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The Botanical Garden at Kasetsart University Laboratory School Center for Educational Research and Development

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Her Royal Highness Princess Maha Chakri Sirindhorn emphasized in her book "Suan Prueksasart Rong Rian"(School Botanical Garden) that "In order to educate and train children to be aware of plant conservations, the children should be taught and trained to appreciate the aesthetic values, the interesting aspects and the happiness of plants by studying and conserving the plants. Conventional routine teaching and training procedure whose emphasis is on the shoulds and should-nots and the negative impact will put the children under stress, which will not benefit the country in the long run".

The school board of the academic year 1995 founded the botanical garden at Kasetsart University Laboratory School (KUS) to raise children's awareness of the importance of the plants. Students have the opportunity to observe a variety of plants to create awareness of plant conservation in students' hearts. Moreover, the KUS botanical garden can be an outdoor lab for many classes.

Each year, the botanical garden committee, appointed by the school board, assigns seven different species of trees to be planted in the school. The students from Grade 1 to Grade 11 are engaged in such activities as observation, research, experimentation, data and sample collection, interviewing, drawing, data processing, result evaluation and a conclusion about their findings. At the end of each project, the assigned groups of students must submit a report and present their work in front of their classmates. The students in Grade 9 conduct a school exhibition of the 7 projects.

Feedback obtained from the questionnaires conducted to the students from Grade 1 to Grade 12 on the KUS botanical garden has been positive. The students found the working together part of the experience beneficial. The other benefits and skills gained are adaptation to working in a team, systematic way of working, planning, data researching, responsibility, self discipline, knowledge about nature, importance of plants and the necessities of conserving plant species for sustainable society.

Key words: School botanical garden, Kasetsart University Laboratory School

Introduction

Her Royal Highness Princess Maha Chakri Sirindhorn initiated a project to conserve Thailand's plants. She emphasized that "In order to educate and train children to be aware of plant conservation, they should be taught to see and appreciate the beauty and interesting aspects of plants and the happiness to be gained from studying and conserving plants. Conventional methods of teaching plant conservation that emphasize what not to do, and warn children of negative consequences of their action, can be stressful to children and will not benefit the country in the long run"

Princess Sirintorn has initiated the Plant Genetic Conservation Project since 1992. She ran the project herself. The project aims to make the participants understand and realize the importance of plants so that the knowledge is available to all Thai people. The project set up such activities as the

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prevention of genetic plant, and the collection, planting, conservation of genetic plants, a school botanical garden to make the schoolchildren aware of the importance of conserving plants. The goal of the garden is to teach students to appreciate the value, benefits, and beauty of various species of plants from an early age and to gradually instill in them an awareness of plant conservation. The botanical garden situated within the school allows both students and teachers an continuous access to the plants and their products for teaching, learning, and researching.

The aim of Her Royal Highness Princess Sirindhorn is that every organization participating in the project uses a botanical garden to help run the activities to raise students' awareness of plant conservation. Since the garden activities are organized on-site, within a school, college or university, the limited space of the botanical garden can only serve as a standard model of the botanical garden that gathers as many living plant species as possible. A library should be available in conjunction with the botanical garden for the in-depth study of the botanical garden, as well as a collection of botanical samples (dried and preserved) representing each plant species. To achieve the objectives of the Plant Genetic Conservation Project, her Royal Highness' program arranges seminars to train and guide participating teachers and other staff at schools and universities. Schools currently participating in the project include kindergartens, elementary and high schools, technical colleges, and universities.

Discussion

Kasetsart University Laboratory School, Center for Educational Research and Development (KUS) was founded in the year 1971 and is affiliated to the Faculty of Education, Kasetsart University. KUS has been set up to focus on the study of educational knowledge and research on curriculum improvement. KUS educates students from grade 1 to grade 12 with 7 classes at each grade level. KUS is situated at Kasetsart University's Bangkok campus, occupying 48 rai of land (18.98 acres). The school area has been designed to optimize teaching. A part of the school area has been set aside for "the green".

KUS values Her Royal Highness Princess Maha Chakri Sirindhorn's "Botanical Garden in School" project partly because it agrees with the school's developmental philosophy of planting the green concept to the students' heart. KUS has been a member of the project since 1995. Our goal is to teach the students to appreciate the value of plants, to love and nurture plants as part of the sustainable society.

Educational goals of the "Botanical Garden at KUS" are:

1. To enable students to conduct a survey or research on plants within or outside the school.
2. To teach students how to collect plant samples and preserve them for further studies.
3. To help students combine botanical knowledge with that learned in other subjects.
4. To teach students to look after trees and plants in school and in the community.

During the first half of the project plan of KUS botanical garden, the goal was to collect and plant as many plant species as possible within the school. The choice of species was based not only on the variety but also on the usefulness of plants of which some examples are medicinal herbs, bananas and palm trees. Plants were established in the gardens with a variety of different themes, such as water garden, friendship garden and plants from literature. They provide organized teaching materials for many subjects. The plants in each garden are thoroughly studied and labeled for future reference by the students. The collection and location of plants of each species are precisely marked and recorded in the species registry books. The care and growth-monitoring for the trees in different areas in the school have been divided and allocated so students at different levels can come and look after them. Moreover, the teachers of all school subjects are encouraged to make use of the KUS botanical garden.

A committee has been appointed to manage the activities concerning the KUS botanical garden. The students make portfolios of systematically collected information as well as the analysis, discussion, and summary. The committee facilitates the data collection process and provides the materials required to complete their portfolios.

The KUS botanical garden committee provides a curriculum to suit the students' learning at each grade level. The teachers can use the curriculum and apply it in their teaching for required skills

such as observing, researching, experimenting, data recording, interviewing, drawing, taking photographs, and sampling and collecting plant species. All these processes become part of the record in the collection book of plant species of the KUS botanical garden.

Since 2004, the KUS botanical garden committee has made a plan for the students at all levels. Each class is assigned one species to focus on (Table 1).

For the didactic and hands-on sessions, the classroom teacher can choose the following instruction to explain to the students.

1. The classroom teacher introduces the assigned species to the students during the homeroom period, or the Friday activity class, or in the free time. The students will be divided into groups based on their interest, ability or specialization. The students can also be assigned to take up relevant tasks such as drawing, photographing, inventing and singing.
2. The teachers of other subjects can create teaching-learning activities using any botanical species in the KUS botanical garden as a teaching material.

The KUS botanical committee collects the students' work from all levels, and Grade 9 students organize an exhibition to show all the students' work.

Chana Wan-noon *et al.* (2007) studied the management of KUS's botanical garden. Data were collected from 3,258 students from Grade 1 to Grade 12. The study showed that the majority of the students found the KUS botanical garden activities very pleasant. The unconventional method of learning helped to broaden their minds and it was fun. The students were happy to work in teams. Teamwork could also be taught at the same time without students being aware of it. The students were proud to be a part of Her Royal Highness Princess Sirindhorn's project. The students understood the usefulness of the activities and were certain to be able to adapt the knowledge obtained to everyday usage. Students unconsciously gained research skills such as data collecting, knowledge researching, and observing, and they expressed their intention to take a better care of trees everywhere. The study of plants, with emphasis on the importance of the each species, clearly made the students aware of the need of botanical gardens and increased their fondness for trees.

Students at KUS have founded and participated in the KUS Botanical Garden Society to share their common interests in plants, plant species, research, and conservation. The Society members are clearly aware of the relevant environmental issues in the school, in the wider community, and in the country as a whole. The Society has arranged many interesting activities, both within and outside the school, such as the following:

1. Botanical experts have given seminars to society members and interested students who are encouraged to take part in the activities like plant drawing and collecting.
2. The Society has organized educational activities for teachers, students, parents and school personnel to broaden their botanical knowledge at several occasions, such as "Indian Shoot and Father's day," "Jasmine and Mother's Day," "Orchids and Love," and "Banana Day...Make It Easy."
3. The Society has organized visits for members and interested students to organizations such as Her Royal Highness' botanical garden, the Royal project of the Kungkraben bay ecological study site, and other departments whose work is related to the study of plants at Kasetsart University.
4. The Society has organized "the bird watching and tree searching" to create awareness of environmental and natural resource conservation and public property concerns, and to develop students' skills in problem solving, and decision making, creativity, responsibility, and team-work. The activity has been arranged so that the students have a chance to be a part of the nature. The bird watching was the activity organized for interested students at KUS. They went camping at Kao Yai Naational park, the world heritage, to live in the wild and enjoy activities like go walking and exploring. From the variety of available activities, the students combine learning with fun.
5. The Research and in-depth study of the botanical gardens are the main activities for the students conducted in the school. The knowledge, skills, and equipment are provided by teachers, parents, and botanical experts. The

Table 1. Species assigned to each class to study

Year	Classroom	Names of plants.
2004	1	Oil Palm (*Elaeis guineensis* Jacq.)
	2	Frangipani (*Plumeria acuminate* Art.)
	3	Burma Padauk (*Pterocarpus indicus* Willd.)
	4	Mulberry (*Morus alba* Linn.)
	5	Teak (*Tectona grandis* L.f.)
	6	Weeping fig (*Ficus benjamina* Linn.)
	7	Krapeejun *Millettia brandisiana* Kurz)
2005	1	Banana tree (*Musa sapientum* Linn)
	2	Indian oak (*Barringtonia acutangula* (L.) Gaertn)
	3	Cork Tree (*Millingtonia hortensis* Linn. F.)
	4	Queen's flower (*Lagerstroemia macrocarpa* Wall.)
	5	Golden shower (*Cassia fistula* Linn.)
	6	Tamarin (*Tamarindus indica* Linn.)
	7	Pong pong (*Cerbera odollam* Gaertn)
2006	1	Oyster plant (*Tradescantia spathacea* Stearn)
	2	Wild Tea (*Carmona retusa* (Vahl) Masam.)
	3	Scrambled egg (*Cassia saruttensis* Burm.f)
	4	Orang Jessamine (*Murraya paniculata* (L.) Jack)
	5	Mahogany (*Swietenia macrophylla* King)
	6	Christ's Thorn(*Carissa carandas* Linn.)
	7	Wild pepper (Piper sarmentosum Roxb.)
2007	1	White Cheesewood (*Melodorum fruticosum* Lour.)
	2	Artabotrys (*Artabotrys siamensis* Miq.)
	3	Desmos (*Desmos chinensis* Lour.)
	4	Osmanthus (*Parameria laevigata* (Juss.) Moldenke)
	5	Indian shoot (*Canna indica* Linn.)
	6	White Champaka (*Michelia alba* DC.)
	7	Bullet Wood (*Mimusops elengi* Linn.)
2008	1	Kitchen Mint (*Mental cordifolia* Opiz)
	2	Lead Tree (*Leucaena leucocephala* (Lamk.) de Wit)
	3	Turmeric (*Curcuma longa* Linn.)
	4	Fingerroot (*Boesenbergia rotunda* (L.) Mansf.A.)
	5	Cork Wood Tree (*Sesbania grandiflora* (L.) Desv)
	6	Chilly (*Capsicum frutescens* Linn.)
	7	Lemon Grass (*Cymbopogon citrates* (DC.) Staph)
2009	1	Ebony Tree (*Diospyros mollis* Griff)
	2	Hog Plum (*Spondias pinnata* (L.f.) kurz)
	3	Malacca Tree (*Phyllanthus emblica* Linn.)
	4	horseradish tree (*Moringa oleifera* Lam.)
	5	Bengal Almond (*Dillenia indica* Linn.)
	6	Gourka (*Garcinia dulcis* (Roxb.) kurz)
	7	Star fruit (*Averrhoa carambloa* Linn.)
2010	1	Nom-Maew (*Rauwenhoffia siamensis* Scheff.)
	2	Rangoon Creeper (*Quisqualis indica* Linn.)
	3	Bengal Trumpet (*Thunbergia grandiflora* Roxb.)
	4	Babbler's Bill Leaf (*Thunbergia laurifolia* Linn.)
	5	Purple Wreath (*petrea Volubilis* Linn.)
	6	Rose-Su-Kon (*Tetracera loureiri* (Finet & Gagnep.) Pierre ex Craib)
	7	Bread flower (*Vallaris glabra* (L.) kuntz)

results of the research and in-depth study are stored at the KUS botanical garden database. Data collection is handed over to the Plant Genetic Conservation Project. At KUS, there are a lot of studies on Krapeejun (*Millettia brandisiana* Kurz) because it is chosen to be the school symbolic plant. Krapeejun is a medium-sized plant of about 8-15 meters high. Its leaf looks like a feather of a bird. The flower shapes like that of a pea, with whitish-purple in color, which blooms from March to May. Extracted chemicals from Krapeejun and the amount of carbon dioxide it absorbs have been thoroughly investigated. Miss Witchaya Trichoke *et al.,* extracted the substances called flavonoids, Terpin, Tannin, and Saponin from Krapeejun and used them in many products such as soap. Mr. Pornpipat Kasemsap's study on the absorption of carbondioxide in Krapeejun revealed that the absorption depended on the surface area of the leaf and the intensity of light.

Conclusions

Feedback of KUS students from Grade 1—Grade 12 on the KUS botanical garden has been positive. The students found working-together to be the most beneficial part. Other benefits and learned skills were adaptation to team working, systematic ways of working, planning, data searching, new knowledge finding, responsibility, self-discipline, knowledge about nature, and awareness of the importance of plants and the need to conserve plant species for sustainable society (Chana Wan-noon *et al.,* 2007).

Students' opinion towards the KUS botanical garden project has been positive. Students think that these activities help develop their thinking and research skills. They also find that their understanding of nature is crucial to their awareness of the importance and value of plants. The objective of the KUS botanical garden project has been achieved because the students have understood the importance of plant conservation.

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