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A novel approach to architectural education for sustainability: a quest for reformation and transformation

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ABSTRACT: The new generation of architects will have to face an inconvenient situation caused by overall resource depletion. It is inevitable that nurturing them will require a more rigorous approach regarding the concept of sustainability than in the past. This article aims to present new approaches and methods of teaching an architectural design studio for the Bachelor of Architecture (BArch) programme at Naresuan University, Phitsanulok, Thailand, which have been created according to the concept of sustainable education. Knowledge and skills on sustainability and architecture are additionally taught through several specially prepared workshops. The activities have been designed to enforce self-awareness, self-evaluation and self-criticism in order to reform and transform them towards sustainable design.

Keywords: Architectural education, sustainable education, architectural design studio

INTRODUCTION

Architecture is a professional discipline. Teaching architecture students to become architects will definitely require a skilful architect to do so. Whether or not the curricula between schools are similar or different, the core and methods of teaching architectural design studio are still about project design. In many other fields or disciplines, a whole class of students doing the same project within the same contexts do not produce very different results. However, in architectural design studio, differences in architectural design between students are obvious no matter how big the class is. Student-centred learning (SCL) is one of learning approaches in which students are placed at the centre of the learning process. It is the approach that puts the student's interests at the heart of curriculum design, thus, encouraging lifelong learning.

One of many teaching approaches that goes well with the criteria of SCL is problem-based learning (PBL), which is part of an active learning style. PBL is a teaching approach that aims to get the learners to engage in the lesson through a process of problem-solving. Both approaches, however, are rather a tradition of teaching architectural design studio. Most, if not all, schools are teaching a new generation of architects though these approaches whether one knows what they are called or not. In addition to the approaches of SCL and PBL (that are assumed to be common approaches to schools of architecture worldwide), this article aims to present the sustainable education (SE) approach in cooperation with the afore-mentioned two approaches to a case study of architectural design studio for fourth-year students. The main idea of adding the SE approach is to ensure improvement in attitudes and practices towards sustainable design.

SPECIAL TOPIC IN ARCHITECTURAL DESIGN STUDIO

The Faculty of Architecture at Naresuan University is located in Phitsanulok province, one of the two main cities of the northern region in Thailand. The School of Architecture is relatively young, but it is the third provincial school of architecture in Thailand and is celebrating its 20th anniversary this year. Being a regional university, Naresuan University sets many policies to support regional networks. As guided by one of the University's policies, the School is obliged to prioritise applicants from surrounding provinces over students from other parts of the country according to a ratio of 60:40. Graduates from the School are expected to be able to become professional architects. Thus, it is quite common for the students to give high value to the architectural design studio courses which, to some extent, relate to professional practice [1].

In all architectural design studio courses, functionality and construction are stressed alongside creativity, concept design and the aesthetic of the created architecture. Experiments are tested within limits of criteria and contexts. Since the School approach is to focus on sustainable architecture, many subjects in the BArch curriculum add on the issues of sustainability in the course syllabi.

There are seven architectural design studios in the five-year BArch programme. The first three architectural design studios, for first- and second-year students, are basic skills builders, while the next three are architectural designs for sustainability studios. The final course for architectural design studio in the last semester of the fourth year, before the whole-year final project of the fifth year (BArch thesis), is a special topic in architectural design studio (STADS). It is a case study of the implementation of sustainable education presented in this article.

The STADS course is the only design studio that runs differently from the other design studios. The rest of the design studios are run with the whole class having the same project, while for the STADS course, the students are able to choose from a range of studios on offer that year. Therefore, this subject is a perfect platform for both the teachers and students to experiment with different ideas in architecture. Figure 1 shows the whole process of the course.

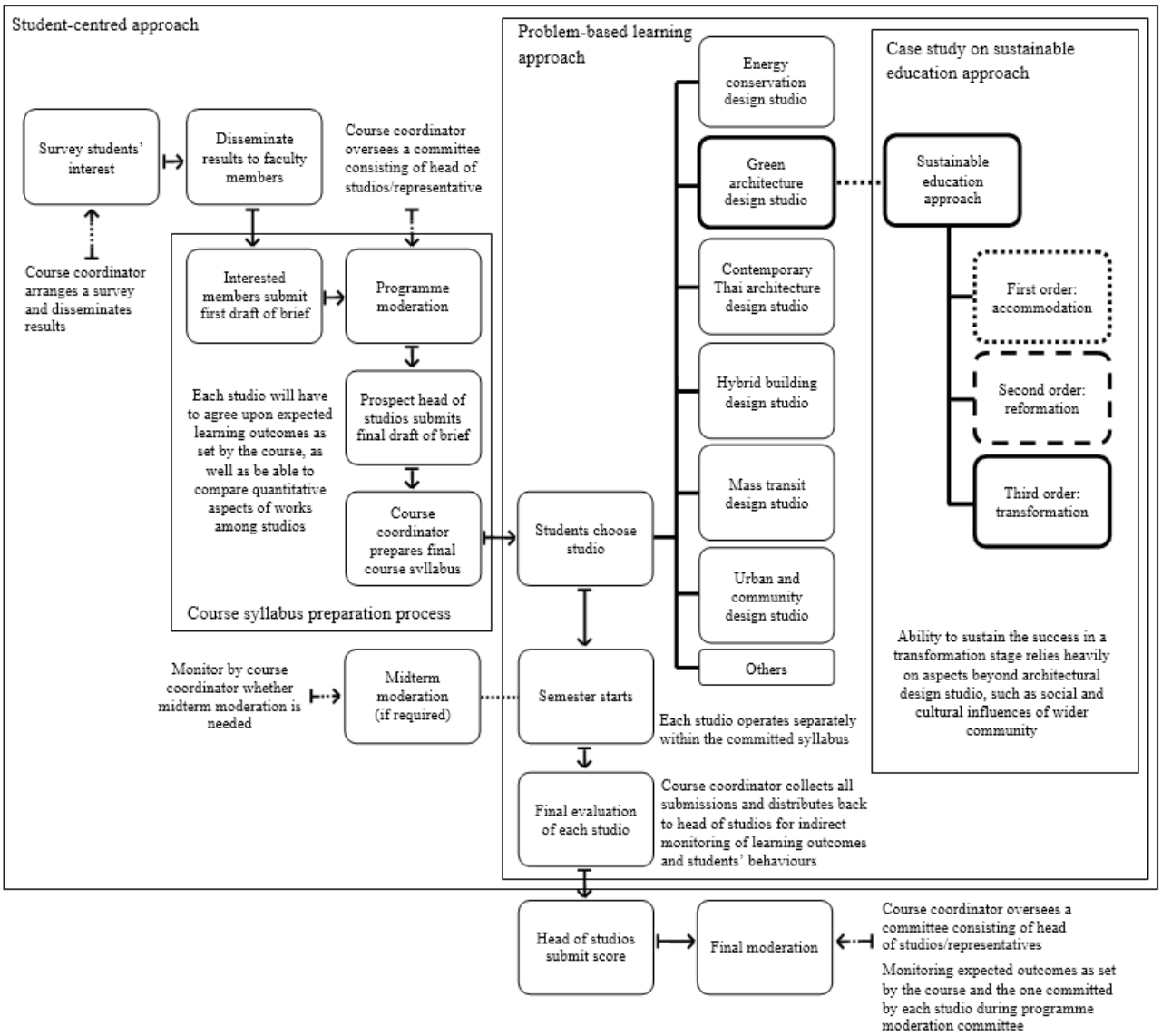


Figure 1: The process of the course, special topic in architectural design studio (STADS).

The process begins during the last week of the first semester. The course coordinator conducts a survey on what kind of project, building types, etc, the students would like to study in the next semester and uses that as a tool to recruit teachers for the studios of in that semester. This process places the students at the heart of the process of teaching in accordance with the SCL approach. Since the School has a quite firm idea on the learning outcomes expected of the students, standards and outcomes have to be able to be compared, assessed and evaluated between each studio.

A process of programme moderation is set during the semester break between prospective studios. The content of the studio, including sequence and proportion of points allocated to assignment, sketch design, tutoring, pin-up and the final evaluation has to be discussed and negotiated before the final syllabus can be disseminated to the students. The students

have several weeks to study the syllabus; just before the second semester starts, they are allowed to choose the studio of their choice.

At the beginning of the semester, rules and regulations regarding the management of the course are explained, and there are discussions between the students, coordinator and staff members of all studios. From this point onwards, each studio operates separately, apart from the course coordinator, who is in charge of collecting all submissions during the semester before distributing them back to the corresponding studio. This allows for minor changes in learning details and the pace of learning to suit both sides, the lecturers and their students. The process of having a centralised submission is considered to be an indirect monitoring system in which the course coordinator is able to check on the progress of each studio. In so doing, the coordinator is able to make suggestions or even call for mid-term moderation if needed.

At the end of the semester, after the final evaluation, each head of studio submits scores to the course coordinator who processes it for the final moderation. Students with similar scores are singled out and all works recalled for comparison of one against the others. The final moderation committee that comprises the course coordinator and head of studios or representatives evaluates and negotiates until a unanimous decision has been reached. The focus of discussion is prioritised on the expected learning outcomes of the course, followed by the commitment from the nature of the studio. For example, the students of the green architecture design studio should be able to express the implementation of green, sustainable or environmentally friendly designs to some extent in order to render the course successful. After the final moderation, the final grade of the whole class is issued on the day based on the agreement of the committee.

GREEN ARCHITECTURE DESIGN STUDIO: A CASE STUDY ON SUSTAINABLE EDUCATION

The green architecture design studio is the studio of the STADS course that has offered classes since 2009. Methods of teaching and learning activities in the studio are continuously developed depending on the theme of each passing year. However, the approach of SE has been an underlying principle throughout the years. As mentioned earlier, the management of the STADS course, as well as the expectations for the graduates of the School mean that the green architecture studio has to equip the students with some stages of achievement on the specific learning outcomes of the studio.

SE is influenced by the idea of sustainable development, which is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs and aspirations [2]. Such a development is the ideal developmental strategy as stated in Agenda 21 [3]. The idea is to guide all activities and programmes to consider the *pros* and *cons*, as well as the impacts of all the aspects: environment, society and the economy. It is the fact that human beings have the ability to modify the environment and shape their society and within it, the economy. To change the course of all developments to sustainable development cannot be done by relying only on government or any policy makers, but it is rather a collective approach. Each individual has his/her role(s) towards a sustainable future. In doing so, education could be seen as an important element for promoting sustainability. Each person could have more than one role. For example, the new generation of architects will not only be an architect of any community, but will also be a member of the community.

Accordingly, education in a university should produce students who become responsible global citizens, while a specialised school, such as a school of architecture, should nurture a responsible architect of the future. Hence, the green architecture design studio is set to educate architectural students into professionals who are able to understand, having the skills and awareness necessary for the implementation of environmentally friendly architectural design. It is hoped that the students will use the concept of sustainability as an overriding criterion for their work and, if possible, even be sustained in their future works. Accordingly, SE is seen as a necessary guideline for the creation of a green architecture design syllabus.

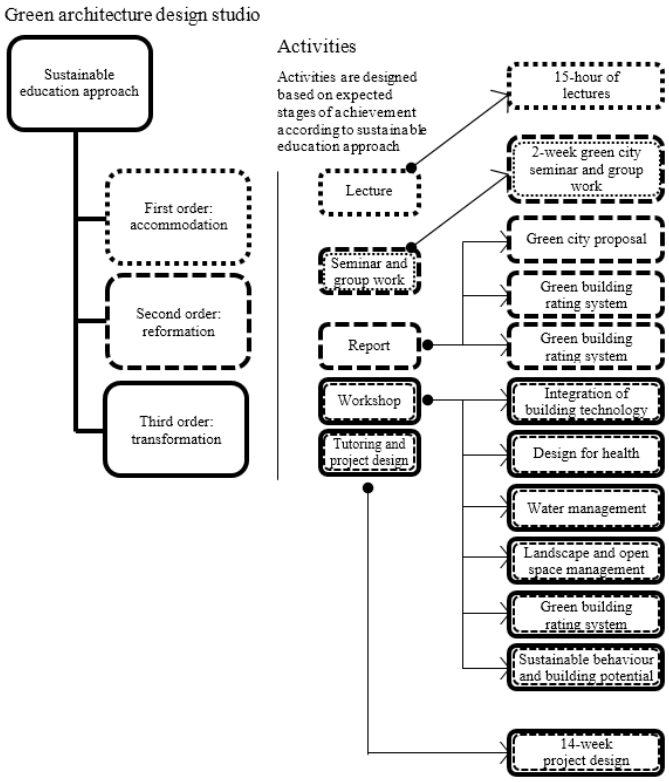
The concept of the SE approach is improved by environmental education after there has been global acknowledgement of sustainable development. The main idea of the approach is to create an education method for sustainability for responsible environmental citizens. As illustrated by Sterling, the implementation of sustainable education can be considered in three different stages: accommodation, reformation and transformation [4]. The first stage, accommodation, refers to the change that takes place within accepted boundaries of the existing education paradigm, but often leaves basic values unexamined and unchanged. It may take the form of adding on issues of sustainability to existing policies and practices or treating sustainability as a separate curriculum subject. Unlike the first stage, reformation involves the change in attitude of the learners, as well as the ability to examine the assumptions behind basic values and influences, as well as reflecting critically on the adoption of the concept of sustainability. This stage is what is often meant by reorientation, as it includes new content and also a value change and capability to cope with change.

The last stage is a transformative level of learning, which involves a deep awareness and ways of practice. It requires continual creation and revision, and entails a cultural shift in education and public awareness from weak sustainability to strong sustainability. Although sustainable education encompasses all three stages, at present, sustainable education has not been broadly implemented in educational systems and most of the learning institutions involved are primarily engaged in the first stage, during which the focus is on information about sustainability. Moreover, because of the limits of separate subject approach and predominant conservative structures and framework, higher education has appeared

slower to take up and respond to sustainability than other education levels [4][5]. Focuses of any university and programme should not be limited to educating knowledgeable and skilful professionals, but also facilitating and nurturing their students to be responsible sustainable citizens. Fortunately, at present, many universities gradually apply such concepts in their management and learning activities.

The green architecture design studio, under the umbrella course of STADS has been used as the case study for the implementation of SE within the architectural design studio. It was planned from the beginning in 2009 to utilise all three stages of the SE approach into the learning process. Models of learning activities within the green architecture studio were arranged to fit within the approach, as well as the objectives and expected outcomes of the course and the studio itself. Students enrolled in STADS are expected to acquire the ability to design a public large-scale project of at least 8,000 square metres in which adequate feasibility studies, reasonable functionalities, and building construction and systems options are part of the basic requirements. In addition to the said qualities, each studio needs other add on learning outcomes to individualise characteristics of the studio. The green architecture design studio is aimed at educating the students into a better understanding of sustainable architecture, as well as of being aware of the roles and contribution an architect has towards sustainable development. The students were also expected to be able to apply the knowledge into practice of sustainable design through the work of their project designs.

This case study presents the observations of the fourth year architectural design projects of a green architecture design studio for three academic years (2013-2015). During the three-year-period, there were a total of 48 students in the studio. Projects during these three years were a result of the signed memorandum of understanding between the Faculty of Architecture and Phitsanulok Municipality. The project focused on future development of Phitsanulok within the area of its urban municipality and surrounding urban fringes. With the help of local personnel and other responsible people, students were able to obtain information about the assumed future and its prospects. The modes of teaching during the period were similar in the manner in which all the students were working as a big group in the first part of the project, before breaking into individual designs later on.



Topic	Lecture	Seminar and group work	Report	Workshop	Tutoring and project design
1. Urban and contexts					
1.1 Sustainable/green city	✓	✓	✓		✓
1.2 Transportation	✓	✓			✓
1.3 Food production	✓	✓			✓
2. Programme and design development					
2.1 User and functional analysis	✓				✓
2.2 Sustainable building material/construction	✓			✓	✓
2.3 Building system and service	✓			✓	✓
2.4 Energy conservation and production	✓			✓	✓
2.5 Waste management	✓			✓	✓
2.6 Water management	✓			✓	✓
2.7 Indoor environmental quality	✓			✓	✓
2.8 Sustainable landscape	✓			✓	✓
2.9 Social dimension sustainability	✓				✓
2.10 Sustainable behaviour	✓				✓
3. Presentation and evaluation					
3.1 Final evaluation					✓
3.2 Green building rating	✓		✓	✓	
3.3 Building potential	✓		✓		✓
3.4 Public exhibition		✓			✓

Figure 2: Examples of the application of SE into learning activity in the green architecture design studio.

STRATEGIES FOR REFORMATION AND TRANSFORMATION

As guided by the stages of SE, learning objectives of the green architectural design studio were set to incorporate all three stages into the teaching where possible. Figure 2 summarises examples of application of the stages of SE into learning activities.

Implementation of the First Stage: Accommodation

The *accommodation* stage is probably the most common in terms of implementation. It is mostly about the content base, including the basics for knowledge and understanding of the issue. This first stage is mostly implemented during the

studio's lectures. A challenge to the implementation is the teaching technique to engage students in the lesson. Simple and quick sketch designs or small quizzes according to the lesson are used to pique students' attention in class. Discussions and sharing experiences during the lectures were also an effective method. A small number of students in each studio made the relationships between students and teachers closer than in bigger classes. This led to informal and casual discussion, which was good for the introduction of knowledge to the whole class.

Implementation of the Second Stage: Reformation

The *reformation* stage is known as education for sustainability [4]. It involves changing attitudes and raising awareness. The students are expected to be able both to apply and to analyse and integrate critical thinking with the knowledge gained from the first stage. Implementation of reformation in the studio was achieved mainly through a seminar and group work, as well as the reports. Teaching techniques were aimed at getting the students to think deeply about the issue. Reports were seen as a model for students to gather basic information by themselves and to analyse it to form their own knowledge. A seminar can be seen as a process of introduction to encourage curiosity or a process of sharing and discussion after the students have gained some basic knowledge.

In the green architecture design studio, seminars were set for both purposes. There were seminars and group work during the first two weeks of the studio and it was planned that the results would be applied and analysed into a group report assignment. During the group work task, students were required to present their findings as a group, which was a process that forced them into deep discussion and analysis of the work they were doing.

During the past three academic years in which the green architecture design studio has been held, projects were directed at the local municipality under the pretext of future development. Basic information and existing future plans were given through seminars between local government and the studio. Surveys of the community to learn about the way the people live, how they use of spaces, as well as the unique characters of each part of the city were planned to stimulate the students into forming the links between reality and knowledge through the combination of analysis and creativity. A proposed development under the concept of green and sustainable community was drawn and submitted in the form of a report. Then, the design projects were selected from a community development proposal for the next stage of project design. Success in changing students' attitudes and raising awareness towards sustainable design were weighed with observation on learning behaviours, eagerness and attitudes of students, while they expressed their thoughts with verbal communication or through written reports.

Implementation of the Third Stage: Transformation

This stage, *transformation*, is the most important stage of SE, which is aiming for education as sustainability. The transformation stage involves a deep awareness and practice of the concept. Main implementations were through the 14-week project design. Combinations of weekly face-to-face tutoring sessions and issue-based workshops were arranged to fit in with students' progress in the project design. Tutoring sessions were the same as in most mainstream design studio, where the teacher provides a face-to-face session for each student in order to comment on and discuss students' work on plans, functionalities, aesthetics and other concerns in architectural design. The unique nature of the green studio tutoring sessions may only be that the discussions and comments are based on sustainable design quintessence. Productive interruptions of the tutoring sessions were made by issue-based workshops. During each workshop, students were required to find ways to integrate specific ideas, concepts, concerns or any required principles into their own drafted schematic design. The main mode of learning of the workshop was through self-awareness, self-evaluation and self-criticism.

Figure 3: A workshop of the green architecture design studio.

For example, in the workshop integration of building technology, students had to find ways to integrate all the necessary building systems and green technologies, as well as to double-check their previous design solutions with the orientation and surroundings. In a water management workshop, students learnt about available water supply. They would also be

asked to calculate water consumption, as well as the size of the immediate available supply. Alternative supplies, such as rainwater and greywater in relation to the catchment area, greywater reuse and recycling facilities, and retention ponds should also be tested against the designs by the student themselves. At the end of each workshop, the students must be encouraged to compare the physical characteristics of their buildings and their capacity to deal with their immediate environment.

During the workshops, the teachers' main role is that of a facilitator. Information, methods of thinking and calculations, figures or conversion factors have to be provided by the teacher to ease the process of workshop. Students are told to bring their drawings, especially plans, site plans and sections, with tracing paper and coloured pencils to every class. Each student works on problem-solving activities through marking, connecting and re-arranging their draft throughout the workshop. They judge their own work based on information given by the teacher or the teacher's concerns. From past experience, workshops were the most successful activity of the studio in terms of engagement, as well as in making the skills stick. This conclusion was drawn from the fact that it was possible to engage and captivate students' attention and enthusiasm on each workshop and for up to three or four hours. Casual atmosphere, leisurely questions and answers, group discussions and comparing the work of different students are the keys that make an intense lesson out of a casual architectural puzzle. After the workshops, students have gained a better understanding of how to improve the arrangement of the design to fit more with the concept of sustainability. Most students gain better design skills or at least have more understanding of the comments of the teacher regarding design for sustainability in later tutoring sessions.

In all three years that these courses have been held, by the end, the students of the green architecture design studio also had a chance to present their ideas and design projects in form of open exhibitions. The exhibitions were set up in a local department store, where people in Phitsanulok Municipality and surrounding areas could easily visit. Each year, the students were tasked with designing exhibition displays and setting up the whole exhibition by themselves. They were also assigned a role as guides and presenters of their own proposals for alternative urban development projects and their work. Via personal communication with local people, the students learned about other opinions towards their work and the green design features they proposed and, sometimes, they were exposed to further arguments about the projects and professional practices. This activity signals a feedback that teaches the students about real professional life that they could encounter after graduation.

Besides the basic knowledge and architectural design skills that students learned from the studio as a part of standard expected outcomes of the STADS, the green architecture studio added the change in attitudes and awareness towards sustainability and possibility of commitment to integrate green features and sustainable issues into future designs to the enrolled students. Continuation of such transformation, however, cannot be readily guaranteed. Only about half of the students undertake their final year projects (BArch theses) with noticeable application of sustainable architecture or at least green features. Ensuring a higher rate of sustaining the transformation will require more than one semester of intense study, as well as some other outside factors, such as major change in cultures and public awareness regarding sustainability.

CONCLUSIONS

Architecture for sustainability is what architects of the 21st Century agreed upon as the Declaration of Interdependence for a Sustainable Future [6]. Since then, it still has not yet become a common practice among architects, even though it is a well-known fact that natural resources are becoming depleted at an alarming rate. New generations of architects will inevitably have to face the situation. Therefore, it is rather appropriate to advise them on how and why architecture for sustainability should be implemented. The School of Architecture in the Faculty of Architecture at Naresuan University may be advanced in adopting the concept of architecture for sustainability as the overriding approach of all curricula, but a sustainable reformation and transformation of these new generations of architects will require more than the reach of academic institution. Influences from wider communities and professionals will be significant in the move towards sustainability.

This case study describes an example of a quest to use a model of sustainable education approach as the underlying principle for teaching a green architecture design studio. Modes of teaching were designed according to the suggested stages of sustainable education. Implementations were recognised by teachers of the green studio as being successful, based on observations over the past three years. Self-awareness, self-evaluation and self-criticism continue to be teaching techniques to introduce changes in attitude and awareness for sustainability. Most students had improved design knowledge or at least had more understanding regarding design for sustainability by the end of the course. It should also be possible to apply these teaching methods and approaches to other courses and disciplines. With a new pedagogy, future generations of professionals could become responsive citizens, who have the ability to cope with continual change.

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BIOGRAPHIES

Sirimas Hengrasmee graduated with a Bachelor of Architecture from Khonkaen University, Thailand, in 1999, and completed her Master of Architecture (sustainable design) and a PhD in Architecture at the University of Auckland, New Zealand, in 2004 and 2009, respectively. Her background of study is in the areas of sustainability and the implementation of sustainable concepts to Thai context. Her research is related to sustainable architecture, sustainable education, environmentally friendly practices and behavioural change. She is currently an assistant professor and the Director of the Postgraduate Programme in the Faculty of Architecture at Naresuan University, Phitsanulok, Thailand.

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