A DEVELOPMENT AND OPERATIONAL PRACTICES OF STUDENT-CENTERED CLASSROOMS

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ABSTRACT

The modern student-centered classrooms in the Faculty of Engineering, Chulalongkorn University, were modeled after the SCALE-UP platform, a total disruption approach from the previously gradual improvement of classrooms. The first pilot room was completed in 2014 with five more fully equipped and two semi-equipped large classrooms in the next three years. The rooms were only allocated to courses with active learning only; lecturers who requested to use the classroom had to pass through the training. By the end of 2016, the classrooms were used around 48% of the working hour for regular courses, and 14% of all lecturers passed through the utilization training. While the classrooms were very popular, the invested resource and effort were equally high in order to meet the demand of the stakeholders. While the conception and infrastructure development was quite challenging due to financial regulation and bureaucratic practices, the real tests were the strategic deployment and operational practices for the room utilization, management, maintenance, and continuous development.

KEYWORDS

Change Management, Learning Environments, Faculty Development, Standards: 6, 8, 10.

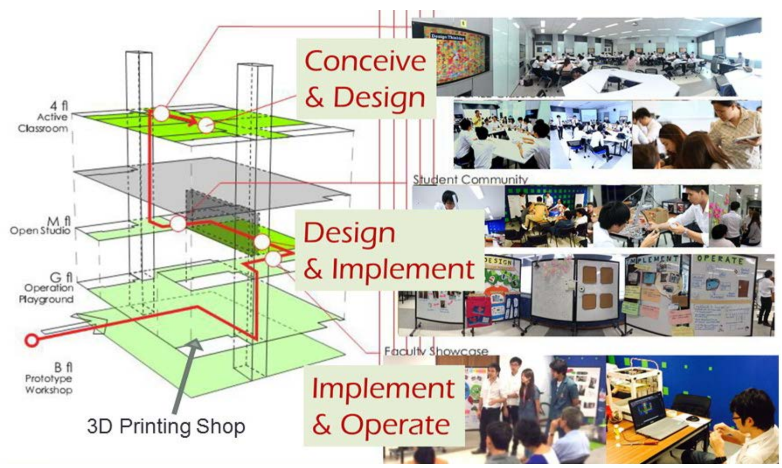
INTRODUCTION

Learning environment influenced learning quality. Previous classroom developments in the Faculty were incremental; user experiences in existing classrooms, e.g., the visibility (Singhanart et al., 2012), were studied and the room layouts were modified accordingly. While classrooms were indeed improved, they were still very much teacher-centered. For the envisioned roadmap for engineering education (Sripakagorn & Maneeratana, 2013), the classrooms that better suited student-centered instruction models as well as promote active and collaborative learnings were needed. In short, the situation required a disruptive change.

The SCALE-UP was a part of the outstanding success in the development of the interactive, collaboratively based instruction (Beichner et al., 2000). It was found in previous studies that students were generally more engaged, and performances could be improved under the combination of the resulting active-learning instructional model and the supporting environment (Dori & Belcher, 2005). The developers' network setup up a website for assimilating the knowledge at http://scaleup.ncsu.edu from which the concept was adopted. To better accommodated the local learning experiences, identified needs included the discussion and interaction between students, tables' space for laptop computers as well as the ability of teachers to circulate to engage students. Classrooms were refurbished in three phases with were distinctive for round tables for students to work in groups and the instructor station at the center.

To improve the quality of engineering education (Sripakagorn & Maneeratana, 2013), the curricular were to incorporate the CDIO platform to raise the overall educational quality (Lee et al., 2015). To facilitate the CDIO Standards 4-8: Introduction to Engineering, Design-Implement Experiences, Engineering Workspaces, Integrated Learning Experiences, and Active Learning, the Learning Corridor was envisioned and implemented into the new Engineering Centenary Building (Figure 1). There were classrooms for Conceive & Design on the fourth floor, the engineering workspace on the mezzanine floor for the Design & Implement, and the ground floor concourse was for exhibition and demonstration.

(a) The Centenary Building



(b) The Learning Corridor

Figure 1. The learning space for CDIO Implementation

Concerning the classrooms for active learning, the developer selected the SCALE-UP classrooms and registered as a site member to gain additional information. However, the adoption and implementation in the local contexts and constraints required much effort. This paper described the experiences, pitfall, and lessons learned from this exercise.

INFRASTRUCTURE DEVELOPMENT

Starting the conceptual design in April 2013, examples of the SCALE-UP-type classrooms were studied in details. The existing rooms were surveyed while the available furniture, electronic equipment such as televisions, smartboards, signal controllers and software in the market were reviewed. The initial imposing of the classroom format involved many components, including the writing space, lighting, air conditioning, video signal, and audiovisual systems. After the room requirement was outlined, a mock-up room, using borrowed furniture and televisions was set up for a demonstration to test both the instructional practice and potential donators' reaction during the 2013 alumni reunion event sound out the potential donation.

Then, details of the system and the required resources were refined. The architecture and outlook of the planned classroom were digitally rendered (Figure 2). The brand name iSCALE was chosen, the SCALE recognized the SCALE-UP platform while the suffix i denoted the word intania which was the nickname for the Faculty of Engineering. The initial project consisted of the total refurbishment of the rooms on the fourth floor of the Centenary Building, involving four large and two small classrooms.

Figure 2. The architectural render for the first iSCALE room for fundraising purpose

With the full support of the then Dean of Engineering, Assoc. Prof. Boonsom Lerdhirunwong, the project was pitched to Chevron (Thailand) in August 2013; the company sponsored a large room and a small room. The second set of large-room sponsors were the Thai industrial conglomerates, the SCG, PTTEP, and PTT Global Chemical. The donation came as a lump sum for the sponsored room. The first pilot room was completed in early 2014, just in time for the cascade training session of the first batch of the Thai CDIO master trainers (Figure 3). The next three rooms went into full operation in 2015.

Figure 3. The inaugural activity for the iSCALE: CDIO cascade training on 24-27 June 2014

After the first iSCALE rooms became a success, the Learning Innovation Center (LIC), which was responsible for promoting educational quality in the Chulalongkorn University, took up the practice and started to co-funding similar rooms throughout the University (Table 1). The LIC paid for the sets of computers, television, interactive whiteboard, projector, video signal equipment, tables, and chairs while faculties were responsible for the rest of the room refurbishment, including wiring, writing board, audio equipment, acoustic system, air conditioning systems, and other accessories. The Faculty of Engineering received the co-funding of two such rooms in 2015 and 2016.

Table 1. The list of LIC-sponsored classrooms between 2015-2018

Faculty/Offices	Numbers		Involvement	
	Rooms	Seats	Procurement	Site training
Allied Health Sciences	1	32	✔	✔
Architecture	1	64	✔	
Arts	2	80	✔	✔
Commerce & Accountancy	1	64	✔	
Communication Arts	1	64	✔	
Dentistry	2	64	✔	✔
Economics	1	48	✔	✔
Education	1	64	✔	
Engineering	2	128	✔	✔
Law	1	64	✔	✔
Medicine	1	64	✔	
Pharmaceutical Science	1	64	✔	
Political Science	1	64	✔	
Psychiatry	1	64	✔	✔
Science	2	128		
Veterinary Science	2	96	✔	✔
Petroleum & Petrochemical College	1	32		
Language Institute	1	32		
General Education Office	1	32	✔	

The rest of the classrooms on the 5th floor were semi-furbished with new tables and chairs. The portable whiteboards that were provided for discussion could be used as partitions and poster stands. The available iSCALE rooms (Figure 4) became sufficient in numbers such that they might have a substantial impact on the learning environment in the Faculty. Also, the LIC sponsored the Design Workspace (Chancharoen & Maneeratana, 2016) on the mezzanine floor which completed the integrated Learning Corridor for CDIO in 2016 (Figure 1).

Figure 4. The floor plan and available iSCALE classrooms

The processes of procurement and infrastructure development provided another insight into the management system. For the first four rooms, an education technology company, TRINiTech was responsible for all implementing works. The company collaboratively worked with the iSCALE developers in the co-creation of knowledge, providing much-needed expertise on interior design, electronic equipment selection and installation, acoustic absorption, and other finer points of room refurbishing. The company had since provided services in implementing active learning classrooms in universities around the country.

On the other hand, the LIC, that provided partial funding to many faculties, procured equipment and furniture in large batches. While this approach was better in terms of discount and the custom furniture, designed from the users' feedbacks, there were many problems with product and service specification. Unexpected problems included the lack of the compulsory standard for furniture and a visit by officers from the Office of the Auditor General of Thailand due to a complaint by a fail bidder who misunderstood the process. The coordinating for room development was much more difficult due to the lack of a professional interior designer and the arrival order of equipment, installation, and services. With such a small amount of works in each stage, it was very difficult to find good contractors. The atmosphere and color schemes of the rooms were not as elegant as the previous rooms as well.

In reflection on the infrastructure development, the expectation of stakeholders had been getting higher as they became accustomed to highly polished commercial products and services in increasing prosperity of the country. High-quality services were valued; drab government facilities were no longer satisfied. The development of the iSCALE followed similar practices for the famed development of the Engineering Library (Vorasaiharit & Thawesaengskulthai, 2016). The practice and potential benefits had to be well researched. Planning required professional services of architects and interior designers; the fundraising activities enticed potential donators with attractive vision as well as returned benefits of either tax deduction or public relation opportunities.

However, the normal due process in a public university had not been keeping up. The government strictly regulated the fiscal and spending procedure in an attempt to fight corruption. It was hard to employ professional services that were perceived as unsuitably extravagant – such as the architects, interior designers, procurement and inspection specialists as well as the service managers – that allowed the possibility of truly outstanding quality.

The procurement practices were equally outdated. The current norm was to rely on lecturers and supporting staff for writing the technical specification of rapidly changing technology and products. They had to participate in the bidding and purchasing processes as well as for the acceptance procedure. This required personnel to face enormous challenges on both the technology and bureaucratic practices that were not their core duty. The steep learning curve could be somewhat overcome but never be sufficient good for notable achievements. Either training existing personnel as specialists for operating in a university-wide scale or, more likely, allowed more outsourcing might be the way forward, but the path was still very much in doubts (Upping & Oliver, 2012).

IMPLEMENTATION AND PRACTICE

Due to the technology-intensive in iSCALE classrooms, the users had to be trained so that they could operate the equipment in proper manners. The utilization manual and training video clips were provided; any persons who applied to use the room regularly had to complete the certification process (Figure 5). The training on instructional practice and techniques were conducted in separate projects. Lecturers and other users had to declare the instructional method and use of active learning in order to book the room. For group teachings, at least one lecturers had to be certified. The most crucial point was to use software to control signals, use the free connectors that were provided at the podium or under each television and to avoid using hardware controls on equipment and detaching cables for direct connection at all cost. It was noted that due to different visual signal controls in the early and later development, the certification for these two sets of rooms had to be separately conducted.

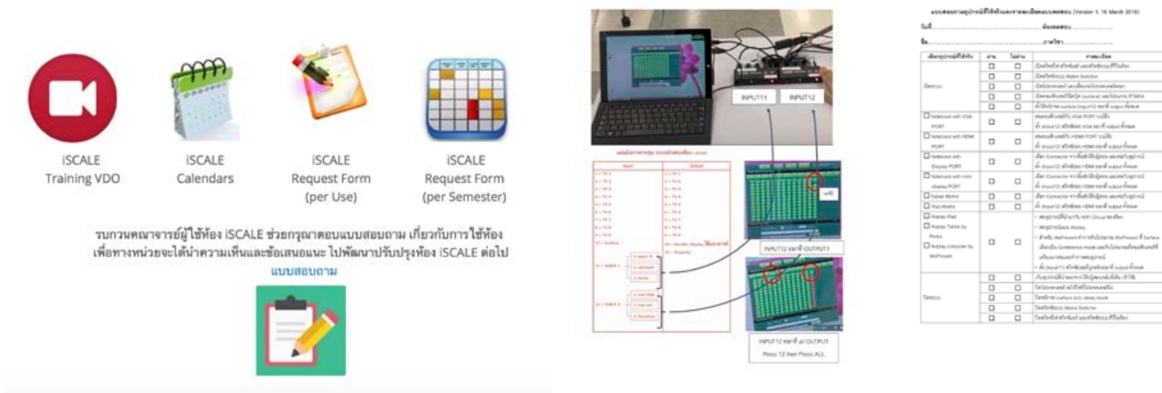


Figure 5. Room booking and user training media and documents

With the iSCALE rooms, lecturers that pioneered and implemented innovative instructional models were empowered with the ecology that much better suit to their needs (Figure 6). It was noted that the room and technology utilization were tracked for continuous developments. Instructional practices and problems were recorded such that the problems would be addressed in the development process of the next room. This design and equipment were continuously fine-tuned and matched with the usage modes and current technology in the never-ending cycle.

As the room configuration was not friendly to teacher-centered lectures, it was hoped that the environment would force some lecturers to change their teaching to be more active. However, it was found that if the lecturers really wanted to lecture, they would do so regardless of the environment. Some might even arrange the tables into rows as in the typical classroom. These study cases further supported the operational need to ensure that that only courses with suitable instructional models were able to use the rooms.

Lecturers and students were surveyed on the utilization of the iSCALE classrooms. Lecturers were very satisfied with the comfortable and clean environment for discussion and group works, the compatibility with different OS system and multiple screens for presentation. The main complained was the old projectors as well as some unreliability of the video signals and the internet access, particularly the University's wifi network. Despite multiple wireless microphones in each room, the numbers were considered too few, and there was occasional interference from the adjacent rooms. Frequently, natural light was too bright, and the disposable such as markers and battery were not readily available.

For students, the initial pro opinion of the classroom that were most frequently mentioned, from ascending order, were the ease of discussion & interaction, the television screens & ease of presentation, good atmosphere, good working condition with computer & electronic equipments with lots of electric sockets, easily moved table & chairs, and the built-in board for writing. The most common dissatisfaction was the screen visibility, particularly for the table at the center which was far away from the nearest television. There were also complaints about the lighting and too bright natural light, the crowdedness near the wall and entangled chair, too few microphones and electric sockets as well as minor problems in the operation and supplies. There were also requests to use the room for students' extra-curricular and club activities.

Figure 6. Examples of active learning activities in iSCALE classrooms

In 2015 and 2016, 41 lecturers, equivalent to 14% of all academic staff, passed through the training (Table 2). However, when the distribution across the departments was considered, the level of expressed interested varied from as high as 30% to negligible. The early-adopters data helped the planning of lecturers' training in order to ensure core numbers of active-learning practitioners. Also, a lecturer of Architecture was also trained to use a room for a general education course.

Concerning the room utilization, around 65-67 courses using the room regularly every semester, accounting for 48% of the standard 8-hour days. Besides, the rooms were used for courses that requested occasional usage as well as other activities (Table 3) which clearly showed the popularity of the rooms. Concerning investment, the depreciation value of the durables in the rooms per usage hour was no more than 600 Baht (about 19 USD) according to a most conservative estimation using the maximum depreciation rate of governmental financing regulation. The operation costs, particularly the electricity bills, were not much different from regular classrooms.

Table 2. The number of trained personnel between 2015-2016

Department/Offices	Lecturers		No. of Staff, & TAs
	Numbers	Percentage	
Mechanical Engineering	9	29.0	
Computer Engineering	9	25.0	4
Civil Engineering	8	24.2	
Survey Engineering	2	18.2	
Water Resources Engineering	1	16.7	
International School of Engineering	2	16.7	4
Nuclear Engineering	1	11.1	
Electrical Engineering	5	10.4	2
Metallurgical Engineering	1	8.3	
Environmental Engineering	1	4.8	
Industrial Engineering	1	4.0	
Chemical Engineering	1	2.8	2
Mining and Petroleum Engineering			
Faculty Offices			8
Total	41	14.0	

From the operation and surveyed feedbacks, the utilization of the iSCALE rooms had two main concerns, the operation, and maintenance. With intensive incorporated technology, it was easy for instructors to slip and unable to operate the equipment and signals despite the training. Most of the times, the problem was minor but might results in a long delay while the users could quickly get frustrated. The most severe problems were the I/O control of audio-visual signals by the matrix software. Students frequently did not want to wait for the video signals to be switched by the software or tested whether their output signal was sufficient good for the matrix signal channeling. Many went on directly connected their notebooks to the television's screen. The forced move of the built-in screens and cable disconnection easily caused the wear and tear on the hardware which, in turn, further exacerbate signal problems.

Table 3. Non-regular extracurricular activities during the second semesters of 2015

Activities	Activity Numbers	Total Time (hr)
Industrial liaisons & workshops	7	99
Internal workshops & trainings	5	17
Educational visits	14	40.5
Student activities	8	49.5
Total	34	206

Secondly, the maintenance routine was much more intensive than typical classrooms. Accessories and battery supplies had to be regularly checked and restocked. The infrastructure had to be kept in good condition or had a short downtime. The rooms were costly with a steep decline in values of the incorporated electronic equipment; it was necessary for the rooms to be heavily used to justify the expenses.

The key response to these two problems was to have a supporting staff in the nearby office such that if any problems arose at any time, there would be a one-stop service that could solve minor problems for the lecturers while coordinating with other offices or the support centers.

SUSTENTION AND EXPANSION

Since the first iSCALE room became operational, there were many interests in the rooms. There were regular requests for the visit and use from inside and outside the University (Figure 8). The classrooms became a compulsory stop for the tours of the Faculty's learning showcases – the Library, Workspace and iSCALE (Table 3).

Figure 7. A workshop by the Faculty of Architecture (left) & science teachers' training by the Faculty of Science (right)

With the success of the first four pilot classrooms in the Faculty of Engineering, the Learning Innovation Center (LIC), started to co-sponsor the rooms in various faculties (Table 1 and Figure 8) as described in the previous section. The iSCALE classrooms were used as the demonstrative rooms for interested lectures to visit and experienced first-hand in addition to the uses in training on teaching and learnings. For the room development, details with incorporated lessons were adapted to suit specific needs. The on-site training was mostly conducted by the growing crops of iSCALE operators.

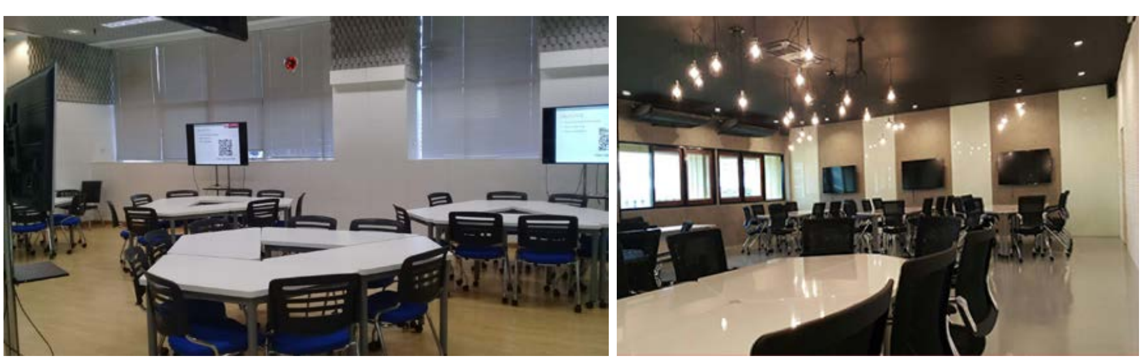


Figure 8. Expansion to other Faculties: Faculty of Law (left) & Faculty of Economics (right)

As the classroom operation was perceived to be stable, the operation was absorbed into the standard hierarchy within the Faculty of Engineering. The duty of the on-site staff was handed over in 2018 to the Academic Offices for booking, the Building Operational Office for the regular operation and the Audiovisual Unit and the Infrastructure Office for maintenance. As this procedure was causing several mishaps, the practice transfer and long-term operational performance and effectiveness had to be evaluated.

CONCLUSIONS

The iSCALE classrooms at the Faculty of Engineering, Chulalongkorn University, could be considered a successful adaptation of the SCALE-UP environment into a Thai public university as an integrated component of the CDIO adaptation. The availability of facility empowered and encouraged changes of instructional models on educators who either had changed or inclined to change.

During the implementation and the operation since then, the iSCALE adoption could be seen as a harbinger of new practices. With the high expectation on the level of services in the modern economy, the stakeholders of iSCALE – staff, students and donators – expected high-quality services, not the most economical option as in the previous generation.

The infrastructure development was just the beginning. The critical items for success thus far were the course selection, room management system, lecturers', on-hand operational supporting personal, continuous development and understanding of the administration and administrative offices. Also, the gained extrinsic and intrinsic knowledge had to be passed on and instilled in the regular operation.

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