management

Concerning the philosophy of electronic waste management, Germany has been adjusting and working on its ideology in electronic waste management since the 70s. From random disposal, end control to resource regeneration, the idea of material circulation has contributed to the vision and direction of electronic waste management in Germany, which the German relied much on when promulgating new policies.

Concerning the legal system, the recycling, treatment, and management of electronic waste are ensured strong legal assurance by legal provisions in the German

government's policy on electronic waste, Waste Management Act and related pollution control measures. In order to embody the management principle of electronic waste, which is to recycle materials, the policy on electronic waste aims at preventing hazardous waste produced by electrical and electronic appliances as well as promoting the ideas of reusing electronic waste, recycling materials and material regeneration in any other forms, so as to reduce the quantity of management of electronic waste and the formation of harmful substances possessed in the electronic waste. According to the differences in management requirements, the end-of-life management of electronic waste involves three objectives, namely, separate recycling of electronic waste, promotion of resources revival, and prevention of damage caused by pollution to human body and environment. Corresponding management tasks, such as reaching and fulfilling the minimum amount of recycling, the rate of recycling utilization and the requirement of pollution control, are configured to achieve the above objectives.

Concerning the recycling of electronic waste, the policy on electronic waste requires electronic waste to be segregated from domestic waste and placed separately. These legislations clarify the responsibilities of respective stakeholders in electronic waste management, safeguarding an effective implementation of electronic waste management in Germany through rules and regulations of states and districts.

Implementing the polluter-pays principle, the German government, while sharing responsibility with the producers, clarifies responsible stakeholders and their responsibilities in recycling, treatment, and management of electronic waste. The standard of measure, clear shares, and a rigorous link among stakeholders, regulated by the producer responsibility, guarantee material regeneration in the circulation of electronic waste. Providing an institutional platform and regulatory support, which are based on law and regulations, sensible collaboration, power, and responsibilities, a complete organizational system is formed by various institutions, namely, the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety, Federal Environment Agency, state capitals, local government, related environmental protection departments, the local authority waste management services and clearing agencies, and so on.

Regarding the implementation mechanism, identification, distribution, accounting and monitoring of electronic waste management are established depending on the well-developed separate collecting facilities of electronic waste, scientific statistical methods, an effective statistical system and adequate communication. All of these contribute to the separation of responsibilities of electronic waste producers and processors, leading to a beneficial complicity of producer responsibility and marketization of electronic waste management.

Concerning refinement of the policy on electronic waste, communication and exchange of ideas among stakeholders and the feedback mechanism ensure the effectiveness of the policy instruments (Cave, 2017). Both the general public and evaluation of policies are legally involved throughout the processes of establishing and revising laws, regulations, policies, plans, and schemes in Germany. With these, opinions of stakeholders and evaluation of policies regarding the effects of implementation are prevented to be neglected.

8.2.2.1 Operation of Electronic Waste Management System in Germany

The federal states of Germany are the executive party for the Waste Management Act, responsible for the promulgation of regulations of different states and appointment of state administrative departments and the local authority waste management services. State administrative departments are responsible for setting up the rate paid by producers to the local authority waste management services while the local authority services are responsible for management and operation of waste recycling, transport, treatment, and disposal. In order to refine different states' regulations, rural, urban areas and the municipal governments are responsible to promulgate regulations of districts. Examples of such district regulations are clarifying recycling frequency, methods, sites, and payment of fees to name but a few.

Domestic consumers must sort their garbage, separate, and place the electronic waste into collecting containers. They are also forbidden from making agreements with the third party about waste recycling and treatment. According to the principle of extended producer responsibility, producers are responsible for the end-of-life management of its electrical and electronic appliances. In Germany, regarding extended producer responsibility, electronic product producers have to bear their responsibility by doing the following things: attaching a separate recycling reminder label, doing registration, transporting, and managing electronic waste as well as reporting obligation and providing a financial guarantee.

The local authority waste management services, according to the policy on electronic waste, are legal institutions, which are responsible for collecting domestic electronic waste, managing and operating electronic waste collecting sites. They complete their responsibility by the time they transfer the collected domestic electronic waste to its producers or management agents. To be more concrete, the local authority waste management services bear the following obligations: collecting domestic electronic waste, reporting obligation, providing separate storage of electronic waste, and free transfer.

Due to the needs for the establishment of extended producer responsibility (Cal-Recycle, 2018), clearing agencies are set up under the policy on electronic waste. They are set up for coordinating and monitoring the direction of electronic waste, defining and assigning responsibility to producers as well as monitoring and providing evidence for producers bearing and completing their responsibility.

The best technology should be used for managing electronic waste to make sure the management can achieve the legal recycling and reuse rate. Regarding electronic waste management, the policy on electronic waste, Waste Management Act, regulation for specialized waste management companies and pollution control act provide a related legal basis for different stakeholders.

8.2.3 Japan: Legal System of Waste Management and Recycling

In 2000, Japan established the Basic Act for Establishing a Sound Material-cycle Society (Basic Recycling Act) (Ministry of Environment, Japan, 2014). In addition to the Green Purchasing Act (2000), different laws were established involving the Act on the Promotion of Sorted Collection and Recycling of Containers and Packaging (Containers and Packaging Recycling Act, 1995), the Act on Recycling of Specified Kinds of Home Appliances (Home Appliance Recycling Act, 1998), the Act on Promotion to Recover and Utilize Recyclable Food Resources (Food Recycling Act, 2000) and Act on Recycling of Construction-Related Materials (Construction Recycling Act, 2000), to name but a few. The promulgation and establishment of the Home Appliance Recycling Act were a pioneering case worldwide, indicating the existence of law/act and a well-constructed management system (Ministry of Environment, Japan, 2014). In 2003 and 2004, Japan introduced the Environmental Education Promotion Law and the Environmental Awareness Promotion Law respectively (Regional 3R Forum in Asia and the Pacific, 2009). The Japanese government and local provinces devoted a lot of efforts to promote students and citizens' environmental awareness and behavior (Lee, 2010).

Using electronic waste as an example, producers, sellers, and consumers of electrical and electronic appliances are equally responsible for material recycling. Consumers will be heavily fined if they are found illegally disposing of the electronic waste, such as burying and throwing the waste away privately. This kind of after payment involves consumers since they also gain benefits and consume energy and resources when using the appliances they buy. Also, consumers' sense of management and recycling of electronic waste can also be fostered through taking part in the process of recycling and reuse of electronic waste, carrying out environmental education for the general public.

To examine the effect of the implementation of Home Appliance Recycling Law, the Association for Electric Home Appliances is the responsible organization. Regarding the operation of electric waste recycling, the home appliance recycling coupon system is established. Regulating the operation of recycling and reusing four types of electronic waste, the Home Appliance Recycling Coupon Center (Recycling Ken Center, RKC) is responsible for the system.

Besides the regulation of the Association for Electric Home Appliances, social media also plays a role in examining the implementation effect of electronic waste management. Environmental conservation highly promoted in the society, it takes up an important part in the media, newspaper, on the Internet and even in advertisements. Japanese citizens are highly concerned and involved in environmental conservation because of the serious environmental pollution, leading to man-made diseases, which happened years before. Owing to the environmental education of electronic waste management, most of the electronic waste collecting sites entertain citizens to visit. High school students and families are all welcome to go and the working staff will introduce the legal system and flow of electronic waste management in detail using

PowerPoints, and even lead the students to visit the disassembling sites while explaining every step of disassembling and even every type of valuable disassembled part. The success of waste management and recycling in Japan counts on not only the policies and infrastructure but also the linkage of initiatives with schools and communities. For example, school lunch leftovers are arranged for composting and direct communication of source separation of waste messages involving communities and schools are highlighted (Hotta and Aoki-Suzuki, 2014).

These above-developed countries showed that waste management and reduction has been placed at a priority with the enactment of laws and support of technology and community participation. School education is an area which deserves attention and now we turn to.

8.2.3.1 The Role of Education for Waste Management

Education for waste management plays a significant part on both environmental and sustainable development education. Environmental education lays emphasis on the aspect of personal and organizational changes in knowledge, skills, experiences, attitudes, and behaviors which also include the education about environment, education in the environment and education for the environment (Tilbury, 1995). According to the UNESCO (n.d.b), educations for sustainable development (ESD) sanction learners to make knowledgeable decisions and responsible actions for developing a society involving environmental quality, sustainable financial development, respect, and equity. ESD is all-around and transformative education which puts emphasis on learning content, pedagogy, learning environment, and the changing society.

Concerning the content, waste management education involves sustainable consumption and production (SCP), addressing student-centered and interactive learning, owing to transformative learning which based on exploration and action. The societal transformation allows people to lead an environmentally friendly and sustainable life through lifelong learning and practice. Consequently, a behavior of reducing, recycling, and reusing can be fostered, equipping people with skills for green jobs and leading to greener economies and societies (UNESCO, n.d.b). This transformation of green education draws attention to critical and systemic thinking, collaborative decision-making skills and bearing responsibility for the present and future generations (Lee, 2010).

Taking Taiwan as an example, environmental education in primary school is comparatively desirable (Lee, Wang, and Yang, 2013). While in secondary school, environmental conservation in life is addressed (Wang, 2004, pp. 91–92), “recycling, reducing lunch boxes and reusing resources” are some of the activities organized. However, there are still differences in schools, some schools rather join the volunteer scheme organized by the Environmental Protection Bureau. Students participate in cleaning and recycling in the neighborhood, promoting environmental education in regions.

In addition, taking Hong Kong as an example, different environmental conservation campaigns have been organized. A campaign “Reduce Your Waste and Recycle

Your Plastics Campaign 2012” was jointly organized by the Environmental Protection Department (EPD), the Environmental Campaign Committee, the Education Bureau and Yan Oi Tong EcoPark Plastic Resources Recycling Centre (Waste Reduction and EcoPark Group Environmental Protection Department, 2011). Aiming at raising students’ awareness of waste reduction, students are encouraged to participate in the campaign with their families. Moreover, EPD also collaborated with CECTL Child Education for Teaching & Learning to launch the Early Childhood Education Pilot School Campaign “Prevention First before Reuse and Recycling”, aiming at cultivating a green culture starting from the younger generation by delivering the 3R concepts, which are “reduce, reuse and recycle” (Child Education Centre for Teaching and Learning, Hong Kong Institute of Vocational Education, n.d.).

Waste reduction education and campaigns are being held all over the world. Since 2001, Canada has been running the Waste Reduction Week, which is a national-level waste reduction campaign, owing to increases awareness of schools and the public toward sustainable and responsible consuming behavior, waste management, and preservation of the environment and natural resources (Waste Reduction Week in Canada, n.d.b) Waste Reduction Week is held in October every year, supported by numerous environmental organizations. Organizations provide support to the campaign by holding different activities and offering resources, to mention but a few, providing educational resources for schools, teaching the schools and students’ families to pack a waste-free lunch, leading students to pay a visit to a material recovery factory and encouraging schools, families, and offices to join a recycling scheme named Terra cycle Canada. In the U.S., the Wisconsin Department of Natural Resources (2012) provides schools with a guide on recycling and waste reduction. In Wisconsin, electrical and electronic appliances like calculators, printers and televisions are illegal to be incinerated or put in the trash. To promote the sense of recycling, the E-Cycle Wisconsin program is advocated in schools and districts, suggesting schools to set goals related to the waste prevention, donation, and recycling (Wisconsin Department of Natural Resources, 2019). Besides, Sustainability, Victoria and Victoria State Government (n.d.) encouraged the seven-step development of “Waste Smart Schools” under “Resource Smart Schools” (Sustainability Victoria and the Metropolitan Waste and Resource Recovery Group, 2016) which echo some similar five-step procedures such as waste audit/assessment, action plan and review promoted by “Recycling and Waste Reduction” school guidelines (Wisconsin Department of Natural Resources, 2012).

8.2.4 Awareness of Waste Classification and Reduction in China: Current Situation and Policies

China has initially formed a series of laws and regulations based on the basic laws such as the “Circular Economy Promotion Law”, the “Clean Production Promotion Law” and other special laws such as “Solid Waste Pollution Prevention and Control

Law” (hereinafter referred to as “Solid Waste Law”) as the basic framework for waste management, which is also supplemented by other laws and policies of the waste management legal system. In the special legislation on waste management, China has adopted “safeguarding ecological security” as the legislative objective for the “Solid Waste Law” revised in December 2004 for the first time. It is clearly stated that the country is adopting the circular economy strategy through the introduction of Producer Responsibility Scheme, Compulsory Recycling System, and Solid Waste Import Classification Management System so as to preliminarily establish a waste management system. It can be seen that China has reached some consensus with other developed countries on sustainable waste management. First, China has realized the serious damage caused by throwaway culture and waste pollution as well as the importance of “turning waste into treasure.” The principles of circular economy “reduce, reuse and recycle” has in fact been legislatively practiced that end pollution control system has been implemented. Second, China has established a relatively sound waste management system that is supplemented by an administrative licensing system, sewage charges, producer responsibility scheme, government’s incentives, public participation system, to ensure the implementation of waste recycling.

However, there are still some problems with waste management in China. The strategy that mainly remains in the field of operational management and industrial management is yet to be in line with the market and social management. The market mechanism of waste disposal is also yet to be comprehensive and spontaneous. Without a sound waste recycling market, the recycling of waste will come to an end in a “no-sale-and-yield” way. Other than that, the focus of relevant laws and regulations are primarily on solid waste disposal and recycling of resources, rather than on course control over producers and sellers. The missing of a clear waste hierarchy has limited the operation of waste management. As regards education for waste management, the main approaches in China are to infuse the ideas of waste classification, reduction, and recycling through informal science education, tourism education, city district activities as well as extracurricular activities, integrated activities in school and school-based curriculum. Some education initiatives are discussed as follows.

The Litter Less Campaign is a joint initiative of the Wrigley Company Foundation and FEE, and was initiated in 2011. The Litter Less Campaign is implemented in schools through the Eco-Schools and/or Young Reporters for the Environment (YRE) programmes. It aims to engage and educate children and young people on the issue of litter, and encourage them to make positive choices. As a full-member of FEE, Centre for Environmental Education and Communications of the Ministry of Ecology and Environment (CEEC) implements education programmes of FEE in China exclusively. From 2011 to 2016, selective schools in China, nominated by CEEC were asked to promote and implement such project. (Eco-Schools, n.d.a)

In the domain of conducting waste classification and environmental educational activities on waste reduction throughout schools, the project could not only enhance teenagers the knowledge and ability in handling wastes as well as its reduction, but also drew positive impact toward families and communities in promoting recycling of resources. It served an important role in demonstrating and leading the society toward household waste reduction and recycling enhancement by simply imposing the waste classification.

8.3 Overview

All through the past 6 years, an average of 502 kg wastes have been reduced for every semester from each school with highly high participation from 24 provinces (including autonomous regions and municipalities), and approximately 300,000 teachers and students of 195 primary and secondary schools.

Students and teachers should have a better understanding of environmental and social issues were wastes occurred from their participation as well as improving their knowledge and ability in reducing waste productivity and possessing effective waste management. Throughout the implementation project, schools collaborated and exchanged views on different issues and thus fostered the establishment of education for sustainable development (ESD) further (Table 8.1).

Table 8.1 Distribution of schools participated in the Litter Less Campaign in China (Data from CEEC, and prepared by the co-author Ms. Jin Yuting)

Province	No. of schools participated in waste reduction project
Beijing	7
Anhui	2
Chongqing	3
Guangdong	26
Guangxi	3
Guizhou	1
Hebei	11
Henan	2
Heilongjiang	15
Hubei	9
Hunan	1
Jilin	1
Jiangsu	24
Jiangxi	4
Liaoning	2
Inner Mongolia	4
Shandong	26
Shanxi	3
Shanghai	22
Sichuan	5
Tianjin	10
Xinjiang	1
Yunnan	5
Zhejiang	8
Total	195

8.4 Implementation Strategy

Students were encouraged to conduct activities of Eco-Schools under the theme of waste reduction, by following the methodology of “Seven Steps towards an Eco-School” with teachers’ guidance. The key points about the individual steps (Eco-Schools, n.d.b) are listed as follows:

1. Establish an eco-committee.
2. Conduct an environmental review.
3. Implement an action plan.
4. Monitor and evaluate the results.
5. Integrate with the curriculum work.
6. Inform and involve the stakeholders.
7. Develop an eco-code.

Taking an eco-committee of a primary school located at Shandong Province as an example. Its membership comprised of school management bodies, teachers, parents, and social representatives. Student members from the committee formulated an action plan with the review of campus environmental issue before launching the “Waste Reduction, Waste Recycle” activity. They proposed setting up a waste collection box and monthly monitoring the total weight of the recycled waste. In addition, they actively promoted families and communities the benefits of recycled waste. For the school, teachers were highly appreciated in educating their student’s environmental issues during teaching, especially for subjects of language, mathematics, and visual arts. Last but not least, an Eco code was produced after various meetings, discussions, and modifications. It was necessary to continuously implement and improve subject to social trend.

Students and teachers were enhanced in the knowledge and ability related to the aspect of waste classification and reduction after their participation. They could join hands together and serve as a role model for families and societies to further promote waste and environmental awareness.

8.5 Case Study of Waste Management in China

According to the submission materials of Eco-schools to the CEEC, The People’s Republic of China, three examples were chosen for illustrating waste management education in schools.

8.5.1 Case Study 1: Guangdong Primary School

School A is a primary school in Guangdong Province, the southern part of China which aims to establish itself as an international eco-school. One of the projects is “Action for reduction of rubbish.” Seven steps, in line with the eco-school protocol, are adapted to drive the classification of rubbish and reduction of rubbish (Eco-Schools, n.d.b): (1) forming an eco-committee; (2) conducting an environmental review; (3) formulating an action plan; (4) monitoring the progress and evaluating the outcomes; (5) linking with curriculum work; (6) informing and involving school and community; and (7) producing an eco-code.

School A started the practices of sorting rubbish into different types and reducing the amount of rubbish since 2003. Every year, students are mobilized to utilize lucky red packets and moon cake boxes collected during the Chinese New Year and the mid-autumn festival, respectively, for creating artifacts for display in school. After the display, these old exhibits were destroyed at the technology lessons to make recycled paper for students to use in visual arts lessons. Through these activities, students were encouraged to make use of recyclable materials. At the same time, teachers adopted a paperless office policy and used electronic files and communication for daily business and operations. Used envelopes and teachers’ handbooks were also recycled for a second use. The trash in the school kitchen was transformed into renewable resources. School A has also taken into account the situation of fallen leaves and food waste and bought machines for their treatment onsite. The school also established a “storage place for hazardous rubbish” for collecting used light pipe by electrician master, mercury thermometer and expired medicine by the school doctor, waste electronic appliances and printer cartridges by information technology teachers and maintenance company officers, respectively. This hazardous rubbish would then be managed by the school’s General Affairs Office for their delivery and treatment by professional companies. Colleagues also kept a record of the amount of other kinds of rubbish collected each day from the established collection pool in school and then transferred to the nearby street collection station managed by the local government’s environmental hygiene unit.

As regards student participation in environmental education activities, the school set up an eco-school committee and each class is represented by one student either through self-nomination, recommendation or election. Then at the school level, each eco-school committee student member was elected by at least more than 50% of class representatives. The eco-school committee also consisted of representatives from school management, teachers and parents as well as community members and local environmental organizations. While teacher and other representatives were mainly responsible for tasks such as the implementation of environmental education activities and infusion of environmental education elements into the school curriculum, student representatives were tasked for collecting other students’ views of improving the environment and organizing activities and communicating the decisions of the eco-school committee to all class and grade representatives in the school.

In 2013, a competition was organized to select exemplary families in classifying rubbish and as a result, more than 500 families were chosen to be recognized. An eco-code was also formulated through the concerted efforts of teachers and students and selected through more than hundred eco-code submissions. The selected eco-code highlighted that “rubbish classification being a scientific task, rubbish reduction being a collective effort, plastic waste not being thrown away and being recollected for re-use; treasuring the food and don’t waste, reducing food waste; hazardous rubbish not thrown away and combating white pollution.” School A also made liaison and established networks with other schools promoting cross-school endeavors in reducing energy consumption and emission. The positive results revealed that the amount of recycled materials increased from 170 kg in March 2012 to 205 kg in June 2013. Other rubbish was reduced from 110 barrels to 92 barrels during the same period.

8.5.2 Case Study 2: Beijing Primary School

School B was a city-level environmental education school and green school. It has been recognized as a school with teachers and students having high environmental consciousness and awareness of saving energy. In order to enhance the overall level of environmental awareness and behavior, the school decided to become a “Saving School”. The following measures have been adopted. The first approach pertains to the establishment of a leadership team with clear responsibilities for various teams within the school. For efficiently and effectively promoting the classification and treatment of rubbish, a leadership team was set up led by the Principal as the chairperson in charge of teaching and learning and Vice-Principal as the Vice-Chairperson in charge of general affairs and logistics as well as heads of the departments of teaching affairs, general affairs, moral education, and project leader as members. This leadership team enables coherent planning, construction, propaganda education for waste management and reduction as well as facilitates collaborative action, consolidation, and review, clear division of labor and responsibility (Table 8.2).

In the second school, the researchers conducted an evaluation of the utilization of resources in school environment, the extent of meeting stakeholders’ needs and contribution of school endeavors to the enhancement of local environment. Based on the evaluation results and past school achievements in green education, a rubbish classification system and its implementation details are set up: (a) rubbish classification: categories of rubbish bottles, aluminum foil package, paper, and waste; (b) collection time and venues: separate collection and distribution of different rubbish and nonrecyclable rubbish centrally managed; and recyclable materials sent to school rubbish collection point on every Thursday; (c) Income of recycling would be sent back to each class; (d) check of rubbish recycling: The performance of each class including its cleanliness would be scored for interclass competition. The environmental group would check regularly every afternoon. If a class has incomplete sorting of rubbish according to categories, scores of that class would be deducted and immediate onsite

Table 8.2 Division of labor and responsibility within the leadership team (Data from the submission materials of Eco-schools to the CEEC)

Chairperson and members of the leadership team/department	Main role in waste management and reduction
Principal	Overall coordination; Responsible for mobilizing all staff and students Clearly defining different department's relevant tasks and realizing whole-school planning Responsible for securing and providing funding and venues for activities
Cadre Party Office	Coordinate and monitor the tasks of all departments and offices; Responsible for tasks of regular research, checking, and consolidation as well as managing raw data and documents Responsible for consolidating reports
Moral Education Office	Responsible for promoting environmental education for staff and students Organize various activities including talks and exhibition with a view to cultivating a culture that is conducive to fostering green concepts among school members Ensuring the cleanliness and hygiene of school campus and classrooms as well as central treatment of rubbish; reducing pollution of the of school campus and neighboring environment
Teaching Affairs Department	Responsible for infusing environmental education elements into school subjects, their teaching plans and teaching resources
General Affairs Department	Providing support for activities and tables/forms for keeping records

sorting and checking needed to be done before allowing waste to be put into the rubbish bin; (e) Implementation: the school campus provided different zones of garbage disposal responsibility so that each class would collect and classify different categories of garbage in designated sites while leaves, tree branches, weeds, and wooded products would be treated centrally.

The second approach to education for waste management and reduction in school B was propaganda education and training for staff and students. In a weekly assembly, teacher delivered a speech covering the school's environmental situation and the importance of rubbish classification. Other related messages were disseminated through school broadcasting, noticeboard, poster, and blackboard display. Videos were shown in the teaching and learning web links to educate students about the appropriate manners of throwing garbage, the importance of reducing rubbish, recycling rubbish as a resource and making rubbish nonhazardous. Through different activities such as quiz competition and talks as well as participation in rubbish collection and treatment, students developed better awareness and knowledge of waste management as well as engaged in reducing the rubbish.

The third approach was to implement rubbish reduction, recycling, and other measures of reducing energy. Staff and students had developed a routine to classify and throw rubbish according to three types into different kinds of rubbish bin: the first type as waste paper, used books, and newspapers; the second type as plastic bottle and bags as well as cans; the third type as nonrecyclable materials. The first and second types could be recyclable and their amount was recorded. Other types would be disposed of immediately. An environmental protection association was also set up by students through election and student “Little Environmental Guardian” was involved to guide students for garbage disposal. Regular monitoring by “School Environmental Cleanliness Inspection Team” was conducted to ensure environmental cleanliness and environmental actions of staff and students. Rubbish collection and classification was extended to school to families and an activity “I talk with my parents on environmental protection” was organized as part of the green education programme. The school also required students to go with their parents to visit an ecological education centre during the weekend or vacation. Comments or ideas were put forward through the collaborative efforts of students and their parents in reducing the rubbish and enhancing the environmental cleanliness (less spitting and sticky glue everywhere) in the tourist area and the school campus. In addition, School B signed an agreement with the local resident committee on “providing students an activity base for community service” so that students could be actively involved in the local community services for promoting environmental awareness and action and enhancing environmental cleanliness.

8.5.3 Case Study 3: Chongqing Primary School

School C conducted its waste reduction programme by implementing various policies and actions on 11th December 2016. To build up students’ sense of environmental knowledge as well as the concept of waste classification, the school extensively worked on the promotion, education, and advocacy of such kinds of messages through different means, such as campus broadcasts and window showcases. Students were highly expected to participate in the programme such that they are competent enough to realize the importance of waste classification from the understanding of the drawbacks of wastes to the society. They should have the ability to perform waste classification in a routine manner. In addition, the school also arranged promotion and training of waste classification on a class-based level. Students were asked to conduct discussions with peers by using the data collected from the internet or observation. They could make use of this opportunity to exchange ideas and share information with each other. Awards were presented to outstanding classes for their great achievements.

It is necessary to widely conduct waste classification through practical issues. The school was suggested to design and implement such kinds of programmes with reference to students’ ability. Different forms of programmes could facilitate more ideas,

which imperceptibly generated a positive impact on environmental responsibility toward students.

Students were asked to classify wastes and place in the correct trash when disposing of in schools. Meanwhile, recycled waste bags or boxes were set up in each classroom for classification convenience. For instance, students could send the glass bottles to the waste collection point after consuming and collect monetary return for operation funding of class activities. Students were not only benefited from monetary terms, but also created their sense of environmental responsibility by doing actions good for the environment. On the other hand, the school could spend fewer expenses on the disposal of wastes and utilize more resources in recycling instead. As a result, pollution from wastes could be reduced. Conducting waste classification and reduction programmes in school could bring up students' sense of environmental responsibility and encourage 3Rs comprehensively. Each of us should have the role to join hands together and create a green society for a better living environment.

It was appreciated that there was a significant impact to waste reduction after a semester trial in the third School. Rewards were presented to awardees with outstanding performance. Students were encouraged to continuously support waste reduction and build a clean and comfortable environment in the future.

8.6 Analysis

The Environmental Education Unit of An Taisce was entrusted by Foundation for Environmental Education (FEE) and Wrigley Company Foundation in 2015 to conduct an observation on waste issues for 22 countries and 530 Eco-Schools (including 30 of those in China), there were 1,790 questionnaires received and (O' Mahony & McGroarty, 2015). As regards China's student scores on knowledge and perception and less littering, it ranked high among 22 countries. In addition, China's student scores on opinion leadership ranked the highest among all surveyed countries, revealing that students paid a lot of promotion and leadership efforts on less littering and more recycling. Below the table illustrated the pattern of some findings (Table 8.3).

Compared with some developed countries and places such as Wales, Australia, Canada, China's scores on average perception, average behavior, and average opinion leadership tended to be higher than their Western counterparts such as Canada and the United States. Nonetheless, it is noteworthy that relatively speaking, the average behavior score on recycling is slightly lower than their western counterparts.

The majority of eco-schools implementing environmental education in China were following the project planning and strategies on Eco-School formulated by The Foundation for Environmental Education (FEE). The methodology of "Seven Steps towards an Eco-School" was proposed in the project that aimed at paving the way for schools to carry out environmental education and education for sustainable development (ESD). On the other hand, different municipalities have implemented different kinds of education for waste management under the advocacy of China's government toward the goal of sustainable development. There are three main approaches. The

Table 8.3 Average ratings on students' perception, behavior and opinion on less littering and more recycling

Country	Average scores on knowledge and perception	Students' average behavioral ratings on waste reduction from selected countries			Students' average opinion leadership ratings on waste reduction promotion from selected countries		
		Behavior score on littering (BSL)	Behavior score on recycling (BSC)	Behavior score on both (BC)	Scores on littering (OPL)	Scores on recycling (OPL R)	Combined scores on both (OPL C)
Wales	0.67	0.84	0.82	0.83	0.46	0.48	0.48
Australia	0.67	0.85	0.78	0.82	0.47	0.44	0.47
Canada	0.68	0.80	0.88	0.84	0.45	0.45	0.47
United States	0.75	0.84	0.79	0.82	0.47	0.48	0.50
China	0.86	0.86	0.76	0.81	0.67	0.68	0.70

Sources

Table 13 Survey 1 (S1) Average Perception Score (PS) per Country. O' Mahony and McGroarty (2015). Litter less Evaluation Summary Report. Ireland: Environmental Edu. Unit, Ireland

Table 14 Survey 1 (S1) Average Behavior Score per Country. O' Mahony and McGroarty (2015). Litter less Evaluation Summary Report. Ireland: Environmental Edu. Unit, Ireland

Table 15 Survey 1 (S1) Average Opinion Leadership Score per Country. O' Mahony and McGroarty (2015). Litter less Evaluation Summary Report. Ireland: Environmental Edu. Unit, Ireland

first approach is to establish some exemplary schools to demonstrate ways of collecting and classifying daily living waste as well as to cultivate a good mechanism and habit for waste reduction. The second approach is to enhance student understanding of waste management through school-based environmental science thematic activities which encourage and engage students as ambassadors to design ways of reducing and recycling waste. The third approach is to arrange social practice and volunteering activities, which facilitate students to visit related institutions and participate in community waste reduction and propaganda activities.

8.7 Concluding Remarks

Despite continuous efforts over the past years, waste education in China is still in its initial stage. “Reduce”, “reuse”, and “recycle” (3Rs) were emphasized in environmental education. Furthermore, there could be a possibility that schools can consider adding more elements matching with “economic”, “ecological”, and “equitable” (3Es) with the 3Rs in educating students for promoting green consumption, so that they can have a more understanding on the way of protecting the environment. For example, choosing to use environmentally friendly products can bring less harmfulness and pollution to the environment. In addition, schools can consider practicing waste education from the aspects of four pillars of becoming “toxic-free”, using “resources sustainably”, producing “a green and healthy space” and integrating teaching, learning, and student engagements as becoming a healthy and sustainable school (Green Schools Initiative, n.d.).

Given that China has fast economic growth and commitment to achieve the goals of sustainable development in future, China could learn the good practices and adopt innovative approaches from other advanced economies through the provision of funds and resources as well as formulation and execution of waste management and related educational policies. There is already a good foundation at the policy level as keywords such as scientific outlook on development, environmentally friendly society and ecological civilization have been disseminated in official documents (Wang, 2012). Nonetheless, there is scope of enhancement of China’s environmental citizenry through the following approaches: leading by examples and establishment of exemplars which reveal the realization of basic concepts of waste management education; infusing the ideas of sustainable consumption and production into existing curriculum across levels of schooling and teacher education programmes; promoting multidisciplinary approaches and multiple partner collaboration in research and development of innovative education for waste management; and enhancing opportunities of social participation and service learning as well as intergenerational learning especially through community- and district-based activities.

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