Chapter 6
The River Guardian Program for Junior High Schools on the "River of Kings," Thailand

Supitcha Kiatprajak and Lynda Rolph

Abstract A country's main river is like the central bloodline sustaining the majority of people who live there. The Chao Phraya River is Thailand's main river, running through Ayutthaya, Thonburi, and Rattanakosin or Bangkok, three important capital cities from the days of Siam to present-day Thailand. Over time, our relationship with this river has changed and our actions have degraded it. Pollution, canal building, and damming have contributed to ecosystem changes. The best way to try to conserve our main river is to enable new generations to learn about and to love their own resource. With this desire in mind, the River Guardians Project was created. The River Guardians Project is one of the programs administered by Traidhos Three Generation Barge Program (http://barge.threegeneration.org/), working in the field of education for sustainability at different locations in Thailand. A group of five Thailand government junior high schools (M1-M3 level, or 13–15-year-olds) in Bangkok were identified and trained to test the water quality in their section of the river, going from near the city boundary, downstream, to the heart of the city. Dissolved oxygen (DO), biochemical oxygen demand (BOD5), E. coli, nitrate (N), phosphate (P), pH, water temperature, total dissolved solids (TDS), and turbidity were analyzed as representative parameters for the quality of the river in this research. Trends in water quality were observed particularly in relation to local land use patterns. Although coordination with the schools at times can be challenging, overall the teachers felt that the students have benefited from the experience academically and it has given them an appreciation for the connection of water and community. The Education for Sustainable Development philosophy behind the program, the logistics of creating the program, water quality testing results, and lessons learned are presented in this chapter.

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Introduction

Water is the most important element on this planet earth, and no one can live without it. Yet, availability of clean water varies tremendously from country to country. Pruss-Ustun et al. (2014) concluded that 842,000 diarrheal deaths occurred globally in low- and middle-income countries in 2012 as the result of inadequate water, sanitation, and hand hygiene. Asian rivers are among the most polluted in the world, with three times as many bacteria from human waste as the global average (United Nations University 2016). Water consumption has almost doubled in the last 50 years and globally; the acreage equipped for irrigation increased from 193 to 277.1 million hectares between 1980 and 2003; the largest proportion of this irrigated land is in Asia (Food and Agriculture Organisation of the United Nations (FAO) 2016).

If we are not concerned about our water resource, we may experience considerable social and economic stress in the near future. Therefore, the River Guardian Program was set up to help the new generation learn about and love their water resource.

The Chao Phraya River is Thailand's main river that provides nourishment to its people in both direct and indirect ways (Fig. 6.1). With its low alluvial plain forming the central landmass of the country, it runs through Ayutthaya, Thonburi, and Rattanakosin (or Bangkok), three important capital cities from the historic times of Siam to present-day Thailand, before it empties into the Gulf of Thailand. The Chao Phraya Watershed covers about 30% of Thailand's land area or about 160,000 km^2 (Komori et al. 2012). The flow on the Chao Phraya River follows the seasonal monsoon pattern, with low flows occurring in the dry season, December to May, and with the flow rising to peak around October (Fig. 6.2).

Water is an extremely important element in the Thai peoples' lives because they have lived with and on the water since historic times. It provided the main form of transportation through rivers and canals, when roads were absent in the early periods of their history. This is the reason why many important places such as the Grand Palace, temples, government offices, mosques, and also residences were settled along the banks of the river as well as along the canals (Sitthithanyakij 2007). Daily life is connected to the river or the water also because Thailand is an agricultural country with extensive rice fields and fruit gardens. Rice fields always employ small canals or the water wheel to pump the water into their rice fields (Tiptus 2000). Moreover, there are many other careers such as fishing and commercial navigation that are supported by the water from the river. In addition, most of the bricks that were used to build the Grand Palaces in Sukothai, Ayutthaya, Thonburi, and Rattanakosin were created by the clay taken from the Chao Phraya River or its tributaries.

During the rainy season, flooding frequently occurs in the middle part of Thailand and this brings nutrients to the farmers' fields (Pollution Control Department 2003). The local people also learned how to live with this situation as we see from the architectural styles of the houses that have high stilts and a very

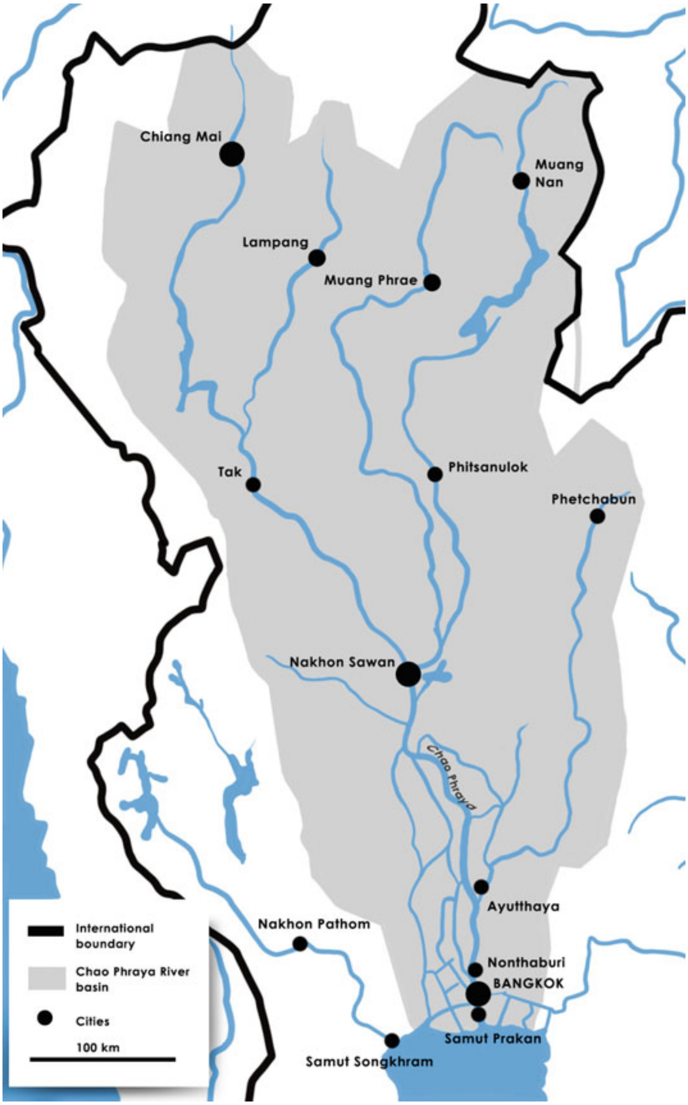

Fig. 6.1 Chao Phraya Watershed (from the Working Group of the Office of Natural Water Resources Committee of Thailand) (*Source* adapted from UNESCO 2006, p. 391)

sharp roof. Thai houses traditionally were designed to use the space under the house for activities such as cooking and family gatherings and to be safe in the flooding season (N Paknam 1988). And yet, Thai traditions are changing. Some have argued that Thai people are losing their connection with the water, particularly in the urban and peri-urban areas of Bangkok (Suwanarit 2012).

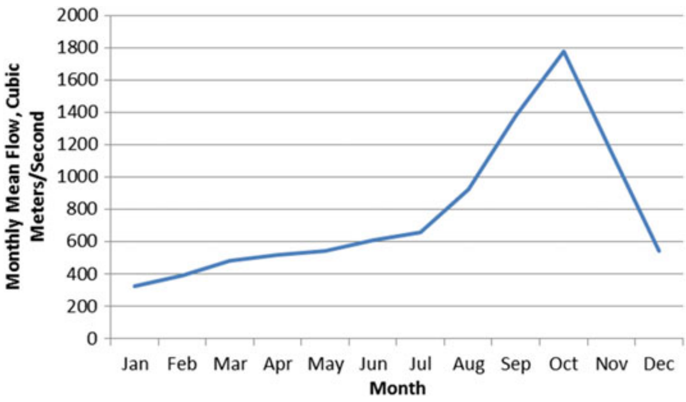

Fig. 6.2 Monthly mean flow, 1976–1984, for the Chao Phraya River at Nakhon Sawan. *Source* Oakridge National Laboratory, Global River Discharge Database, RivDIS Project (*Source* (National Aeronautics and Space Administration (NASA) 2016)

The Chao Phraya River has been degraded through anthropogenic activities (e.g., Patarasiriwong 2000; Ongsakul and Sajor 2006; Price et al. 2012). Since the Ayutthaya era, international trade has been welcomed in Thailand (Reid 1990; Villiers 1999), the Chao Phraya has been dredged, and canals were constructed to straighten the meandering river course for the purposes of navigation. However, all is not gloom and doom. From the water quality reports of many organizations including those by the River Guardian Project, water from the upper and middle part of Chao Phraya River is still of an acceptable quality. It is only the lower part of the river where water quality is quite poor (see also Simachaya 2003). If we are not aware of the value and the importance of the river, we run the risk of severe environmental impairment for future generations.

The best way to try to conserve our main river is to enable new generations to learn about and to love their own resources. Once they feel a connection to the river and realize its value, we should build their capacity so that they can help each other to take good care of their own resource. The aim of this chapter is to describe a water testing program that was established with five Thai government schools along the Chao Phraya River and present results of the testing and discuss the implications for teaching and learning. To provide context and a framework for the water quality testing work, we will first describe the River Guardian Program through a case study approach, showing that non-formal, field-oriented education can provide authentic research experiences that solve real-world problems, benefitting both the students and the community.

Background of Traidhos Three Generation Barge Program

The Traidhos Three Generation Barge Program has been running since 1995, when Mom Luang Tridhosyuth Devakul converted a teak rice barge into a floating classroom on the Chao Phraya River (Fig. 6.3). The program was developed to showcase experiential environmental education, based on examples in Canada and the USA. The early days of the program were limited to working on the Chao Phraya River with international and Thai government and private schools and offering training to Thai teachers wanting to implement the Thai Ministry of Education's child-centered curriculum and developing critical thinking initiatives. The program was subsequently extended into a Watershed Program, with the addition of activities in mountain areas, rainforest habitats, and at marine sites of the watershed, enabling us to facilitate students with a consistent theme but different watershed contents over a number of years. Fieldwork provides a number of benefits through hands-on practice that often gives more meaning to theoretical material taught in the classroom, which can positively influence cognitive processes and affective learning (Kern and Carpenter 1984; Smith 1999; McGuinness and Simm 2005; Boyle et al. 2007; Dummer et al. 2008; Brundiers et al. 2010). The authors have found the fieldwork programs have been well-received by Thai schools and students and international schools and students alike.

The UNESCO Decade of Education for Sustainability prompted us to re-examine the work we were doing and to realign our program with those ideals. Our Environmental Education (EE) programs have already contributed to Education for Sustainable Development (ESD) but we became more aware of the process of systems thinking and the skills of envisioning, critical thinking, and the importance of networking (discussed in more detail in the next section). With the curriculum enriched by new processes and ways of thinking, we wanted students participating in our programs to be exposed to skills relevant to twenty-first-century thinking.

The River Guardian Program is a systems-thinking approach to education for sustainability. The water quality testing task has been framed in the geographical context of both the Chao Phraya Watershed and the immediate environment around

Fig. 6.3 Three Generation Barge (left) and class instruction on the barge (right)

the various schools. The partnership formed between Buffalo State, State University of New York, and the Traidhos Three Generation Barge reminds us of the global nature of today's world dependent on the same natural resources regardless of wealth, status, or location.

The River Guardian Project discussed in this chapter was conducted in four phases over two years with five Thai government schools:

Phase 1. Watershed awareness: Games and activities were developed for students to appreciate that they have a watershed address and that the Chao Phraya River near their school comes from somewhere and goes to somewhere. This is to raise awareness that the river is a system.

Phase 2. Water quality testing and data collection: Introduction to water quality test kits, introduction to what the tests mean, introduction on how to record and manage data, and testing and river bank observations.

Phase 3. Community investigation around school area, using the AtKisson Compass of Sustainability (Steele 2011). Systems-thinking approach was used to identify what is happening in the immediate area that may be impacting on the water quality (water testing also continued).

Phase 4. Student led community action to address an issue identified in phase 3. Presentations by all River Guardian schools and the submission of their final reports.

Education for Sustainable Development (ESD)

Over the last twenty years, there have been many definitions of "sustainable development." Perhaps the most famous and long-lasting is the definition offered by the Brundtland Report, where sustainable development is that which meets the "needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development 1987, p. 7). Indeed, ESD falls within the larger umbrella of environmental education and the chapter will consider these two terms to refer to the same goal of enabling our learners to care for and take action on their environmental future.

In our discussion, however, sustainable development will be taken as continuous change in the direction of sustainability as defined by the AtKisson Group. Education for Sustainable Development is any learning that creates change and that leads in the direction of sustainability (Steele 2011). By the end of the UNESCO Decade of Education for Sustainable Development in 2014, much has been written about ESD. As with the concept of sustainable development itself, different groups and countries have different (at times conflicting) views and approaches to ESD (e.g., Jickling 1994; de Haan 2006; Vare and Scott 2007; Venkataraman 2009; Mogensen and Schnack 2010; Wals and Keift 2010). The value of both formal and non-formal educational approaches for ESD has been highlighted by a number of researchers (e.g., Haigh 2006; Tilbury and Wortman 2008; Brundiers et al. 2010; Wals and Keift 2010), and the River Guardian Project is a good example of how non-formal education and fieldwork can enhance the student learning experience.

UNESCO Clearly Defines ESD

Education for Sustainable Development aims to help people to develop attitudes, skills, and knowledge to make informed decisions for the benefit of themselves and others, now and in the future, and to act upon these decisions (UNESCO 2011).

So how does ESD as a teaching tool enrich the River Guardians Project? Essential to ESD are the following skills identified by Tilbury and Wortman (2008) and Tilbury (2011):

1. Envisioning
2. Critical thinking and reflection
3. Systemic thinking
4. Building partnerships
5. Participation in decision-making

Envisioning

We want the students involved in the River Guardian Project to be able to imagine a pollution-free Chao Phraya River. We want them to understand how the river that passes their school is part of a system. To this end, the first few sessions with each school did not focus on water testing but instead the students were engaged in a program of general environmental awareness, their watershed address, and understanding that the river comes from somewhere and flows on to somewhere else, hence connecting their school and community to the wider watershed. If students are to be motivated to make a difference, they need to envision a clean and sustainable river. This will help them to identify the goal for part two of the project where children have to imagine a world in which people from all backgrounds and levels of expertise are engaged in a process of learning for improving quality of life for all within their community and beyond for future generations, in a world where people recognize what is of value to sustain and maintain, and what needs to change through "reflecting, understanding, asking, making choices, and participating in change for a better world" (Tilbury 2011). Envisioning identifies relevance and meaning for our students, it explores how change can be achieved, as it offers direction and energy to take action, and it results in the ownership of visions, processes, and outcomes.

Critical Thinking and Reflection

Critical thinking and reflection challenge our current belief system and the assumptions underlying our knowledge, perspectives, and opinions about how Thai children learn. This is very important in Thai government schools since students are traditionally taught to respect the opinion of the teacher and are not encouraged to question material that is presented.

Critical thinking helps River Guardian students to reflect and develop the ability to participate in change, as it provides a new perspective and promotes alternative ways of thinking. In phase two of the project, students reviewed what was happening around their school areas from multiple viewpoints—environment, economy, society, culture, and personal well-being—since these are the strands that contribute to a sustainable system. By doing so, a holistic view of all that is happening in their area was created and this gave confidence to students to address the unsustainable practices which may be contributing to the poor water quality in their section of the river.

Systems Thinking

Systems thinking is "a unique perspective on reality—a perspective that sharpens our awareness of the whole and how the parts within those wholes interrelate" (Waters Foundation 2016). One might ask why systems thinking is important for learners. Exploration of dynamic complexity is a highly motivating learning experience for students. Their learning is enhanced by the "real" nature of the problems that they explore…[and] it creates tremendous potential for engaging students in powerful learning experiences (Waters Foundation 2016). Our River Guardian students move from a general watershed understanding to specific knowledge of the health of the river at their school and then in phases three and four, and get the chance to connect their testing results to what is really happening around their school. Students will start to make real-life connections as they use the AtKisson Compass of Sustainability, and that once they see the river as part of a system, they will be able to suggest where changes can be made, making the system more sustainable.

Systems thinking allows students to develop a number of higher order skills. We start to seek the big picture, look for change over time, and become aware of delays in change. By looking from a number of perspectives, students learn to understand an issue more fully. Systems enable the learner to consider cause and effect and where change can be innovated; systems allow us to understand the effect our actions will have more easily.

Imagine a world where decision makers "saw the whole picture" and can honor the connections between their actions and local, regional and global issues; a world where people and communities have the skills to understand links between thinking, actions, and impact across the world, and where they are empowered to address core problems and not just the symptoms (Tilbury 2011).

Participation in Decision-Making Empowers Oneself and Others

Putting decision-making and responsibility for the action in the hands of the participants creates a sense of ownership and commitment to action for the River Guardian participants which will help build capacity for self-reliance and self-organization and empower individuals to take action.

By rooting River Guardians in the theory of Education for Sustainable Development, the program is characterized by being interdisciplinary, values-driven, and a shared learning between teachers, learners, and our partners. It is locally relevant and seeks innovation. It enables students to stop looking at fragments of a situation and to look at connections to other things.

The four phases of River Guardian Project, watershed understanding, water testing, community investigation, and action project, will not only achieve a class water testing project but it will build the capacity of each participant to understand their locality and to develop thinking skills, knowledge, and understanding that they can apply to many aspects of their life.

Water Quality Testing Program

Target Group

With the desire to provide a dynamic educational experience in sustainability that is rooted in the local issue of water resources, five Thailand government junior high schools (M1–M3, 13–15-year-olds) were identified and trained to test the water quality in their section of the river using the water testing kits that were supported by Buffalo State, State University of New York. The project fits with the school's curriculum and study development program as the students have to do the water testing and learn about basic environmental chemistry in the science subjects, and this will help them, for example, in developing a "junior project" in the following year, which is also part of phase four of the River Guardian Program. The schools are located in Pathum Thani, Nonthaburi, and Bangkok, and three of these were selected to represent conditions along the lower Chao Phraya River. The fourth school was selected to represent the former Chao Phraya River which is now known as Bangkoknoi Canal. The fifth school was selected to represent the boundary conditions upstream of the Greater Bangkok area (Fig. 6.4).

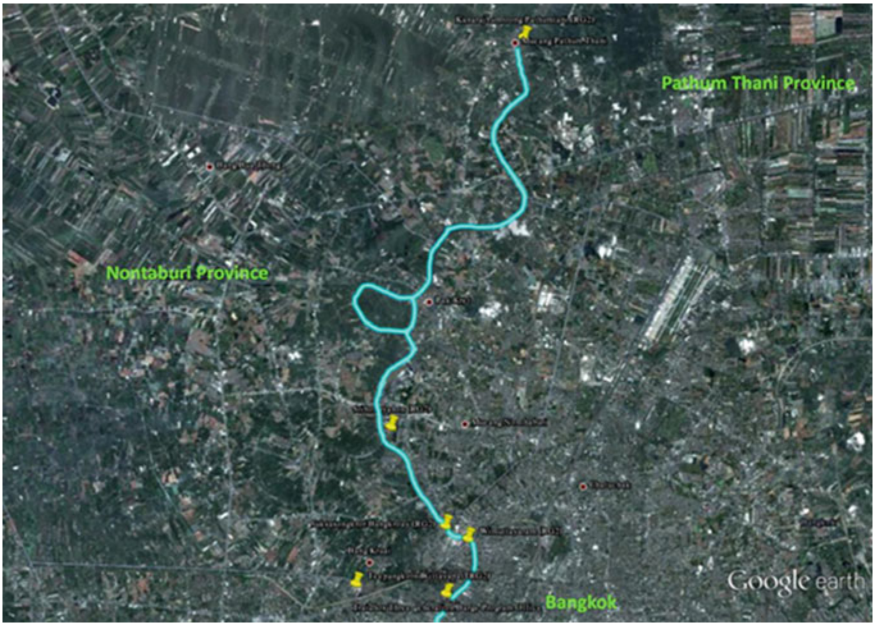

Fig. 6.4 Location of the River Guardian Schools on the Chao Phraya River. The pin furthest south on the Chao Phraya River represents the office location of the Traidhos Three Generation Barge Program

Kanarajbumroong Patumthani School: This school is one of the science centers among other Thai schools. The school is located at the upstream of the Chao Phraya River in Patumthani Province and opposite Patumthani fresh market which is still in the perimeter near Bangkok.

Sriboonyanon School: This school is located downstream from the first school in Nonthaburi Province. They are a very active school that has a record of success with science projects.

Suksasongkror Bangkruay School: This school is located in the Bangkruay district, Nonthaburi Province. Their location is the border between Nonthaburi Province and Bangkok. This school was chosen because all of the students are members of hill tribes from the northern part of Thailand, which is the source of the Chao Phraya River.

Wimuttiyaram Wittayakom School: This school is located in Bangkruay district as well but at the end of the Chao Phraya River, downstream of the Bangkruay Power Plant.

Dipangkornwitthayapat (Wat Noi Nai) School: This school is located on Bangkoknoi Canal which is used to be the former Chao Phraya River before the present river was dug up.

Procedure

Each school collected grab samples from the bank of the Chao Phraya River in front or nearby their school using a bucket. Sample collection was done on the first day of every month. The water was then analyzed using testing kits provided by Buffalo State, State University of New York, and included nine tests:

1. E. coli—using the Coliscan Easygel system (www.micrologylabs.com/). Each test comes as a self-contained unit that includes the growth media in a disposable plastic vial, a specially treated plastic, disposable petri dish, and a disposable pipette. Normally, 1 mL of water is extracted from the sample and dispersed into the growth media vial. The vial is then gently swirled to fully mix the water and growth media and poured into the petri dish. The proprietary coating on the petri dish produces a chemical reaction with the growth media and bacteria in the water sample such that E. coli colonies turn blue or purple, whereas the total coliform colonies are pink. In this study, only the E. coli colonies were counted. Colonies are counted after 48 h, and an advantage of the system is that no specialized incubation equipment is needed. Incubation is done at room temperature, and the analysis can be completed on a laboratory bench. Irvine et al. (2011) compared the Coliscan results to E. coli levels determined from a split sample using the standard membrane filtration method at a New York State-certified laboratory and showed the Coliscan results were similar over a wide range of E. coli levels.
2. pH—Extech Instruments PH60 waterproof pH/temperature pen.
3. Temperature (difference between two sites)—Extech Instruments PH60 waterproof pH/temperature pen.
4. Turbidity—Secchi Disk. The Secchi depth can be converted to the NTU or JTU scale using the conversion graph provided by Mitchell and Stapp (1995).
5. Total Solids—evaporation method.
6. Dissolved Oxygen (DO) and BOD5—CHEMetrics Oxygen (dissolved) kit (http://www.chemetrics.com/). This kit uses a colorimetric approach employing the indigo carmine method (Gilbert et al. 1982). A 25 mL sample is used for analysis. A separate 25 mL sample was collected at the same time and stored in an amber HDPE bottle. The same kit was used to analyze DO in the amber bottle 5 days later.
7. Nitrate—CHEMetrics kit which uses a colorimetric approach employing the cadmium reduction method (APHA Standard Methods, 21st ed., Method 4500-NO3- E (APHA 2005)). A 15 mL sample is used for analysis.
8. Phosphate—CHEMetrics (reactive ortho) kit which uses a colorimetric approach employing the stannous chloride method (APHA Standard Methods, 21st ed., Method 4500-P D (APHA 2005)).

These parameters were selected to be consistent with the National Sanitation Foundation (NSF) Water Quality Index (WQI) (Brown et al. 1970), and the kits have been calibrated in New York state (Stephen Vermette, Professor, Buffalo State, State University of New York, pers. Comm. and in Singapore (Lok 2014; Ng 2014) to provide robust results. These kits are easy to use and are cost-effective.

The WQI can be a useful tool for summarizing and communicating complex water quality information to the public and has been applied in many countries worldwide (Bhargava 1983; House and Ellis 1987; Dojlido et al. 1994; Palupi et al. 1995; Wills and Irvine 1996; Pesce et al. 2000; Bordalo et al. 2001; Cude 2001). The students use the data to calculate the WQI, which synthesizes the results of all water quality tests into a single value between 0 and 100 (closer to 100 being better water quality). The WQI facilitates interpretation of the data and also provides the students with experience in graphing data and making simple calculations. The calculations for the WQI can be done using a Microsoft Excel spreadsheet developed by Kim. N. Irvine; Buffalo State, State University of New York or manually, using the water quality (Q-Value) rating curves and tables provided by Mitchell and Stapp (1995) (Figs. 6.5 and 6.6).

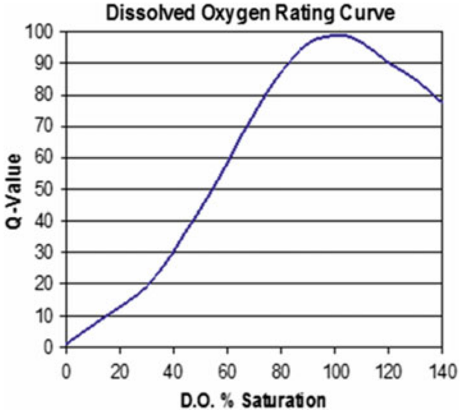

Fig. 6.5 Example of Q-value rating curve, in this case for dissolved oxygen (based on Mitchell and Stapp 1995)

Analyte	Test Result	Q-Value	Weighting Factor	Total
DO			0.17	
E. Coli			0.16	
pH			0.11	
BOD			0.11	
Temperature			0.1	
Phosphorus			0.1	
Nitrate			0.1	
Turbidity			0.08	
Total Solids			0.07	

Overall Water Quality Index Score: ________

Fig. 6.6 An example of the tabulation to facilitate manual calculation of the WQI

Results and Discussion for the WQI

The sampling process (see Fig. 6.7) started in February 2012; however, some schools started in June 2012 because the historic flood of 2011 delayed the program. Results of the sampling in terms of the WQI are summarized in Fig. 6.8, and generally the WQI values fall into the "medium" to "good" range following the scale proposed by Mitchell and Stapp (1995). Results were somewhat unevenly reported, and this is discussed in the next section in more detail. The Wat Noi Nai School continued the project past November 2012 and into September 2014, and the full set of results for this school are shown in Fig. 6.9. The results do not show any real seasonal variation, as we had expected in planning the project. In fact, human factors seem most likely to dominate the water quality characteristics of the area. For example, even though the Kanarajbumroong Patumthani School is furthest upstream and above the Bangkok CBD, it is located opposite to the Pathumthani market and throughout the day ferries run back and forth, continually pouring exhaust and oil discharges into the water. The area is residential with septic tanks frequently emptying into the river, while market vendors tip waste into the water. Wat Noi Nai School is located in the small klong, Bangkoknoi. It is an area of

Fig. 6.7 Photographs of students on the project. **a** Students at Kanarajbumroong Patumthani School conducting water tests. **b** Supitcha Kiatprajak with colleague explaining the water testing kits to Dipangkornwitthayapat (Wat Noi Nai) School. **c** Students, teachers, and Buffalo State partners at Kanarajbumroong Patumthani School. **d** Suksasongkror Bangkruay School and Dipangkornwitthayapat (Wat Noi Nai) School student testing water

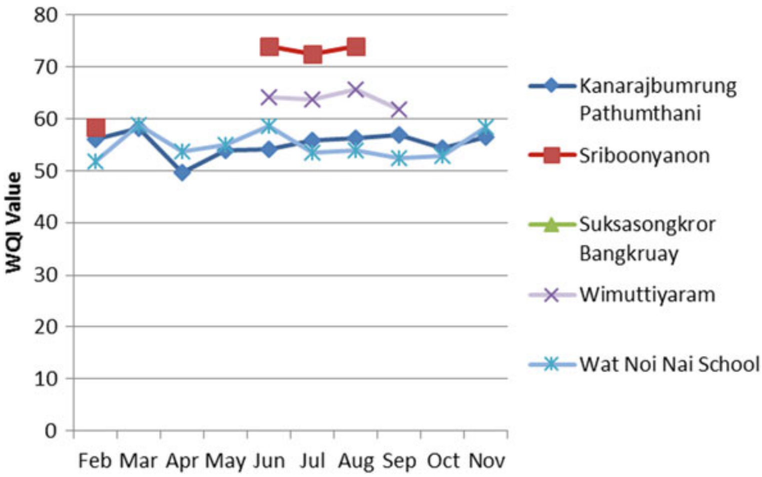

Fig. 6.8 WQI results for all reporting schools, February–November 2012

mostly gardens and orchards with some redeveloped residential units. It also is a popular site for tourist long-tail boats. When the water level is low, these boats stir up the sediment on the bottom of the canal, contributing to the volume of black, turbid water.

The results from the WQI have allowed the students to think deeply about a few things. For one, they had to correlate the findings to understanding the spatial location of their sites. In addition, the students also had to explain how the situation at the site will help explain the results. The example of Kanarajbumroong Patumthani School is worth mentioning here, where students are provided the

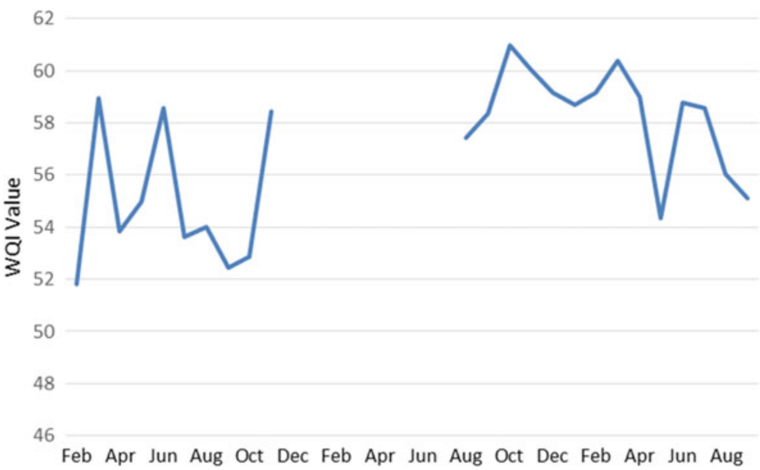

Fig. 6.9 WQI results for Wat Noi Nai School, February 2012–September 2014

opportunity to link their knowledge about turbidity with the real-world context of sediments stirred up by passing boats. However, this is just the WQI portion of the program and there are other lessons learnt throughout the entire project.

Lessons Learned and Concluding Thoughts

Overall, we believe we delivered a successful program (e.g., Figure 6.10) but we also identified shortcomings that need to be considered, as well as some factors that impacted the project that were beyond the authors' control. The teachers at the Kanarajbumroong Patumthani School said that all of students who joined the project gained valuable experience through their participation in the program and it helped develop their leadership skills. The students felt confident to work with the water testing kits and started to be able to think and to organize a junior project of their own. Although the junior project did not use the WQI directly, the data that they gathered from this project suggested that the quality of the Chao Phraya River is variable over one year and this inspired the students to think about possible projects. Subsequently, the junior project came about after testing their school sewage water. They created a filter after testing different kinds of filter material, including jackfruit peel charcoal, mangosteen peel charcoal, orange peel charcoal, and coconut peel charcoal. The conclusion of the project was that the mangosteen peel charcoal was the best to filter the water. This school had an excellent experience, in part because of the teacher leadership and in part because the school has a strong science/research tradition.

Wat Noi Nai is another school that worked very enthusiastically on the project but after November 2012, they could not conduct the testing for a period of time because their water testing box was stolen from the school laboratory. We replaced the kits for them at the middle of the year 2013, and they started to collect the data again in August 2013 and finished their data collection in September 2014. Unfortunately, the lead teacher moved to another school.

The Sriboonyanon School submitted a report to us, but was concerned about their results because the students got confused while doing the testing. However, the teachers were very pleased that students had a chance to try the test kits and work on an authentic research project.

The authors were little disappointed with the results at Suksasongkror Bangkruay School. This school potentially was the most interesting, since many of the students are from hill tribes in northern Thailand, near the headwaters of the Chao Phraya River. They had two challenges at this school. First, because the students generally come from a remote area in Thailand, their primary school training did not prepare them well for this type of study. More importantly, the teacher assigned to this project was not as dedicated as we had hoped in guiding the students.

(a)

รายงานสรุปผลโครงการศูนย์เรียนรู้แม่น้ำเจ้าพระยา

หลักการและเหตุผล

โรงเรียนคณะราษฎร์บำรุงปทุมธานี เป็นโรงเรียนที่ตั้งอยู่ริมฝั่งแม่น้ำเจ้าพระยาซึ่งเป็นแม่น้ำสายสำคัญของประเทศ เป็นแหล่งอารยธรรมและวัฒนธรรมของชาติ ก่อเกิดประเพณีต่าง ๆ มากมายเกี่ยวกับสายน้ำ แม่น้ำเจ้าพระยาได้หล่อเลี้ยงผู้คน อำนวยประโยชน์ต่อคนในชาติอย่างอเนกอนันต์ ทั้งใช้ในการอุปโภคบริโภค การคมนาคม แหล่งอาหาร และการท่องเที่ยว แม่น้ำเจ้าพระยาจึงเป็นแหล่งเรียนรู้ที่สำคัญของเยาวชน ที่ทำให้นักเรียนมีจิตสำนึกในการอนุรักษ์และพัฒนาสิ่งแวดล้อมที่เกี่ยวพันกับแม่น้ำเจ้าพระยา และยังมีจิตอาสาในการช่วยกันอนุรักษ์แม่น้ำเจ้าพระยาให้มีสภาพแวดล้อมที่ดีสืบไป

ดังนั้นทางโครงการเรือไตรทศ ร่วมกับมหาวิทยาลัยนิวยอร์คบัฟฟาโล่ เสตท คอลเลจ นำโดยศาสตราจารย์ เท็ด ทัคเคิ่ล และศาสตราจารย์ คิม เออไวน์ ให้การสนับสนุนอุปกรณ์ในการตรวจสอบคุณภาพน้ำในแม่น้ำเจ้าพระยาให้แก่โรงเรียนคณะราษฎร์บำรุงปทุมธานี และจัดกิจกรรมการเรียนรู้ที่เกี่ยวข้องกับแม่น้ำเจ้าพระยาต่างๆ ในระยะเวลาหนึ่งปีการศึกษา ทางโรงเรียนได้ส่งผลการตรวจสอบคุณภาพในแม่น้ำเจ้าพระยาเดือนละครั้ง ตั้งแต่เดือนมีนาคม 2555-เดือนมีนาคม 2556 ให้แก่โครงการเรือไตรทศทุกๆเดือน

วัตถุประสงค์

1. เพื่อให้นักเรียนมีแหล่งเรียนรู้ที่เกี่ยวข้องกับแม่น้ำเจ้าพระยา
2. เพื่อให้นักเรียนมีจิตสำนึกในการอนุรักษ์และช่วยกันรักษาแม่น้ำเจ้าพระยา

สรุปผลโครงการศูนย์การเรียนรู้แม่น้ำเจ้าพระยา โรงเรียนคณะราษฎร์บำรุงปทุมธานี จังหวัดปทุมธานี หน้า 1

Fig. 6.10 Reports from Kanarajbumroong Patumthani School (**a**) and Sriboonyanon School (**b**)

(b)

Fig. 6.10 (continued)

An important takeaway from the project is the necessity of developing a strong collaborative interaction that provides training and guidance for the teachers and students, but also not surprisingly, a committed teacher cohort to implement the program.

While the chapter has provided an extensive description of the thinking behind the program, the design considerations, the actual learning experience, and the links to geographical and environmental education, the program can benefit from a more structured evaluation of students' beliefs and attitudes in future. For now, the chapter presents key challenges and learning points that will provide an exemplar of how field-based learning in geography and environmental education can be conducted.

The journey to Education for Sustainable Development will not be an easy one. Challenges to implementing the program also included the record flood of 2011 that closed schools and delayed the start of sampling, as well as the theft of analytical kits. The schools involved in the project are not elite schools, yet the majority of teachers viewed the project as positively impacting student learning and critical thinking skills. It is precisely these types of schools where intervention through authentic, non-formal learning can have the biggest impact on education in Thailand.

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