Students lined up for a morning meeting at the Baan Huay Euen School in Chiang Rai Province, Thailand.

DEVELOPING A COMPREHENSIVE EDUCATIONAL GARDENING PROGRAM FOR THE BAAN HUAY EUEN SCHOOL

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An Interactive Qualifying Project Report Submitted to the Faculty of
WORCESTER POLYTECHNIC INSTITUTE and CHULALONGKORN UNIVERSITY
In partial fulfillment of the requirements for the Degree of Bachelor of Science
In collaboration with The SATI Foundation

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Submitted to:
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Abstract

Many students in rural areas do not receive higher education, so schools must adapt their curriculums to meet the needs of their students. The goal of this project is to develop a comprehensive educational gardening program to teach agricultural skills at the Baan Huay Euen School in Northern Thailand. Through observation and interviews with the staff and students, we found that the existing program lacked the effectiveness and structure required of successful educational gardens. To address these issues, we designed a gardening manual that will improve the efficiency of the garden and provide educators a consistent source from which to teach. The implementation of the manuals and other recommendations in the report can result in a more sustainable educational organic gardening program.

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DEVELOPING A COMPREHENSIVE EDUCATIONAL GARDENING PROGRAM FOR THE BAAN HUAY EUEN SCHOOL

Executive Summary

APIMUK DAOKHUNTOD, ALLYSON DAY, HANNA GRU, PHAKINEE KHUNSIRIKULWANIT, NATNICHA LERTPLAKORN, PERAPATCH RAVIRUJIPHAN, PATRICK SCHENKENBERG, MARIAH SULLIVAN

Poverty and Schools' Responses

Due to accessibility and high poverty rates in rural areas, many students do not continue onto college or higher institutes (Gibbs, 2000). Without more education many students in rural areas stick to traditional occupations such as animal husbandry, farming, handicraft work, and fishing (Indiazone, 2012). As students continue to seek work in more vocational jobs, schools focus on skill based education, rather than college preparatory courses like mathematics and science (Jones, 2015). The Baan Huay Euen School, located in Chiang Rai province, recently implemented a gardening program to satisfy the government's Less Study, More Skills program aimed at teaching students vocational skills.

Objectives and Methods

In collaboration with the SATI Foundation and the Baan Huay Euen School, **the goal of our project was to develop a comprehensive educational gardening program to provide students with valuable life skills.** To accomplish this goal we established the following objectives:

1. *Identify what makes other educational gardening programs in Thailand successful*
2. *Determine the needs of the school garden at the Baan Huay Euen School*
3. *Identify the current gardening practices and knowledge used in the area*
4. *Analyze the school curriculum and determine how to incorporate a gardening program*

To gather information about each objective we used semi-structured interviews, focus groups, and non-participatory observation. Semi-structured interviews were conducted with teachers, the principal, the head villager, a local agricultural teacher, and a representative from the SATI Foundation. Students made up the focus groups to allow them a space they felt comfortable in. In order to get feedback on our proposed solutions we held a focus group of teachers. Non-participatory observation consisted of watching students work the garden, daily routines of the school, as well as observing agricultural techniques of the local community.

Key Findings

Lack of shared knowledge negatively affects students' education.

Through interviews with teachers, we found varying levels of gardening knowledge within the school, which means that students learn different information depending on their teacher. Teachers do not have the background knowledge to effectively teach students about gardening and in many cases, students whose

parents farm have more knowledge than their teachers. After visiting the local farmers market and observing a household farm, we found the community had extensive knowledge about agricultural techniques though those did not translate into the school. Without consistent source of information coming from, students' educations suffer.

a)  b) 

Figure A: a) Poorly organized garden at school; b) Well organized garden at school

Current permaculture techniques decrease effectiveness of the educational program.

The current layout of the gardens and the lack of fertilizer integration negatively impacts the success of the garden as a comprehensive educational tool. Unorganized gardens spread throughout campus do not provide a good model for students. From our observations we found students wash pig waste down tubes directly onto a garden which causes health risks to students as well as an inability to use the waste for fertilizer. Without proper technique for collecting waste to make fertilizer and creating well organized gardens, students learn incorrect information from the beginning.

Looking Ahead

Short Term Recommendations

Varying levels of knowledge about organic gardening among teachers at the Baan Huay Euen School negatively impacted the success of the students. Therefore, the success of the gardening program relies on the ability of the teachers to maintain consistency in their lessons. For this reason, we created an easy to follow guide of gardening techniques, and we recommend that the teachers in the Baan Huay Euen School reference this manual in order to teach consistent information (Appendix A). The manual contains information on appropriate planting techniques, fertilizers, nutrition, and meal recipes. Following this manual ensures all teachers have the same information about organic gardening as well as helpful infographics they can use to teach with. Additionally the school can start to incorporate fertilizer into their gardening practices and increase space efficiency. Alternatively teachers can attend extra classes on agriculture though that would put undue stress on them.

Long Term Recommendations

The gardening manual provides short term improvements to the current garden, however long term considerations can increase the effectiveness and continue to grow the program. With this in mind, we recommend our sponsor distribute the gardening manual to other schools wishing to teach their students agricultural skills. By doing so, a network of schools could form where ideas can spread.

As another long term consideration, we recommend addressing erosion and water scarcity before they become detrimental to the gardening program. Erosion provides a hazardous environment for students to work in as well as takes away valuable space for gardening. The school should build retaining walls for large dirt precipices, especially on the Terrace Garden to keep it from collapsing. On the other hand, water scarcity, though not a huge issue currently, could prove problematic as the garden expands. Waste water from students using a filtered water tank can accumulate through a system of tubes and used to water the garden provided the soap contains organic materials.

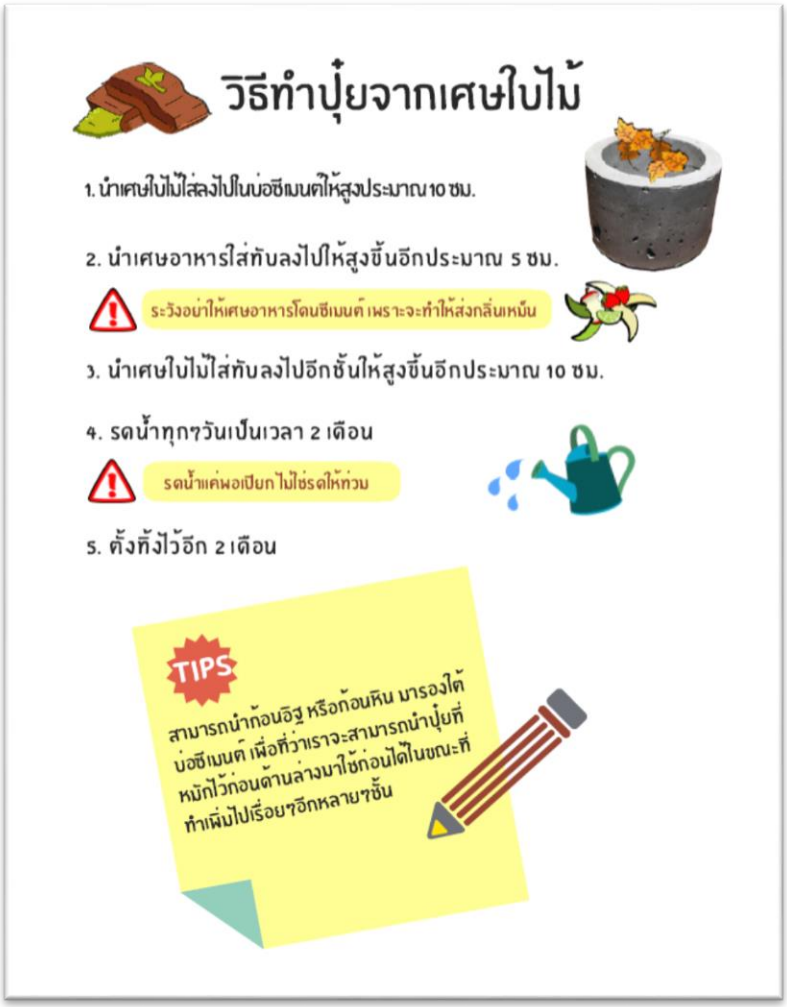

Figure B: Example page from the gardening manual

Conclusion

By adapting our proposed gardening manual to the curriculum at the Baan Huay Euen School, the school will have a more comprehensive gardening program to teach students valuable life skills. We designed the manual in two main parts: a general organic gardening guide that any school can use to create a comprehensive gardening program and a more specific section to address the specific needs of the Baan Huay Euen School. With minor changes to the manual, any school can adapt the information to fit their specific needs. The program we developed in collaboration with the SATI Foundation and the Baan Huay Euen School can serve as an example for other rural schools hoping to arm their students with valuable knowledge to improve their futures.

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Authorship

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Presentations	Phakinee and Natnicha			
Logistics	Apimuk and Phakinee			

Chapter 1: Introduction

Rural communities in developing countries often live in poverty, and as a consequence, children seldom continue on with higher education (Farrigan & Parker, 2012; Cullen & Pretes, 2000). Primary education not only provides the opportunity for children in rural communities to learn how to read and write, but it is the best opportunity for them to learn important life skills. However, in many rural areas around the world, children are unlikely to receive formal education that fully addresses their needs (Taneri & Engin-Demir, 2011; OECD, 2012). Because different lifestyles require different knowledge and skill sets, education designed for urban communities will not adequately address the specific skills that rural students need in order to thrive.

One relevant set of skills taught in rural schools is agriculture techniques; a common occupation in rural areas is farming because of the natural resources available. People farm to provide food for their households and sell any excess for profit (Indianetzone, 2012). Without proper skill development, children who grow up in farming communities may find themselves at a major disadvantage once they need to support themselves. Through gardening and other small-scale agricultural activities at school, younger children can begin honing the skills that will help them provide for themselves and their families later in life.

In the United States of America, gardens have been incorporated into schools to serve as educational supplements on many occasions (Bauermeister, Savio, Surls, & Swain, 2013; Briggs Koumjian, Morris, & Zidenberg-Cherr, 2002; Vermont farm to school, n.d.). They are used as outdoor classrooms that facilitate scientific learning, but seldom do they teach technical skills beyond the basics. In Northern Thailand, a region dominated by farming practices, some schools have begun teaching agriculture as a part of the curriculum to better prepare their students for when they leave school.

The Baan Huay Euen School in the Chiang Rai Province of Northern Thailand recently implemented a gardening program intended to provide invaluable skills to its students, but because the program is still in its infancy there are obstacles and logistical hurdles that need to be addressed. The school has adopted the “Less Study, More Skills” program into their curriculum in order to provide students with life skills. As many students from rural areas do not go to college, life skills could prove more useful than college prep courses like mathematics or science.

One organization dedicated to helping the underserved areas of Thailand is the SATI Foundation. They are a non-profit organization providing thoughtful, long-term solutions for problems in underprivileged areas by working off the Buddhist principle Sati, or mindfulness. In the Baan Huay Euen School alone the SATI Foundation has built a filtered water tank and taught students about personal hygiene and healthcare. Our project aims to provide a comprehensive educational gardening program to guide this school in the development of its existing program. By teaching its students effectively and thoroughly, the Baan Huay Euen School will better prepare its students for successful agricultural careers or to provide for their families.

Chapter 2: Background

2.1. Poverty in Rural Areas

Rural areas in developing countries tend to be overlooked by governmental and non-governmental organizations due to their isolation (Cullen & Pretes, 2000). Impoverished rural communities seldom receive sufficient aid to sustain a healthy learning environment for their children (Büthe *et al.*, 2012; Brown, 1996). Without aid, isolated communities may struggle to provide adequate education, reliable healthcare, and consistent food sources for themselves (Francken *et al.*, 2012).

In order to provide for their families, many people in rural areas obtain traditional occupations such as animal husbandry, farming, handicraft work, and fishing (Indiazone, 2012). In some more modernized communities, job opportunities in factory work, construction, and security have emerged (Nixon, 2011). Jobs in infrastructure development can help improve quality of life in the local community through higher wages and improvements in efficiency of existing jobs. For example, if new roads were built throughout the community, goods could be brought to market more easily and offer new jobs to bring higher wages (Nations Encyclopedia, n.d.). Though these jobs can help strengthen rural communities, they require the government to allocate money to developing the area, which cannot be guaranteed (Nixon, 2011).

This chapter discusses the poverty, occupations, and skill development in rural communities as well as how schools can help bridge knowledge gaps using gardens.

2.1.1. Effects of Poverty on Rural Schools

To get the skills to obtain high paying jobs, students would have to attend secondary education institutes however colleges and public universities are typically found closer to urban areas rather than rural developing communities (Gibbs, 2000). Poverty and urban-rural divides extend beyond the community, affecting the level of education in rural schools as well. According to the Program for International Student Assessment (2009), students studying in urban areas perform at a higher level than students studying in rural areas; rural schools often fail to meet the national education standard (OECD, 2012). Teachers usually have limited educational background due to the lack of secondary educational institutions for teachers and are often less interested in rural positions, thus bringing lower enthusiasm to the job (Masinire, 2015). Therefore, the deficits rural areas face in money and other resources contribute to poor education (Jones, 2015).

Not only are rural children subject to a lower quality of education than their urban counterparts, they are also limited in their opportunities after finishing with school (OECD, 2012; Jones, 2015) While students in urban areas commonly continue their education at a university, in rural settings with limited resources, students cannot access the education needed to get high level, well-paying jobs (Victorian Auditor-General, 2014). One reason for this is the prevalence of low

household income in addition to the lack of educational institutions in rural areas because smaller populations make it difficult to sustain educational services and opportunities (Victorian Auditor-General, 2014). Vocational and technical training provide students with relevant skills to support their families with, experiential learning, and a level of sustainability and concern for the environment (Jones, 2015). With these benefits in mind, some schools have turned to incorporating gardening into their schools as an educational tool (Abruzzi School Garden, n.d.; Lopez Island School, 2017; Whole Kids Foundation, 2014).

2.2. Rural School Education

In Thailand, Princess Maha Chakri Sirindhorn suggested that schools implement a "Less Study, More Skills" program to teach children through more practical methods than lectures. The princess proposed this program after scores for a national exam, O-NET, were lower than average (Office of Basic Education Commission, n.d.). Because schools have been incorporating more useful skills (such as cooking, cleaning, and agriculture) into their curriculums, more school time has been used for hands-on instruction.

2.2.1. School Gardening and Agricultural Techniques

Hands-on learning methods foster confidence and an improved ability in children to learn (Briggs *et al.*, 2002). Currently, schools around the world include gardening programs in their curriculums to supplement education by providing hands-on experience in geology, biology, ecology, and overall scientific methods among others (Briggs *et al.*, 2002; University of Georgia College of Agricultural and Environmental Sciences, 2011). These programs help children develop mentally and focus in school while also teaching responsibility and awareness about the benefits of local agriculture, further increasing the students' involvement with the gardens (Vermont farm to school, n.d.). Additionally, school gardens help children gain an appreciation for vegetables and encourage healthy eating habits (Briggs *et al*., 2002). Gardens located inside school grounds and implemented into the curriculum can give students important health and nutritional benefits, life skills, and a more comprehensive education (Bauermeister *et al*., 2013).

2.2.2. Examples of School Gardening Programs

Schools around the world have efficiently incorporated gardens into their curriculums to teach a variety of subjects, serving as outdoor classrooms for students to gain hands-on experience. Lopez Island school district in Washington, USA, for example, has a school gardening program called LIFE, which teaches students from kindergarten through twelfth grade (Lopez Island School, 2017). This program incorporates a garden-based curriculum to teach math, science, literacy, and social studies. Specially trained educators teach students and allow them to garden independently. Students participate in the "seed-to-plate" cycle, which demonstrates the method

to prepare fertilizer, plant, and harvest crops. Additionally, in the LIFE program, all of these crops are organic products that will be used as ingredients in the school cafeteria from January through June and all of the students learn to integrate a healthy diet in their daily lives.

In northeastern Pakistan, a community incorporated a gardening program into their primary school serving grades two through ten (Abruzzi School Garden, n.d.). The school focuses on using the garden to reinforce agricultural techniques for students of all ages within the community and surrounding areas. The success of this garden comes from the student-centered approach; students are encouraged to experiment with alternate gardening techniques in the higher grades to discover what works well on their own. The Abruzzi School argues students have more control over their learning through trial and error.

In Austin, Texas, the Samuel Smith Elementary School uses gardening in its curriculum before preschool. The students grow plants starting from seeds. The school requires that the teachers learn how to properly water and maintain a garden, ensuring students learn proper techniques as well (Whole Kids Foundation, 2014).

Gardening programs incorporated in school curriculums have proved to be effective tools for education and skill development, however, utilizing a school garden to teach students comes with its own difficulties. Teachers in rural areas typically change locations and the continuation of farming knowledge between faculties may decrease significantly (Gardiner, 2008). Also, students must feel some ownership to the garden so they will not neglect it. Finally, school curriculums often have long breaks during the year when no one tends the gardens, and therefore students lose interest in the program while the gardens start to die.

2.3. Agriculture in Rural Schools

The increased number of rural school gardening programs leads to a common need for safe, healthy agricultural practices. Common problems faced by gardens such as soil infertility and pests are often combated through the use of chemical fertilizers and pesticides to increase the chances of a high yield at the end of the growing season (Treadwell, 2015). These pesticides and fertilizers vary in toxicity and use and can lead to adverse health effects in humans and animals if not used properly (Ecobichon, 2001; Gesesew, Woldemichael, Massa, & Mwanri, 2016; World Health Organization, 2010). Furthermore, children are much more sensitive to these effects than adults (Pesticides and Children, 2015).

Studies of rural farming villages in developing countries show that over 90 percent of farmers experienced pesticide poisoning despite the fact that many farmers are aware of the adverse health effects of chemical pesticides (Gesesew *et al.*, 2016; Snelder, Masipiqueña, & de Snoo, 2008; Ecobichon, 2001). Some people treat their gardens with pesticides sprayed directly onto the crop, which causes damage to nearby people and animals who inhale the chemicals. Additionally, the external application leaves some residue that easily washes away in rain and spreads through rivers, streams, and aquatic ecosystems, contaminating water systems (Snelder *et al.*, 2008). Chemical fertilizers help crops prosper quickly but can cause long-term damage to the

soil in the form of nutrient depletion (Shambhavi, Padbhushan, S.P. Sharma, & S.K. Sharma, 2016).

2.3.1. Organic Gardening Practices

Organic farming can be described as the strategies that maintain and enhance soil fertility, prevent soil erosion, and promote biological diversity while minimizing risks to humans, animals, and natural resources (Treadwell *et al*., 2015). The Ministry of Agriculture and Cooperatives (MOAC), in Thailand, has developed organic standards that explain the definition of organic agriculture, they allow the use of natural substances while prohibiting the use of synthetic substances in the soil. Adopting organic standards in agricultural practices involves relying on substances of organic origin such as manure and compost (McEvoy, 2012). The main goal of organic agriculture is to contribute to the enhancement of sustainability (FAO, 1999). The International Federation of Organic Agriculture Movements has established four principles of organic agriculture: health, ecology, fairness, and care (IFOAM). Organic agriculture should preserve the nutrients and organisms in the land and water, while protecting the health of the environment.

Instead of harsh chemicals, microorganisms can create the same positive effects on plant growth without causing drastic harm to the surrounding ecosystems (Scialabba & Hattam, 2002). A study done in rural areas of Mexico found that organic fertilizer can increase production of food while decreasing the harmful effects on the environment, and farmers there are in favor of the change to more organic farming practices (Barragán-Ocaña & del-Valle-Rivera, 2016). Organic fertilizers and compost manage soil nutrients by replacing lost nutrients and acting as a substitute for chemical fertilizers (Recycle Works, 2017; Royal Horticultural Society, n.d.; Watson *et al.*, 2002).

Organic pest control consists of using microorganisms to suppress and control the population of insects, animals, and plants that damage the crops. Those organisms prey on undesired pests while working harmoniously with nature (OganicNZ, 2014). Biological pest control utilizes insects such as ladybugs, hoverflies, dragon flies, and parasitic insects. Plants that produce scents many pests consider unpleasant or provide an alternative habitat for the pests also reduce the damage to crops (New World Encyclopedia, n.d).

2.3.2. Transitioning to an Organic Garden

Switching to organic farming can have a high initial cost mostly due to certification and food storage however many rural communities forego those formalities to cut costs and still produce high quality vegetables important for students' nutrition (Komazec & Aleksic, 2015). Dr. Nilabja Ghosh (2004), a developmental economist in rural India, studied the effect of integrating organic biofertilizers and biopesticides into rural farming practices and recommends the switch. If

done effectively the transfer would be almost seamless and result in minimal effects to farmers' incomes and food production.

According to the Food and Agriculture Organization of the United Nations (FAO) (2002), many farmers do not want to fully transition their agriculture approaches due to the financial turbulence caused by such changes. The FAO also suggests making smaller changes to approach over time to improve the agricultural technique while reducing financial instability as much as possible. Another study in Mexico found similar challenges when surveying peasant producers on the implications of organic gardening, however the study recognized that a lack of skills and financial troubles can contribute to the adaptation of organic techniques (Barragán-Ocaña & del-Valle-Rivera, 2016). Incorporation of organic agricultural practices would need to be gradual to lessen the financial burden and increase sustainability in the program.

Organic techniques are capable of producing high quality vegetables that are both healthy and desirable. Because of this, organic gardens are ideal for incorporation into school programs to provide healthy food for children while teaching them techniques to preserve the environment and provide for their futures. With the proper planning, educational organic gardens are easy to implement and maintain. Rural education programs need to prepare their students for their futures, and organic gardening programs would do that safely and effectively.

Chapter 3: Methodology

The goal of our project was to develop a comprehensive educational gardening program to provide students with valuable life skills. To accomplish this goal we established the following objectives:

1. Identify what makes other educational gardening programs in Thailand successful
2. Determine the needs of the school garden at the Baan Huay Euen School
3. Identify the current gardening practices and knowledge used in the area
4. Analyze the school curriculum and determine how to incorporate a gardening program

In this chapter we explain these objectives in detail, discussing how we accomplished each one. We then describe challenges we faced while researching the objectives.

3.1. Objectives

Objective 1: Identify what makes other educational gardening programs in Thailand successful

In order to accomplish this objective we visited NIST International School in Bangkok and the Mechai Pattana Foundation in Pattaya, both of which were good examples of successful educational gardening programs. According to Ms. Puongpetch Sanisuriwong, a teacher at the school, the program at NIST International School is tended by students to fulfill an extracurricular requirement and the vegetables they grow are sold to parents, school staff, and local community members. The garden at the Mechai Pattana Foundation began as a project that would educate students and produce enough food to feed the entire Mechai Pattana School and was very successful. The school has since moved, but the garden remained in its original location. We asked them questions regarding their gardening care and maintenance and about incorporating gardening into their curriculum. Understanding how other schools' gardens function helped provide a reference when we made decisions about our proposed program. They have tried many ways to improve and change their gardens, which gave us insight into techniques that work well and some that may not work well. Understanding how past programs have failed or succeeded helped us adapt our program to the specific needs of the Baan Huay Euen School.

The interview with a teacher from NIST International School focused on how they manage the care for the organic garden in a school environment and how they use it as an educational tool. Interview questions are located in Appendix A. During our visit with the Mechai Pattana Foundation we discussed their ways of making fertilizer and various methods of planting including hydroponics, mushrooms, and organic practices. Interview questions are located in Appendix B.

Objective 2: Determine the needs of the garden at the Baan Huay Euen School

Understanding what the teachers, principal, administrator, and sponsor think about the garden provided valuable insight into the current condition of the gardening program and helped determine areas where improvements could be made. Through interviews we were able to discern their ultimate goals for the project and the expectations they had of us. We chose to use semi-structured interviews with the staff and sponsor to form a better relationship with them and understand their specific concerns. At times, informal conversations took place with both groups and provided valuable information outside of structured interview setting. We asked questions about the existing gardening program and made sure to focus on any challenges the school currently faces as well as improvements that the principal and teachers would like to see. Interview questions for Dr. Sakson Rouypirom, the head of the SATI Foundation, can be found in Appendix C; interview questions for the school principal, Mr. Somphet Nosee, can be found in Appendix D; questions for the administrator can be found in Appendix E; questions for teachers are in Appendix F.

Another method we used to accomplish this objective was non-participatory observation of the gardens. Understanding the structure and organization of the gardens enabled our team to better understand their current conditions. We noted pest problems, plant types, and space usage. We also took measurements of the spaces used for gardens. The data we gathered was separated and analyzed by garden plot in order to address the needs of each garden.

The biggest challenge we faced while conducting interviews at the school was finding the time to do so. We could only visit during school days, however the teachers had classes most of the day and the principal was often busy. Therefore, we planned our interviews on a case-by-case basis to not disrupt their schedules significantly. Because Dr. Rouypirom works in Bangkok, contacting him was not an issue.

Objective 3: Identify the current gardening practices and knowledge used in the Baan Huay Euen area

By assessing the existing agricultural practices of the region, we were able to understand some of the most common methods of small-scale farming and determine how the community's current skills could be used effectively. We also learned of challenges specific to that region. Utilizing the knowledge the people already possess to improve the existing garden will save time and make the new information easier to retain for the teachers.

We began our research by conducting semi-structured interviews with a local agricultural teacher, Mr. Ronnakrit Rinnairak, and teachers from each grade; the specific questions can be found in Appendices G and F respectively. We looked into knowledge or evidence of practices such as water distribution, fertilizer use, pest control, crop choice, crop placement methods, harvesting techniques, erosion prevention, and land use systems. We allowed interviewees to

control the direction of the conversation to learn about the points they felt were important to address and we asked impromptu follow-up questions on those subjects. When talking with students, we organized focus groups to ease any unrest they might have about talking individually with strangers. Focus group questions can be found in Appendix D.

We analyzed the teachers' and students' data together to identify common ideas and overarching themes. Discrepancies in gardening practices arose between the two groups, and additional interviews were conducted with more specific questions to determine the correct information. The knowledge within the school was compared to recommendations from individuals trained in organic farming within the surrounding community.

Objective 4: Analyze school curriculum and determine how to incorporate a gardening program

We obtained information regarding the school curriculum mainly through non-participatory observation of how the existing garden is made and maintained and how it fits into the existing school schedule. We focused on the times that students gardened throughout the day as well as the time allotted for gardening in the "Less Study, More Skills" program. This data allowed us to develop a program that teachers can unobtrusively introduce into the curriculum and sustain in the future. Observation from afar lessened the effect that our presence had on the daily operation of the school, since we did not interrupt their daily routine. In this way we were able to observe when the students worked on the garden and how they interacted with it.

We interviewed teachers to understand their knowledge about the existing gardening program and met with students in focus groups to understand their involvement with the gardens. Through these activities, along with our discussion with the principal, we were able to understand and analyze the existing school schedule and curriculum. The semi-structured interviews allowed us to get more specific information to supplement the observations and clarify specific points. Additionally, we observed and participated in meals preparation and asked questions regarding the knowledge of plants and how meal preparation is carried out (Appendix H).

Chapter 4: Results

4.1. School Background

The Baan Huay Euen School, located within the mountains in the Chiang Rai Province of Northern Thailand, hosts about 250 students. This remote, rural area experiences temperatures ranging from eighteen to twenty six degrees Celsius throughout the year (www.thaifocus.com/climate). Water is abundant during the rainy season and scarce during the summer, though this scarcity rarely results in drought. These conditions create a suitable environment for many crops, so farming is a common occupation.

With this in mind, the principal of the Baan Huay Euen School, Mr. Somphet Nosee, wants to ensure that the curriculum taught in his school aims to teach the students skills related to the future occupations they are likely to have. Therefore the Baan Huay Euen School participates in the "Less Study, More Skills" program which consists of learning sewing, cooking, cleaning, livestock raising, and agricultural work. Students participate in hands on workshops in each subject as well as tend gardens and raise chickens, pigs, and fish.

The school's location not only affects what is being taught, but also who is being taught within the school. Its close proximity to the Myanmar border provides the opportunity for non-Thai students to cross the border and access one of Thailand's state-subsidized primary schools. According to Mr. Nosee, this has resulted in a large number of non-Thai students at the school, whether they are immigrants from Myanmar or members of local hill tribes such as Akha and Lahu who are not considered Thai citizens. This means that most of the school's budget from the government, funded by Thai taxpayers, provides education to foreigners. Some community members and local officials express disapproval for the foreigner students going to school for free because they think the foreign students take advantage of Thai people; the principal, on the other hand, believes that all children deserve the chance to go to school.

An important part of the curriculum at Baan Huay Euen School is to teach useful, applicable skills to the students, and the garden program plays a major role. Below, we list the four key findings from our research at the school to help develop a comprehensive gardening program.

Finding #1: Varying levels of gardening knowledge amongst teachers leads to inconsistencies in student learning.

It is the job of teachers to impart their knowledge to students, but many teachers at the Baan Huay Euen School, through no fault of their own, lack the requisite expertise for teaching gardening. One of the most important aspects of any educational program is ensuring that all of the required knowledge is taught. Asking teachers to teach subjects about which they know little information and for which they have little guidance is not an effective method for adequately conveying knowledge to students.

According to the principal, many of the teachers at the Baan Huay Euen School did not grow up in the same type of rural community that they now teach in and never learned the skills that their students will need in order to thrive. Teachers we talked with expressed that because they have never learned agricultural practices, they often find themselves unequipped to oversee programs such as animal care or gardening. Ms. Nhampueng, the first grade teacher, explained that some students teach other students how to garden properly because they know more about the topic than their teachers. Furthermore, the government only requires that educators learn to teach conventional school subjects and has no requirement for many practical skills suited to rural environments, reported Mr. Methasit, the teacher in charge of the school's curriculum.

According to students from varying grades, many teachers maintain very little involvement or oversight in the care and maintenance of the plants after they are initially planted. The teachers each have the same amount of time allotted for the gardening program, meaning the differing information the students receive cannot be attributed to time spent teaching. It follows that the teachers are not all imparting the same knowledge unto their students. Figure 1 depicts two gardens at the Baan Huay Euen School, one of which is well organized while the other is poorly organized.

Students have varying levels of enthusiasm regarding the gardening program. While some students are motivated enough to spend time outside school hours tending their gardens, others show little initiative and their gardens suffer as a result. If the teachers are able to provide the knowledge that the children need to garden successfully, the students are more likely to see their gardens succeed. Mr. Santi, a second grade teacher, guided students in planting and caring for some of the healthiest plants. He has demonstrated that he has more knowledge of agriculture than most of the school staff. When asked what he already knew about gardening, as all the teachers we interviewed were asked, he was the only one to mention raised beds, how red brittle soil meant it was lacking in nutrients and other information that no one else knew about. His passion and involvement encourages and excites the students to learn how to garden properly. His students' garden demonstrates that the teacher can have a large impact on the success of students' gardens.

Figure 1: Well organized garden at Baan Huay Euen compared to a poorly organized garden

If the teachers cannot properly teach the gardening program, students will not gain the skills from school that they need. Students who help their families garden at home do not gain new information from the gardening program because they practice what they have been taught at

home. Other students need more guidance to garden properly, and the lack of instruction can lead to the formation of bad habits that are hard to break when learned at a very young age. This is an area of concern for Mr. Nosee and an issue he hopes is mitigated through guidelines within the gardening program. Inconsistencies in content taught by teachers and lack of agricultural knowledge has caused some conflicting information to be conveyed to students from grade to grade. This can negatively impact the success in the garden and can translate into less success in future agricultural endeavors of the students.

Finding #2: The current permaculture techniques decrease effectiveness of the gardens.

At the Baan Huay Euen School, each garden is different. Each has its individual problems that are only exacerbated by inconsistent instruction from the teachers. Below, Figure 2 and Table 2, we created a table to identify the six different gardens and provide a picture and name for each. We discuss each garden separately as they have unique challenges, then discuss how the school uses animals and their waste.

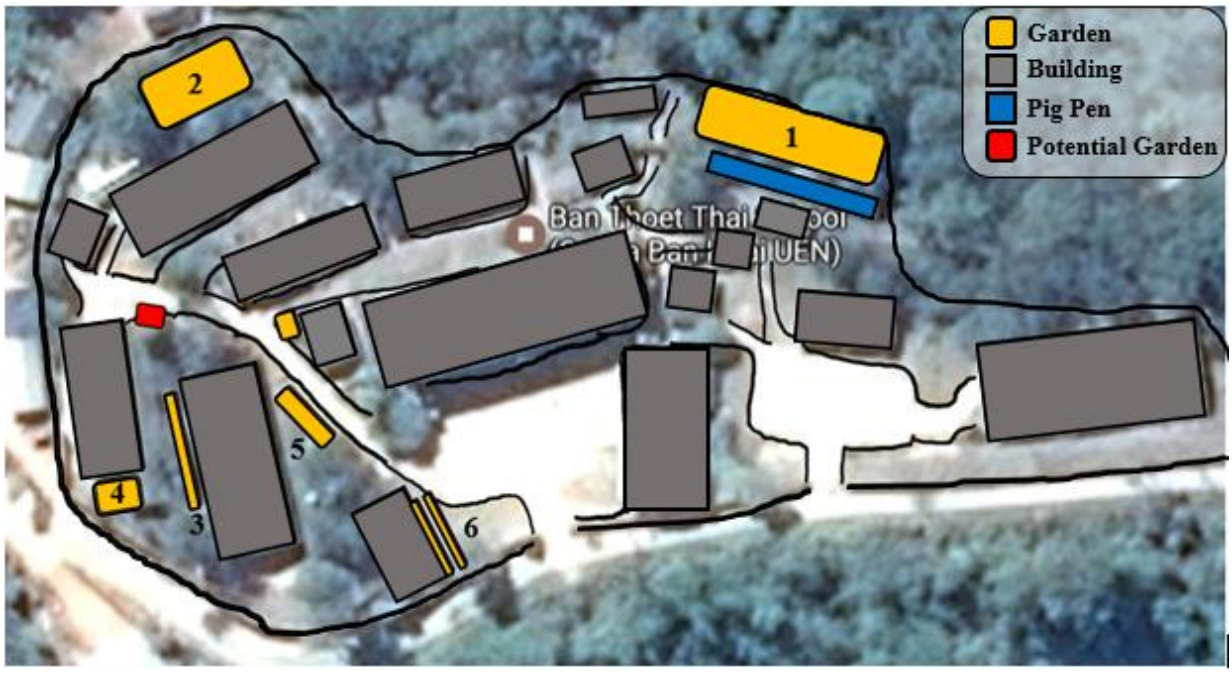

Figure 2: Map of the Baan Huay Euen School campus with labeled gardens and buildings

Table 1: Garden numbers, names, and picture

Garden	Nickname	Picture
1	Terrace Garden	
2	Dorm Garden	
3	Classroom Garden	
4	Playground Garden	

Garden	Nickname	Picture
5	Walkway Garden	
6	Yard Garden	
Unlabeled	Garden used by teachers	N/A

Terrace Garden

The Terrace Garden is the largest garden at the school, taking up the hillside behind the pig pens. As it can be seen in Figure 3, older students (fifth and sixth grade) get their own cement cylinders and tires in which to grow their vegetables. These containers are relatively spaced out, therefore there is a lot of space that is not utilized for planting. Students are responsible for planting and caring for their own vegetables, and many of the cylinder plots are poorly arranged and overcrowded (Figure 4), limiting the growth of the plants. We observed a number of plants that had been eaten by bugs. Additionally, the hillside that is home to the Terrace Garden has eroded in some places leaving no easy-to-follow path through the garden. Children often walk on the edges of the cylinders because there is no other stable footing.

Figure 3: Student gardening on Terrace Garden

Figure 4: Overcrowded cement cylinder on Terrace Garden

Dorm Garden

The Dorm Garden is located behind the dorm where some of the teachers live. The biggest problem that the students face is the chickens from the village that like to wander into the school and eat the plants. This plot is where the students have a trial strawberry plant. In order to conserve space, the strawberry plants are scattered throughout the pathway and often get stepped on. There is also a problem with snails eating the plants. While the students do little to stop the snails besides pulling them off by hand, they have built fences, shown in Figure 5, meant to keep the chickens out of the gardens. We were told that the chickens manage to get into the plots anyway, usually by flying over the fences.

Figure 5: Fences on Dorm Garden

Classroom Garden

The Classroom Garden is an in-ground plot in front of the first-grade classroom. Appropriately, the first graders tend this plot as a group, though they have a tendency to step on the plants because they are not in raised beds. Additionally, this plot is susceptible to bugs, limiting the number of healthy plants that can be harvested. This garden is in a row, which makes the plants easily accessible but leaves a lot of unused space on either side of the garden.

Playground Garden

The Playground Garden, located down the hill from the Classroom Garden, is also cared for by younger students and students step on plants as the garden does not have a barrier or boundary marking it. Half of this garden is shaded throughout the entire day meaning some plots get adequate sunlight while others do not. Although this garden was harvested and reorganized during our first visit, it still does not utilize space efficiently.

Walkway Garden

The Walkway Garden is the location of some of the largest and healthiest looking plants at the school. This garden is cared for by the second graders under the guidance of Mr. Santi. The plots are in raised beds that the students constructed. This garden also has the darkest, least brittle soil of the gardens, which indicates more nutrient rich soil. The Walkway garden has some problems with bugs eating the plants, but there are no other major problems.

Yard Garden

The Yard Garden, located adjacent to the main schoolyard was expanded during our first visit to become more space-efficient with an appropriate sized path and rectangular beds contained by cement blocks. This garden has one of the largest insect problems at the school, limiting the number of quality vegetables that are harvested. Overall, the layout of the gardens increases the

accountability of the students who care for their own plots, but it decreases the amount of vegetables that can be grown. With circular pots, fenced off gardens, and small plots, the children have more responsibility maintaining the plants to help them grow. This layout is intended to result in larger, healthier plants, though in practice, the outcome varies greatly with some students maintaining their section more than others, yielding vegetables in a variety of qualities and quantities.

Organic Fertilizer

Mr. Nosee expressed interested in natural fertilizer because it contributes greatly to healthy plants. While the principal has worked hard to include farming skills in the gardening program, there has been no plan to make or use organic fertilizer at the school. By talking with Mr. Rinnairak, we learned how to make organic fertilizer using animal waste and other components easily accessible to the school. They are aware they can use the animal waste as fertilizer for the plants, but they lack the knowledge to do so. Currently teachers instruct the students to spread chicken feces directly on the garden to act as a fertilizer, but without proper treatment, bacteria in the chicken feces can have adverse effects on children's health. Similarly, waste from the pigs is washed out of the pens onto Terrace Garden where the bacteria pose a potential health hazard to the students who have plots in that area. Because the waste is not collected and dried, it cannot currently be used to make fertilizer.

Finding #3: Unshared knowledge within the community hampers the development of the school's gardening program.

Through interviews with members of the community and after visiting the local market, it became clear many of them possess knowledge of organic practices and techniques. However, Findings 1 and 2 suggest that this information is not being shared with the school. We confirmed through interviews that the head of the village, Mr. Surachart, and members of the community who have knowledge of organic gardening are not in communication with the school.

One community member, Mr. Rinnairak, runs a school for people who have never received formal education or technical training. His school teaches farming and agricultural techniques so people who attend can grow vegetables and provide for themselves. The Baan Huay Euen School has the same goal for its students, but the two parties have not been formally introduced to share knowledge and ideas.

Mr. Surachart has significant influence in the community and contributes to the disconnect between the community and the school. He has the ability to bridge the gap between the two, but they still remain separate. It is possible he simply overlooked introducing the two parties, though strong opinions surrounding the free education of foreign students could play a deciding role in the integration of both programs. According to Mr. Surachart, many people in the surrounding community feel they pay for students who will move away and not give back to the community in

which they studied because all students attend for free. Through our interview with Mr. Surachart, it was clear he strongly opposed the idea of granting foreign students a free education.

The principal has a different view; he believes all children deserve a chance to learn regardless of their background. He hopes that the students will remain in the Huay Euen area and use the skills they learned at school to improve the surrounding community. He hopes that this would also improve the relationship between the school and the community that shares the views of Mr. Surachart. A different teacher at the school, Patcharaporn Chapanont, agreed closely with the principal stating that many students could turn to the drug trade if they returned to Myanmar without valuable skills which in turn could affect the Baan Huay Euen area. In her opinion, it would be in everyone's best interest to ensure all children are educated.

The principal is reluctant to reach out to the community for assistance with the gardening program because he would like the program to be self-sufficient and not create a permanent dependence on the community. However, the school could reach its goal of self-sustainability if it relied on the expertise of the local community without creating a long term dependence.

Finding #4: Passion in teachers translates to successful student gardens.

Other schools such as the NIST International School have used organic gardens as educational supplements that also provide food for the students and the community. At the NIST International School, students choose to garden to fulfill an extracurricular requirement. This requirement provides the opportunity for teachers to conduct hands on learning experiences for their students and to fully engage their students in technical skills. The teachers provide equipment and knowledge and are actively involved in advising the students on the care of the garden. They have students of all ages garden together, making the older kids role models that the younger kids look up to, according to the teachers. The teachers are invested in the gardening program because they understand the lasting positive impacts the program has on the children, as highlighted by a representative of the school, Ms. Puongpetch. This investment and passion is felt by the students and further excites the students to participate.

Mr. Santi, a second grade teacher at the Baan Huay Euen School, provided an excellent example of passion in a teacher translating to success in his or her students. As with the NIST International School, the Baan Huey Euen School has time set aside to allow for the gardening program. Mr. Santi uses this time to give hands on, detailed instruction to the students as opposed to the more hands off method that many other teachers take during this time. He takes time to research methods and techniques, show examples of how to do each step of a given technique, and explain the benefits of the methods that they are using. This immersive role he has taken on has resulted in the students being excited to participate and producing the best quality vegetables.

Chapter 5: Recommendations

The Baan Huay Euen School began a gardening program within the past year. In order to help guide this program while it is still in its infancy, we determined recommendations applicable to any budding garden and then tailored them to the specific needs of the Baan Huay Euen School. These recommendations are separated into **short term recommendations** that the school can begin implementing in the next school year and **long term recommendations** that should be addressed in the future once the school has an established program.

5.1. Short Term Recommendations

Recommendation #1: The teachers at the Baan Huay Euen School should use the gardening manual to teach consistent information about organic gardening.

As stated in Finding 3, varying levels of knowledge about organic gardening among teachers at the Baan Huay Euen School negatively impacted the success of the students. Conflicting information could affect students' education and the health of the gardens because some students will receive insufficient information. Therefore, the success of the gardening program relies on the ability of the teachers to accurately teach the students. If teachers draw information from the same source, they can maintain consistency in their lessons. In addition, having a common source with the information needed is a valuable resource to make the teaching process easier for the teachers who do not have any background on gardening and already have a full time job to do. For this reason, we created an easy to follow guide of gardening techniques, and we recommend that the teachers in the Baan Huay Euen School reference this manual in order to teach consistent information (Appendix I).

The manual consists of information on effective approaches to planting and garden organization that could prove helpful when first starting a garden or improving upon gardens already in place. Additionally, it includes step-by-step instructions for making different types of fertilizer and pesticides and plant care information for more successful crops. Furthermore, the manual includes nutritional information and recipes to cook new types of vegetables.

We considered having teachers attend gardening workshops with Mr. Rinnairak, a teacher from a local agricultural charter school, to get the knowledge many of them lack in regards to fertilizer and other gardening methods. While this would ensure consistency in information, we recommend that the teachers only use our manual to avoid added work and stress. With such busy schedules, teachers likely do not have the time to attend extra sessions. The manual provides the information they need and gives them graphics from which to teach to make the transition into the program as easy as possible and on their own time. By using our manual, the teachers at the Baan Huay Euen School will have taken the first steps towards a fully sustainable organic gardening program.

Recommendation #2: The school should incorporate a more structured gardening plan into their curriculum.

As stated in Finding 2, we found that the school gardens were not operating at their full effectiveness to help students learn and had significant room for improvement in both the physical layout as well as the number of plants within a specific plot. Optimizing these would result in more quality vegetables and a better model on which students can base their learning. By following our proposed plan (Appendix J), the school can increase its production incrementally and not get overwhelmed with sudden, drastic changes to the gardens and curriculum. Additionally, our plan would result in less work for teachers because the children would work to better the garden under their supervision, rather than the teachers doing it themselves.

Implementation of the plan would occur after students harvest each garden and before they replant the entire plot. In this way, expansion and reorganization of the garden can occur without disrupting growing plants and causing a loss in production. After harvesting, students would install rows of raised rectangular garden beds to keep the plants away from any contamination already in the soil. Once fertilizer is ready, students should apply it by mixing it with the soil before planting. Appendix J contains a detailed plan for each garden plot including specific dimensions of each bed, when to grow which plants, and pest control tactics (more pest control tactics can be found in Appendix K).

We considered other options when presenting this plan, such as removing all cement cylinders in Terrace Garden to increase efficiency by planting directly into the soil. We determined that removing the cement cylinders would disturb the current gardening program more than it would help and are therefore not recommending it. By using planters rather than in-ground plots, the plants will be healthier and safer for consumption because chemical runoff from nearby farms would not contaminate the beds. Additionally, some of the gardens already utilize above-ground boxes built by students so it would not be difficult to continue doing this. We also considered introducing all new vegetables that would grow well, but we did not want to overwhelm the students and teachers with unfamiliar plants right away.

One potential limitation is that the school may lack the materials to make raised beds. Also, the teachers will need to plan ahead for the timing to work well. After developing these plans, we spoke with the teachers and school staff to determine if this solution was practical. Overall, teachers thought this plan would be easy to implement given it changes the gardens gradually and most of the work can be incorporated into the existing program.

Recommendation #3: The school should follow an incentive program to motivate each student to garden.

Although some students are self-motivated to garden, not all are as excited to participate. Some students work on the garden more than others because their parents are farmers and they have some gardening knowledge. Figure 6 shows some of these students gardening on their own

time. An incentive program in the school would keep the majority of children engaged in gardening and would encourage students to participate more in the gardening program by creating healthy competition between the grades.

Figure 6: Students working on the garden on their own time

Each week, teachers would sum the scores and announce the best garden. To increase fairness, the program consists of two divisions, grades 1-3 and grades 4-6, where the teachers from each division grade the gardens of the other division to decrease bias. The garden will be graded based on how well they follow the steps outlined in the manual, how consistently they take care of their garden, how healthy their crops look, and how they clean their equipment. The teachers will score the garden every week and post the score on the scoreboard in front of the teacher's office, shown in Figure 7. After two weeks, Principal Nosee will announce the winner at the school's daily meeting. More detailed explanation of the proposed incentive program can be found in Appendix L. Students whose garden received the highest score will have an event or will receive a prize.

Figure 7: Scoreboards for the incentive program

Students who continually care for their garden will receive a reward. The school does not have excess money to put towards prizes however they can provide students with non-monetary rewards such as reduced chores or picking their favorite meal for lunch. Additionally, we

considered incentivizing teachers rather than students, but we decided to let the excitement of the students drive the teachers to keep participating in the program. Some research suggests providing incentives cannot change behavior but have more success increasing motivation or attendance (Gneezy, Meier, & Rey-Biel, 2011). The incentive program would encourage the students to participate more in the gardening program; with the correct implementation of the program, it will appropriately incentivize the students to succeed.

Recommendation #4: The school should utilize its animal waste to make natural fertilizer.

Currently, the school buys pigs and raises them until they are ready to eat. Each day, as shown in Figure 8, students clean the pens by washing the pig waste out of pipes that empty above the Terrace Garden (Figure 9). Animal waste can be used to produce natural fertilizer, however, the waste from the pigs is not collected and plants in the garden are grown using fertilizer that is brought to the school by students. The school collects compost in an uncovered cement box near the pigpens that could be used to dry, store, and properly prepare the natural fertilizer.

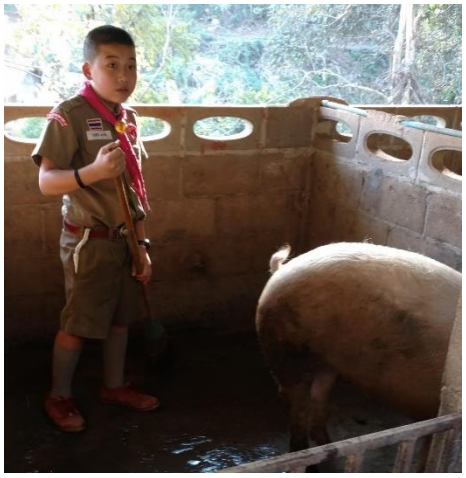

Figure 8: Student cleaning pig pen

We recommend that the students collect the pigs' waste before it is flushed onto the hill and use it to make their own natural fertilizer. This will help the school achieve self-sufficiency; having proper fertilizer will help plants grow well, and this process will also help mitigate any health risks originating from animal waste. To properly collect the feces, the students in charge of the maintenance of the pigs should collect the feces before washing the pens and move it to the existing compost box, shown in Figure 10, with plastic buckets. From there, natural fertilizer can be made following the directions in the manual (Appendix I). Additionally, with collaboration of the community, teachers and students can learn from an expert how to properly prepare their fertilizer.

Figure 9: Pipes draining over Terrace Garden

Figure 10: Compost box

While developing this solution, we considered putting concrete containers below the pipes to catch the waste after the pens were washed for later transportation to the uncovered cement box and treatment. However, placing the concrete containers below the pipes requires both money and manpower. Additionally, the accumulated feces would mix with the water used to wash the pens, removing some bacteria needed for the composting process. The feces need to be dried out to make fertilizer regardless, making this solution much less viable than we initially thought.

Recommendation #5: The school should collaborate with members of the community in order to increase support of the program.

We found that the community has significant knowledge of organic gardening whereas the school does not, meaning information is not being fully shared. Michael Gardiner (2008), a project manager and researcher for the Centre for Education Policy Development, states the relationship between rural communities and schools contributes significantly to the overall success of the educational system. Gardiner also states it is important to bring schools and communities closer

because that relationship can link education and development which contributes to the overall success of the garden. Therefore, the community as a whole would become invested in the garden and could be more likely to help when needed because they feel part of the project. Additionally, the connection would bring more resources and knowledge to the garden, benefiting the educational program.

In order to accomplish this, we recommend the school coordinate a meeting with Mr. Surachart, the head villager, to discuss the plans of the garden and the role the community can have with it. Speaking with community members who garden could prove useful because they likely have tricks and helpful hints from their years of experience that the school can use to improve their garden. If the school requires additional information, the military groups in town also have extensive agricultural knowledge and could provide even more information about gardening with limited space.

5.2. Long Term Recommendations

Recommendation #6: The SATI Foundation should expand the program to other schools in Northern Thailand.

The SATI Foundation intends for the gardening program at the Baan Huay Euen School to be a pilot program with the potential to incorporate it into other schools in the region. The gardening manual should be distributed to other schools wishing to teach their students agricultural skills. By doing so, a network of schools could form where ideas are spread and schools could rely on each other for help. It benefits all involved to communicate within schools and across schools to share information. Communication increases the effectiveness because teachers can share tips and tricks on how to achieve the best garden while having the kids gain the most knowledge. Efficient gardens could lead to surplus produce, potentially turning into a source of income for the schools that could be used to reinvest into the gardens. If a small amount of excess is created by each school, they could collaborate to sell it together. The SATI Foundation partners with Broccoli Revolution, an organic vegan restaurant in Bangkok, which has expressed interest in buying excess produce from the schools.

Recommendation #7: The Baan Huay Euen School should establish erosion control methods.

In the Terrace Garden, we saw evidence of erosion on the hillside. The school staff, when asked, acknowledged the issue but expressed no intent to solve the problem. They see it as a minor issue and do not want to expend the resources required to mitigate erosion. If the erosion remains unaddressed, it could put the garden and the students who work in it at risk; the students already walk on the edges of the concrete cylinders, as evidenced in Figure 11, because there is little or no

stable ground on which to walk. It would likely benefit the school if the erosion were addressed in the future.

Figure 11: Student walking on the edges of the concrete cylinders

Recommendation #8: The Baan Huay Euen School should reuse filtered wastewater in order to feed the garden.

While water scarcity is not currently an issue, if their garden program increases in scale they may find themselves in need of more water than they have. Currently, the school uses a tank to store and filter water which students use to drink, brush their teeth, and wash their hands. The wastewater that drains after students brush their teeth and wash their hands can be collected and used to water the gardens. Because the water from this tank has been filtered already, it is free of chemicals provided that the soap used is not harmful to the plants. This would ensure the plants are not watered using water that the students need. The SATI Foundation has expressed a desire to facilitate reusing this water for the plants, but as of this writing no plans have been created.

5.3. Conclusion

The gardening program at the Baan Huay Euen School aims to provide valuable skills for students to thrive in the future as well as organic vegetables for the students' meals, while satisfying the school's goal of self-sufficiency. We visited the school to better understand their needs and to create a gardening program to best suit their current gardening practices. We found that the existing gardening program lacked the structure and consistency to effectively teach students. By adapting our proposed gardening manual to the curriculum at the Baan Huay Euen School, the school will have a more comprehensive gardening program to teach students valuable life skills.

We designed the manual in two main parts: a general organic gardening guide that any school can use to create a comprehensive gardening program and a more specific section to address the specific needs of the Baan Huay Euen School. With minor changes to the manual, any school can adapt the information to fit their specific needs. The program we developed in collaboration with the SATI Foundation and the Baan Huay Euen School can serve as an example for other rural schools hoping to arm their students with valuable knowledge to improve their futures.

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Appendices

Appendix A

NIST International School Interview Questions

1. How did you choose this specific vegetables/fruits?
   คุณมีวิธีเลือกผักหรือผลไม้ที่นำมาปลูกอย่างไร
2. Why did you choose organic over non organic?
   ทำไมคุณถึงเลือกทำสวนผักอินทรีย์
3. What do you use instead of pesticides and chemical fertilizers?
   คุณใช้อะไรแทนยาฆ่าแมลงและปุ๋ยอินทรีย์?
4. How (if it is) is this garden program incorporated into the school's curriculum?
   โครงการนี้เป็นส่วนหนึ่งของหลักสูตรหรือไม่และอย่างไร?
5. What are the main challenges of organic gardening?
   อุปสรรคในการทำเกษตรอินทรีย์คืออะไร?
6. What kind of organic materials do you use and what do you use them for?
   คุณมีอุปกรณ์ชนิดใดบ้างในการทำเกษตรอินทรีย์?
7. What are the obstacles you've faced so far?
   ตั้งแต่ที่เริ่มทำสวนมา มีอุปสรรคอะไรบ้าง?
8. What do you do with the plants grown here?
   หลังจากเก็บเกี่ยวแล้ว คุณทำอย่างไรกับผลผลิต?
9. What are the priorities/goals of the garden?
   จุดประสงค์ของการทำแปลงเกษตรคืออะไร?
10. What do you want students to learn from this?
    คุณต้องการให้เด็กๆเรียนรู้อะไรจากการทำการเกษตร?
11. Who had the idea to start the program?
    ใครเป็นผู้ริเริ่มโครงการเกษตรนี้?
12. Do the students enjoy tending the garden?
    นักเรียนชอบการดูแลแปลงเกษตรหรือไม่?
13. What do they enjoy most?
    อะไรที่นักเรียนชอบทำมากที่สุด?
14. How much work does each student put in?
    นักเรียนแต่ละคน มีหน้าที่รับผิดชอบงานมากน้อยเพียงใด?
15. Does it make students have more responsibility?
    โครงการนี้ทำให้นักเรียนมีความรับผิดชอบมากขึ้นหรือไม่?
16. Who manages the garden?
    ใครเป็นผู้ดูแลแปลงเกษตร?

17. Are the students involved in taking care of the garden?
นักเรียนมีส่วนร่วมในการดูแลแปลงเกษตรหรือไม่?
18. How are kids of different age groups interacting with the garden differently and how do they view it differently?
นักเรียนแต่ละรุ่นมีปฏิกิริยากับแปลงเกษตรต่างกันมากน้อยเพียงใด และ พวกเขามีมุมมองแตกต่างกันอย่างไร
19. How did you overcome times when things weren't working out well?
คุณมีการจัดการกับสิ่งที่ผิดพลาดอย่างไร?
20. What caused the failure? Was it avoidable?
อะไรที่ทำให้เกิดความล้มเหลว? **สิ่งนั้นสามารถหลีกเลี่ยงได้หรือไม่**?
21. What considerations were taken into account when first planning this program?
สิ่งใดเป็นสิ่งที่ควรคำนึงถึงเป็นสิ่งแรกเมื่อวางแผนโครงการ?
22. What challenges did you have to overcome?
อุปสรรคใดที่คุณพบเจอ?
23. Were there any unexpected things that we should consider when planning our own program?
มีสิ่งไม่คาดคิดใดที่เราควรคำนึงก่อนที่จะวางแผนโครงการเกษตรของเรา?
24. What do the kids get the most excited about at school?
อะไรเกี่ยวกับโรงเรียนที่เด็กๆรู้สึกตื่นเต้นและสนใจมากที่สุด?
25. Does joining Jamie Oliver’s food revolution any help to the program ?
การเข้าร่วม Jamie Oliver’s food revolution **ได้มีส่วนช่วยเหลือโครงการมากน้อยเพียงใด**?

Appendix B

Mechai Pattana Foundation Interview Questions

1. How do you prevent pests?
2. Overall what is the best season to grow vegetables?
3. How many garden plots does a person care for?
4. Are your hydroponic vegetables organic?
5. How to do you grow vegetables year round?
6. Why do some of the vegetables need to be covered with nets?
7. Why do you also do hydroponic garden?
8. How to accelerate the process in the nursery?
9. Are gardening activities included in the school curriculum?
10. How do you grow and take care of mushroom here?
11. What are the basic things that mushroom need?
12. How long can we harvest one mushroom bunch?
13. How do you prepare stacked fertilizer in the cement cylinder?
14. How long do we have to let them compost?
15. What type of tarp should we use?

Appendix C

Dr. Sakson Rouypirom and SATI Interview Questions

1. What level of involvement will the SATI Foundation have in this project?
   มูลนิธิสติมีส่วนร่วมกับโครงการนี้มากน้อยเพียงใด?
2. Short Term:
   a. Which aspect of this project do you see as most important?
      ในส่วนใดของโครงการที่คุณคิดว่ามีความสำคัญมากที่สุด?
   b. What do you expect for the final form of our project?(deliverable)

สิ่งใดคุณคาดหวังจากโครงการนี้?

3. Long Term:
   a. Do we have a quantitative goal to reach as far as the amount of food we need to produce or the level of impact on food insecurity levels?

ทางมูลนิธิมีเป้าหมายเป็นจำนวนของผักที่อยากให้โรงเรียนสามารถผลิตได้ หรือ ผลกระทบเชิงบวกเกี่ยวข้องกับการลดการขาดแคลนทางอาหาร

   b. Who will this project be passed on to when we are done/ who needs to have the full understanding of our work?

หลังจากนี้ โครงการนี้จะถูกส่งต่อให้ใครรับผิดชอบ

4. What is the best way for us to get in contact with people in the community?
   ทางเราจะสามารถติดต่อคนในชุมชนที่เชียงรายได้อย่างไร
5. Who else in the community we should talk to?
   ในความคิดเห็นของคุณ มีใครในชุมชนที่ทางเราควรติดต่อไหม?
6. Have you run into any challenges you expect we might encounter?
   จากที่คุณเคยลงพื้นที่แล้ว คุณคิดว่าพวกเราจะเจอปัญหาและความท้าทายอย่างไรบ้าง?
7. Why did you choose a garden as opposed to some other solution?
8. Do you have any other information about the community you think would be useful before we arrive?
   คุณมีข้อมูลอย่างอื่นที่น่าจะเป็นประโยชน์กับเราก่อนไปลงพื้นที่หรือไม่?

Appendix D

Baan Huay Euen Principal Interview Questions

1. How many students are there in each grade?
   จำนวนนักเรียนในแต่ละชั้นเรียนมีเท่าใด?
2. What are the causes of food insecurity in this community?
   อะไรคือสาเหตุของความไม่เพียงพอของอาหารภายในชุมชนนี้?
3. How dependent are the students on the school meals?
   นักเรียนพึ่งพามื้ออาหารที่โรงเรียนมากน้อยแค่ไหน?
4. How effective is the current garden, and who's responsible for it?
   สวนเกษตรในปัจจุบันมีประสิทธิภาพมากแค่ไหน ใครมีส่วนในการรับผิดชอบ?
   a. If it's not effective, what do you think the problem is?
      หากไม่ อะไรคือปัญหาที่คุณคำนึงถึง?
5. What are the objectives of the garden?
   จุดประสงค์หลักของสวนผักที่โรงเรียนคืออะไร
6. In what way do you want to improve your garden?
   คุณมีความคิดจะพัฒนาสวนผักที่โรงเรียนอย่างไร
7. What gardening supplies does the school have if any?
   ทางโรงเรียนมีอุปกรณ์ทำสวนไหม
8. Does any of the teachers have organic gardening knowledge?
   มีคุณครูในโรงเรียนที่มีความรู้เรื่องเกษตรอินทรีย์ไหม
9. Who do you think could help us on educating the teachers and students about organic gardening methods?
   มีใครในพื้นที่ที่สามารถให้ความรู้รวมถึงสอน คุณครูและนักเรียนเกี่ยวกับการเกษตรอินทรีได้บ้าง?
10. What kind of knowledge do you have about gardening in general and about specifically organic gardening?
    คุณมีความรู้อะไรเกี่ยวกับการเษตรทั่วไปและการเกษตรอินทรีย์บ้าง?

Appendix E

Baan Huay Euen Administrator Interview Questions

1. Who buys the resources for the garden?
   ใครเป็นคนจัดซื้อทรัพยากรการทำการเกษตร?
2. What resources are bought for the garden? (seeds, fertilizer, and construction materials)?
   ทรัพยากรใดที่ต้องจัดซื้อเพื่อทำการเกษตร (เมล็ดพันธุ์, ปุ๋ย ,และ วัสดุการก่อสร้าง)
3. If the garden needs improvements, is there a possibility to buy new resources?
   ถ้าแปลงเกษตรต้องการการปรับปรุง มีความเป็นไปได้มากน้อยแค่ไหนที่จะซื้อทรัพยากรเพิ่
4. What do you think about the long-term goal of growing excess vegetables for sale?
   คุณคิดอย่างไรกับแผนการในระยะยาวที่จะเพิ่มผลผลิตผักให้เกินจำเป็นและนำไปขาย?
5. How does the water system at the school works?
   โรงเรียนมีระบบการจัดการน้ำอย่างไร?
6. Is the government provided lunch budget enough for the school?
   งบอาหารกลางวันที่ทางรัฐบาลกำหนดให้โรงเรียนพอหรือไม่?
7. Other than building up student skills, how do you think the garden is important for the school?
   สวนเกษตรมีความสำคัญต่อโรงเรียนอย่างไรบ้าง นอกจากการเพิ่มทักษะให้กับนักเรียน?

Appendix F

Baan Huay Euen Teachers Interview Questions

1. What variety of food is available?
   ความหลากหลายของอาหารในแต่ละวันมีอะไรบ้าง?
2. What do the students (different ages) know about gardening and organic gardening?
   นักเรียนในแต่ละระดับชั้นมีความรู้ในเรื่องของการปลูกผักสวนครัวมากน้อยแค่ไหน?
3. What does each grade takes care of in the garden?
   เด็กในแต่ละชั้นเรียนดูแลสวนผักอย่างไรบ้าง
4. Do you teach both science and skills with the garden?
   คุณสอนทักษะในการทำสวนควบคู่กับความรู้เชิงวิทยาศาตร์กับนักเรียนหรือไม่?
5. Would you like to see more vegetables in your garden?
   คุณอยากเห็นความหลากหลายที่มากขึ้นของผักในสวนหรือไม่?
6. What styles of teaching do you use? Which one is the most effective? What do you prefer? (lecture, hands-on, group work)
   คุณมีวิธีการสอนนักเรียนอย่างไร? **ลักษณะการสอนแบบใดที่มีประสิทธิภาพมากที่สุด**?
7. Do you have any knowledge or experience on organic gardening?
   คุณมีความรู้เกี่ยวกับการเกษตรและเกษตรอินทรีย์มากน้อยเพียงใด?
8. What do you think is the right amount of time the students should spend on the organic garden each day?
   คุณคิดว่าเวลาที่เหมาะสมที่สุดสำหรับนักเรียนที่จะใช้ในการดูแลสวนคือกี่นาทีต่อวัน?
9. Can you explain the curriculum of the school, especially the “Less Study, More Skills”?
   คุณช่วยอธิบายหลักสูตรของโรงเรียนหน่อยได้ไหม โดยเฉพาะโครงการ “ลดเวลาเรียน เพิ่มเวลารู้”?
10. How does the gardening program works right now? What students are in charge of what?
    ตอนนี้สวนผักของโรงเรียนมีการดำเนินงานอย่างไร? **นักเรียนมีส่วนร่วมอย่างไร**?
11. How do you choose the vegetables that the students are growing
    คุณมีวิธีเลือกผักที่นำมาให้นักเรียนปลูกในสวนอย่างไร?
12. What types of vegetables have you tried growing before?
    มีผักชนิดในบ้างที่เคยลองปลูกในสวนแล้ว?
13. Have all the vegetables that you have tried to grow worked?; If not, what do you think was the problem?
    ผักที่เคยนำมาลองปลูกนั้น ปลูกได้หรือไม่ ถ้าไม่สามารถปลูกได้ คุณคิดว่าอะไรคือปัญหา?
14. Do you have any recommendations or suggestions based on your previous experience with the gardening program?
    จากประสบการณ์ของคุณ คุณมีคำแนะนำอย่างไรให้เรานำไปพัฒนาสวนของโรงเรียน?
15. Can you explain the process you use to manage compost and create natural fertilizer?
    คุณสามารถอธิบายวิธีการทำการย่อยสลาย และปุ๋ยอินทรีย์ได้ไหม?

16. How are the quality of the vegetables from the school garden?
ผักในสวนของโรงเรียนมีคุณภาพเป็นอย่างไร?
17. Does the student eat pig from your farm?
สุกรที่โรงเรียนได้เลี้ยงไว้ได้นำมาประกอบอาหารให้นักเรียนหรือไม่?
18. Is it possible to feed the pig and fish to the kids consistent?**สามารถเป็นไปได้หรือไม่ที่จะนำ สุกร ไก่ และปลา มาประกอบอาหารให้นักเรียนรับประทานได้อย่างสม่ำเสมอ**?
19. How you manage the excrement? Do you combine gardening with animal?
คุณมีระบบการจัดการมูลสัตว์อย่างไร? **คุณได้รวมการเกษตรและการเลี้ยงสัตว์เข้าด้วยกันได้หรือไม่**?
20. How much you know about the organic gardening?
คุณมีความรู้เกี่ยวกับเกษตรอินทรีย์มากน้อยแค่ไหน?

Appendix G

Local Agricultural Teacher Interview Questions

1. What type of crops do you usually grow, and which one has the best price?
   ปกติคุณปลูกพืชชนิดไหนบ้าง และพืชชนิดไหนที่ขายได้ราคาดีที่สุด?
2. Do you recommend us to do crop rotation, if so, how?
   คุณคิดว่าเราควรปลูกผักหมุนเวียนหรือไม่ ถ้าใช่ อย่างไร?
3. In what proportion do you consume and sell your products?
   ผักที่คุณปลูก มีสัดส่วนในการบริโภคเองและนำไปขายอย่างไร?
4. What's the main problem for gardening in this area?
   ปัญหาหลักในการเกษตรในพื้นที่ระแวกนี้คืออะไร?
5. Do you have any advice for us about this project?
   คุณมีคำแนะนำอย่างไรให้เราเกี่ยวกับโครงการนี้?

Appendix H

Interview Questions for Students

Students in charge of kitchen Interview Questions

1. What vegetables do you usually use for cooking?
   ปกติคุณใช้ผักชนิดไหนในการทำอาหาร?
2. How often does the school buy fresh ingredients for cooking school meals?
   ทางโรงเรียนซื้ออาหารสดมาใช้ในการทำอาหารบ่อยแค่ไหน?
3. How many vegetables are needed to prepare food for a day?
   ในแต่ละวันใช้ผักในการประกอบอาหารมากน้อยเพียงใด?
4. Are there menus that you wish you wanted to do in school but have not?
   มีอาหารชนิดใดที่คุณต้องการจะประกอบแต่ยังไม่มีโอกาสได้ทำ?
5. Are you open to try cooking new types of vegetables?
   คุณอยากลองใช้ผักชนิดที่ไม่คุ้นเคย ในการทำอาหารหรือไม่?
6. What proportion of the vegetables you cook are grown in the school and what proportion is bought?
   ผักที่ใช้ในการทำอาหาร มีสัดส่วนเท่าไรที่มาจากการปลูกในโรงเรียน และจากการซื้อ?

Students who take care of animals Focus Group Questions

1. How do you like taking care of the animals? What do you like about it? Dislike?
   คุณชอบเลี้ยงดูสัตว์หรือไม่? ถ้าชอบสิ่งที่คุณชอบคืออะไร? ถ้าไม่ชอบสิ่งที่คุณไม่ชอบคืออะไร?
2. Do you think it is important to keep taking care of the animals?
   คุณคิดว่าการดูแลสัตว์มีความสำคัญมากเท่าใด
3. What do you typically do to take care of them?
   โดยปกติคุณดูแลสัตว์พวกนั้นอย่างไร?
4. How much time do you spend with the animals?
   คุณใช้เวลากับสัตว์พวกนั้นมากเท่าไหร่?
5. Would you like to spend more or less time working with them?
   คุณอยากใช้เวลากับสัตว์พวกนั้นมากขึ้นหรือน้อยลง?
6. Are there any challenges you face?
   ในการดูแลสัตว์พวกนั้นมีอุปสรรคอะไรบ้างที่คุณพบเจอ?
7. When in the day do you do this?
   ในช่วงเวลาใดของวันที่คุณดูแลสัตว์พวกนั้น?
8. What have you learned from working with the animals?
   คุณได้เรียนรู้อะไรจากการดูแลสัตว์พวกนั้น?
9. Do you think your friends would like working with the animals? Why?
   คุณคิดว่าเพื่อนคุณอยากดูแลสัตว์พวกนั้นหรือไม่?เพราะอะไร?

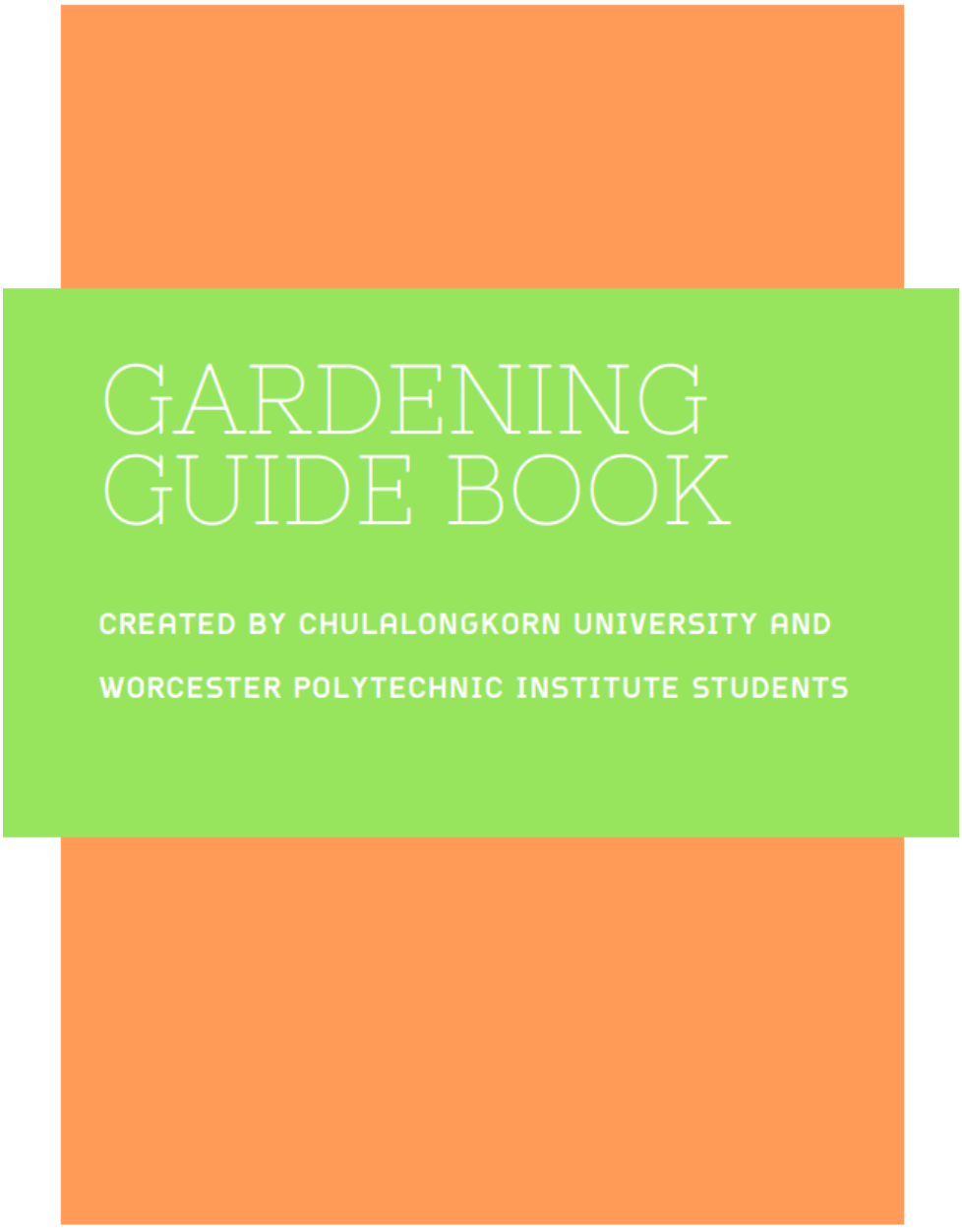
Students (from each grade) Focus Group Questions

1. What do you enjoy most about school? Least?
   อะไรเป็นสิ่งที่คุณชอบและไม่ชอบมากที่สุดในโรงเรียน?
2. What activity in school do you enjoy the most?
   ชอบกิจกรรมอะไรในโรงเรียนมากที่สุด?
3. Where do you eat each of your meals?
   คุณรับประทานอาหารในแต่ละมื้อที่ไหน?
4. When are you most happy? Hungry?
   เมื่อไหร่ที่คุณรู้สึกมีความสุข และหิว?
5. What upsets you the most every day?
   อะไรเป็นส่วนทำให้คุณรู้สึกไม่พอใจมากที่สุดในทุกๆวัน?
6. How do you feel about getting dirty during gardening?
   คุณสะดวกใจหรือไม่ที่เสื้อผ้าหรือร่างกายของคุณจะเลอะเทอะ ในขณะที่ทำการเกษตร?
7. What kinds of foods do you like to eat?
   อาหารประเภทใดที่คุณชอบรับประทาน?
8. Do you like fruits and vegetables?
   คุณชอบผักและผลไม้หรือไม่?
9. Do you like trying new foods?
   คุณอยากลองอาหารแนวใหม่หรือไม่?
10. Will you eat foods even if you don't like them?
    คุณจะทานอาหารหรือไม่ ถ้าคุณไม่ชอบอาหารชนิดนั้น?
11. Do you like the animals that you have at school?
    คุณชอบสัตว์ที่โรงเรียนเลี้ยงหรือไม่ (เช่น หมู,ปลา และไก่)?
12. Do you like being at school? Why?
    คุณชอบมาโรงเรียนไหม เพราะเหตุใด?
13. Do you ever grow your own food?
    เคยปลูกผักทานเองหรือไม่?
14. What do you do during school?
    คุณทำอะไรบ้างที่โรงเรียน?
15. What do you know about gardening?
    คุณมีความรู้ด้านการเกษตรมากน้อยเพียงใด?
16. Do you grow food at home?
    คุณบริโภคอาหารที่คุณปลูกเองที่บ้านหรือไม่?

Appendix I

Organic Gardening Manual

Click on the image to be directed to the full gardening manual in English



Appendix J

Planting Plan

Garden	Improvements	What to plant	Pest Control
1	- Use correct spacing	Carrot and Radish	- Use biopesticide to keep caterpillars out
2	- Remove fences - Use old fences to make raised garden bed - Using correct spacing	Okra, Chilli, and Morning Glory	- Use netting to keep chickens out - If snails become an issue, use eggshells
3	- Create raised beds using bamboo stakes - Use correct spacing	Cilantro and Chinese Kale	- Cilantro will keep out pests
4	- Create raised beds using bamboo stakes - Use correct spacing	Cilantro, Red Cabbage, and Cabbage	- Cilantro will keep out pests
5	- Use correct spacing	Strawberry	N/A
6	- Use correct spacing	Cabbage	N/A

Appendix K

Pest Control

There are three different types of pest in the gardens: herbivorous insects, infections and weeds.
Herbivorous insects:

- Carnivorous insects: hunt and kill herbivorous insects.
- Organic fertilizer: repel bugs
- Companion plants: repel pests and give more nutrients
- Crop rotation: confuse pests by changing food source

Weeds:

- Planting crops closer together
- Planting leafy plants nearby: stop the seeds dispersal on the surface near the plants
- Removing already growing weeds including the roots

Infections:

- Isolation: to limit outbreak

Appendix L

Incentive Program

a. General Rules: The program consists of two divisions, grades 1-3 and grades 4-6, where the teachers from each division grade the gardens of the other division to decrease bias. Teachers score every week and gardens of the week are announced every 2 weeks.
b. Score criteria
    i. Distance veggies correctly , water correctly, apply fertilizer appropriately
    ii. Take care of the garden constantly
    iii. Vegetables are healthy
    iv. Students store and clean equipment
    v. Do not use chemicals
c. The following checklist will keep students on track with assignments.

Gardening Checklist

วันที่ _____ ถึงวันที่ _____

นักเรียนที่รับผิดชอบในการรดน้ำอาทิตย์นี้: _____

_____

_____

นักเรียนที่รับผิดชอบในการกำจัดแมลงอาทิตย์นี้: _____

_____

_____

นักเรียนที่รับผิดชอบในการกำจัดวัชพืชอาทิตย์นี้: _____

_____

นักเรียนที่รับผิดชอบในการใส่ปุ๋ยอาทิตย์นี้: _____

ตารางรดน้ำ

	เช้า	เย็น
จันทร์		
อังคาร		
พุธ		
พฤหัส		
ศุกร์		

ตารางกำจัดแมลง

	ลายเซ็น
จันทร์	
พุธ	
ศุกร์	

ตารางกำจัดวัชพืช

	ลายเซ็น
อังคาร	
พฤหัส