

PROMOTING SUSTAINABLE AND SOCIAL RESPONSIBLE MINDSET THROUGH A TRANSNATIONAL PROGRAMME USING THE CDIO FRAMEWORK

Soh Kim Fai

School of Mechanical and Aeronautical Engineering, Singapore Polytechnic

Noel Kristian

School of Chemical and Life Sciences, Singapore Polytechnic

ABSTRACT

In September 2013, 50 students from the Singapore Polytechnic (SP) formed multidisciplinary and multinational teams, participated in the inaugural Learning Express Programme (LeX). LeX is a unique transnational social innovation programme where students make use of their *domain knowledge*, to conceive and co-create with rural villagers on social projects in a sustainable way. This is unlike a typical Community Service program where students usually contribute merely their labour to work on some predefined projects without having the sense of ownership. LeX programme is developed using CDIO framework and consists of 2 parts which are C-D & D-I-O. For the first part, students spent 12 consecutive days in the host countries; using the SP Design Thinking framework for their ethnographic studies, to uncover the unmet needs of the community. This paper attempts to detail the Learning Express Programme, logistic resources needed and some learning outcomes.

KEYWORDS

Social Innovation, Service Learning, Design Thinking, CDIO Framework, Project Based Learning, Integrative Learning Experience, Active and Experiential Learning.

INTRODUCTION

Singapore's engineering education has primary been focusing on the technical advancement. But with rapid progress of globalization and in line with the Singapore Polytechnic's vision statement of "a caring community of inspired learners committed to serve with mastery"; there is a need to instil a mindset of global social awareness and development, in a sustainable way. In the Singapore Polytechnic (SP), initiatives to infuse this mindset has been emphasized recently and one of the examples is the institutional multidisciplinary subject "Social Innovation Project" (SIP). The second year subject is aimed to instil social awareness to uncover the needs and propose viable solution for the local community. Although SIP has been implemented successfully for the past 2 years in the Singapore Polytechnic, it is believed that this subject could be implemented more effectively and meaningfully overseas for the underprivileged community referred to as the bottom of the pyramid (Amadei, 2004). The learning Express (LeX) program was conceived as an overseas version of Social Innovation Project. This paper will first outline the unique features of the inaugural LeX programme. It will be followed by a detailed description of its various components and the underlying pedagogy (eg. CDIO framework). Supporting administrative departments and groups are also highlighted. Timeline for the programme is also illustrated. Finally key feedback and points for a successful implementation of such a resource intensive programme are highlighted.

PROGRAM AND PEDAGOGY

LeX is a unique transnational social innovation programme where students make use of their *domain knowledge*, to conceive and co-create with rural villagers on social projects in a sustainable way. This is unlike a typical Community Service programme where students usually contribute merely their labour to work on some predefined projects without having the sense of ownership. This is very similar in terms of objectives, vision, values of international humanitarian initiatives based on Engineering such as Engineering without Borders and Engineering for a Sustainable World. LeX is unique because:

1. It is a learning experience fully organised by academics from various countries.
2. Participants are restricted to students with a transnational, multi-disciplinary setting with non-engineering students forming part of the team.
3. Students are assessed for their works.
4. Key methodologies are Design Thinking and CIDO framework.

LeX programme is developed using CDIO framework consisting of 2 parts namely LeX1 (C-D) & LeX 2 (D-I-O). The effectiveness of using CDIO and a framework for project based learning is well documented, e.g Pee et al, (2009), Levy (2009), Armstrong PJ(2005),Soh (2010) and Cheah (2010). In this paper, the inaugural Learning Express Program (LeX) is described. The objective of LeX is to give opportunities for students from SP in using their technical skills and knowledge to tackle the social and environmental issues faced by underdeveloped villagers in the South East Asia countries. This transnational program is meant to provide students with global perspective on the impact of engineering on society and environment (CDIO's third goal) and the urgent need of sustainability.

LeX program consists of 2 parts. For the first part (LeX1), students spent 12 consecutive days in the host countries where the participants immerse themselves into the ecosystem of the community and understand their lifestyle, culture and indigenous skills in order to develop sustainable solutions. Each SP students were paired with another student from a partnering institute of the host country. For the inaugural LeX 1 program, 50 SP students were divided into 2 teams that were further divided into 6 sub-teams. 25 SP students were arranged to visit 3 villages in Vietnam (Ho Chi Minh, 2-15 September) while another 25 students went to another 3 villages in Indonesia (Yogyakarta, 16-28 September). This was done so as not to disrupt the villagers' daily routines with a large influx of outsiders (together with their local buddies). Each village was led by one faculty from the Singapore Polytechnic and one from the partnering institute. SP faculties involved, volunteered for the programme as they see value in their personal and professional development. Projects conceived from the 6 villages included productive tools, new products and heritage tourism model.

As LeX1 is a resource intensive programme, funding are required. On the average, it cost about S\$1000 per students to embark on the programme. However, students need only to contribute S\$100 while SP subsidises the balanced amount.

As part of the curriculum, credit units were given in-lieu of a compulsory course (Social Innovation Project- SIP). The main objective of LeX1 is to allow students to experience the living conditions in the village and to build empathy and collaboration with the people that they will work with. Hence, activities are mainly in *Conceiving* the needs of the society and *Designing* concepts to satisfy those needs. SP Design Thinking framework (as shown in figure 1) is the main methodology used during their ethnographic studies to uncover unmet needs of the community.

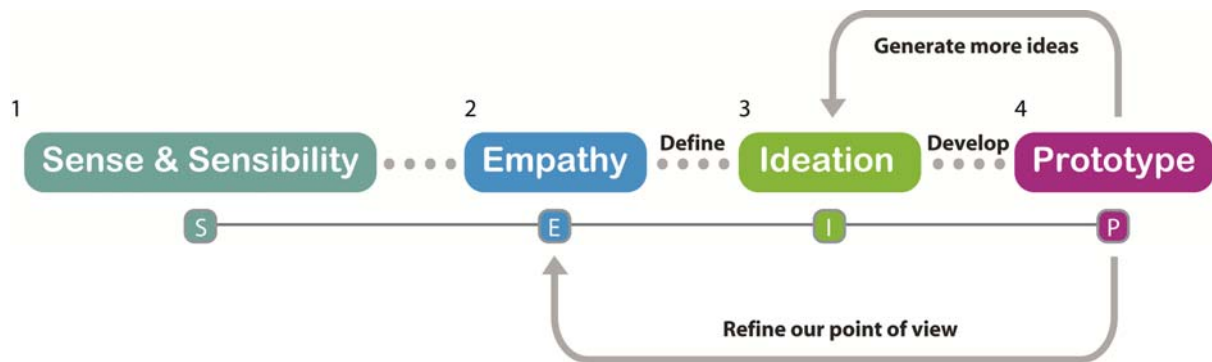


Figure 1: SP Design Thinking Framework

For the second part (LeX2), the students are to Design, Implement and Operate working prototypes based on the concepts that they have conceived in LeX1. Working prototypes that leverage on locally available resources would then be developed and delivered back the villages. Besides using local resources, to maintain the sustainability of the projects, the community would then be trained to know the building, operating and maintaining processes. In the Singapore Polytechnic, the implementations of projects are done, facilitated by the SEE (Social Engagement and Entrepreneurship) technology group. The SEE Tech group has a strategic intent of being the Regional Centre for Co-Creative Capacity Development using technologies as enablers to solve social program in the context of 3rd world countries. Its representatives are faculties from various schools. With the projects collated from LeX1 and some other overseas social initiatives, the SEE technology representatives will look for suitable project groups in their respective schools to implement some of the concepts. All expenses incurred from the building of prototypes to on-site operation will be funded by the SEE technology group. Criteria for projects that the SEE technology group deems suitable for supporting must fulfil at least 2 of the followings:

1. Local/ overseas stakeholders
2. External partners serving communities at the Bottom of the pyramid (BOP)
3. Research projects serving BOP
4. Multidisciplinary group

The implementation can be achieved via project based subjects or capstone projects as illustrated in figure 2. At the end of the semester, students are supposed to implement their functional prototypes in the same village. Besides implementing the solution, students will also transfer their know-how in terms of making, operating and maintaining the prototypes so that the villagers could sustainably use it and scale up the prototypes to other villages.

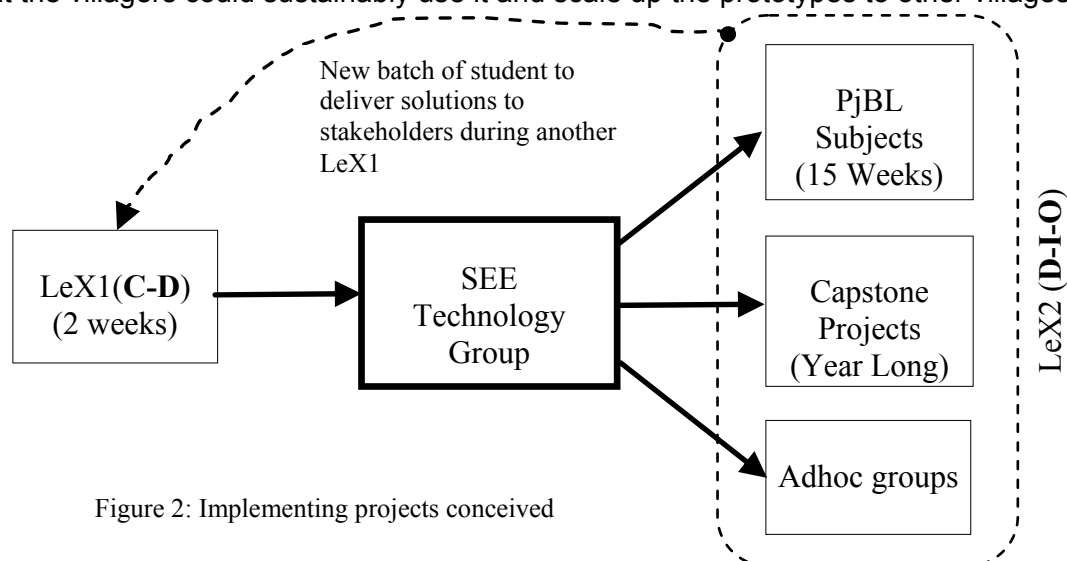





Figure 2: Implementing projects conceived

At the point of writing, LeX2 has yet to begin. Hence, this paper will focus on the learning points gathered from LeX1 while the pedagogy and implementation of LeX2 will be reported in a separate publication.

Details of LeX1 program in Ho Chih Minh City (Vietnam)

As illustrated in figure 1, Design Thinking (DT) is adopted to uncover the unmet needs of the community. It has 4 main stages which are applied throughout LeX1: namely Sense and Sensibility, Empathy, Ideation and Prototyping. Although represented in a linear fashion, the DT process is best thought of, as explained by Brown (2009) as a system of 3 overlapping spaces of inspiration, ideation and implementation; rather than a sequence of orderly steps. Table 1 below provides a comprehensive outline of the LeX1 programme.

Time	Program		CDIO skillsets
Day 1 of pre-trip programme	In order to prepare students to have the right mind-set for the LeX1 programme, a two days training were provided covering Design Thinking (DT) framework and relevant indigenous skills.	 DT presentation	Problem solving, teamwork and communication.
Day 2 of pre-trip programme	For the inaugural LeX1, all activities were conducted in Kampong Temasek (Malaysia) providing a rustic environment for students to condition themselves for the mentally demanding LeX1 programme	 Making Bamboo structures	Problem solving, experimentation, designing and implementing systems.
Day 1 LeX1	Arrival in the host country. Students were brought to the university hostel of the partnering institute.		
Day 2 - 3	Sense and Sensibility by learning local language and culture. DT training was provided for VNU students guided by SP students who were DT trained. Village orientation was also arranged.	 Faculty of Vietnam National University conducting basic Vietnamese language and cultures.	The language and culture lesson was lecture based. Very little skillsets covered. Should use more Active Learning activities for future programmes.



Day 4- 7	Empathy studies by staying in the village and conducting observation and interview to develop deep understanding about the issues faced by the community.	 <p>Students interviewing subjects in the village.</p>	Conceiving system.
Day 8 - 9	Ideation to generate plausible solution to meet the needs of the community.	 <p>SP and VNU students grouping ideas, generating insights and crafting out need statements</p>	Problem solving, teamwork and communication.
Day 10 - 11	Quick prototyping with simple materials to gather feedback from community.		Problem solving, experimentation, designing and implementing systems.
Day 12	Fine tune prototypes and deliver final presentation for the stakeholders at partnering institute's hall. All ideas were consolidated for follow up in SP and at partnering institutes.		Teamwork and communication.

Table 1. Detail implementation of LeX1

By using Design Thinking framework, students developed ideas and co-created together with the local community that consisted of the villagers and local university students. The main requirement of the final ideas that developed into various solutions was the use of sustainable local resources and technology. The key to this pedagogic approach is to maintain the sustainability of the projects that students and local community conceive because local community could only continue the development of these projects on-site using available resources (Brown and Wyatt, 2010).

ORGANIZATIONAL PERSPECTIVE AND SELECTION CRITERION

Reconnaissance trip

One of the key aspects in LeX1 is to pre-identify suitable projects. Faculties of different expertise such as engineering, business, food science and industrial design agreed upon projects that have engineering development opportunity to improve the livelihood of the community without neglecting their social needs. For the inaugural Lex 1 programme, a 3 days reconnaissance trip was conducted together with the local education institution partners for both the Vietnam and Indonesia legs. The local partners will make all logistic arrangements such as pre-identification of villagers, liaise with village heads, and to provide the necessary food and transports. On top of that an emergency response procedure was created to help explain about the nearest hospitals from the villages and also evacuation procedures. From the reconnaissance trip, projects brief was crafted so as to explain to the students about the nature of the projects, the day-to-day activities, emergency contacts that come handy for all the participants when they are on the trip. Most of these coordinating works with the local partners are done by a dedicated department in SP that functions as an International Relation Office. This dedicated department liaise with the overseas counterparts on the logistics. With the involvement of this department, workload for the faculties can then be lessened and they can focus on the delivery of the programme and to design a good learning experience.

Selection Criterion

The criterion used to select the projects in this program are the followings:

1. The projects are directly related to the community
2. The projects have potential technological solutions and also involving social needs
3. The projects are supported by local education institution partners
4. The communities are keen to collaborate with SP and local partners on projects
5. The communities are able to provide a reasonable home stay experience for foreign students.

For example in the inaugural LeX1 in Ho Chi Minh City in Vietnam, 3 projects scoped from the 3 villages were:

1. "Villagers of Tan Thong Hoi is keen to explore effective and efficient ways of making bamboo blinds. Expansion of product range could be another way to value-add to their existing production methods and skill."
2. "Villagers of My Thai is proud of their Bamboo basket weaving skill but lack exposure to new products. Some processes can be more efficient and safe by designing appropriate tools."
3. "Villagers of Tuong Bing Hiep in the lacquered workshop are exposed to hazardous working environment in terms of poor working posture and ingesting chemical vapour. Running waters are used to trap paint particles which are subsequently discharged into the rivers."

These project scopes only serve as useful starting point. Different project scopes will be crafted by students themselves as they work on the field. From the LeX1 experience so far, an average of 3 co-created solutions were conceived from each village.

STUDENTS' ASSESSMENT AND FEEDBACK ON LEARNING EXPERIENCE

Assessment Scheme

Grades will be given for students' efforts in LeX programme using assessments rubrics. Two credit units were given for the LeX1 (Conceive-Design) portion. The means of assessment are as shown in table 2:

Means of Assessment	Weightage %
1. Quality of participation (individual)	30
2. Reflection Journal (individual)	20
5. Presentation (Group)	50

Table 2. Assessment Components for LeX1

For the portion on students' participation, their quality of participation during the pre-trip, LeX programme and post-trip were recorded. Qualitative comments by faculties leading various groups were shown to students on Day 8 of the programme. This had provided a timely self-reflection and to convey faculty's expectation for the remaining learning journey in a one-to-one interview. For students who simply tagged along, treating the trip as another excursion without the mind-set of serving the stakeholders were counselled. This was done not to shame or to threaten students (with marks), but to seize teachable moments to work on their teamwork attributes and personal attitudes. Feedback on the students' daily performances were also given during their nightly debriefs.

After the trip, the students were given one week to complete and submit their Reflection Journals. In the Reflection Journal, the students must answer 3 questions, illustrating the depth of their thought and evidences of their claims. They are:

Q1. What have I learnt about the community that I am serving through my project?

Q2. How did I apply the Design Thinking tools and what was the impact on my project?

Q3. What have I learnt about myself through this project?

The final presentation took place one month later. The presentation date would depend on situation although preference was to have it as soon as students received the grade for their Reflection Journal. Students were given 20 minutes to present their Design Thinking outcomes, merits of their design concepts and self-reflection. This was followed by a 10 minutes of Q&A.

Students' Feedback

Feedback were gathered via an informal post-mortem discussion with the students and through their Reflection Journal. During the informal discussion, students were asked to provide feedback on various aspects of the Lex 1 experience such food, accommodation, recreation activities, interaction with local etc. From the discussion, key points useful for future LeX1 planning were gathered and summarized in the following table.

1	The homestay helped us realise how fortunate our life is compared to the villagers.
2	Interaction with the locals allowed us to widen our experience in speaking with foreigners and also learning their cultures

3	Learning Express Programme helped us to bond among ourselves, creating a fun and memorable experience together.
4	Learn about working with people from different backgrounds and cultures.
5	Project briefs should be given before the pre-trip.
6	The recreation activities after the homestay is appreciated.
7.	Faced communication barrier between with the locals even with the help of English speaking local students. Many needs were wrongly conceived due to communication problem.
8.	Bigger food portion. Also, food not suitable for Muslim students.
9	Travelling time from hostel to villages were too long.
10	I have managed to evaluate my strengths and weaknesses.
11	I am able cope with pressure and work as a team.
12	I learned “new technologies” from the so called “uneducated” people.
13	I have not been very observant. The observation tool in the Design Thinking framework was useful.
14	I like the slower pace and peaceful life in the village.

Table 3. Key points from students' feedback

From the feedback, students were generally appreciative of the learning experience they had gone through. They were humbled by the knowledge which they had picked up during their interaction with the villagers. They realised teamwork was key and not to dominate and impose individual ideas at the conceptual stage. Such deeper self-discovery would never be easily afforded in a normal classroom based lessons. Most participants were motivated to implement the concepts which they had conceived and were keen to deliver the solution to the stakeholders.

Key Factors to a successful implementation Lex1

A close working collaboration with Indonesian and Vietnamese education institutes such as UMY, UPN and VNU is key to the successful implementation of this programme. Firstly, education institutions have similar educational mission which is to serve the society that is inherent among the partners. Secondly, the language and cultural gap could be reduced because the local university students who are proficient in English are paired with SP students. Thirdly, the logistic issues could be resolved swiftly as there is a department liaising with international partners. Finally, local education institution could readily follow up with the projects on-site because they have people with domain knowledge and skills from various schools.

Pre-trip activities is also crucial for LeX1 programme because it allows the students to gain basic insights on their projects and also to develop understanding on how to apply DT in real

world context. Besides that, pre-trip activities is also meant for students to get to know each other better and to develop a good teamwork before they set off for the actual trip.

Staff from the Department of SP International (ie. International Relation office) took on an active role in ensuring all logistic issues are well taken care of with the partnering institute. Academic staff could then focus on providing good learning experience for the multi-national participants.

The forming of the SEE Technology group to match make projects conceived to relevant staff, is key to the sustainability of the programme. Not only would staff leading the team feel confident when the project conceived is not in his domain area, it also provides the stakeholders a sense of hope that we are determined to implement the co-created concepts and bring back the solutions at a later stage.

CONCLUSION

The Learning Express is an International Social Innovation Program developed by the Singapore Polytechnic that provides students with the opportunity to experience the natural world, learn new skills, make meaningful new friendships and rediscover them through out-of-classroom learning. The objectives of Learning Express seek to promote Design Thinking and Social Innovation. By bringing together students from various disciplines and partner educational institutions, teams will collaborate to contribute to a community as they apply domain skills and use the Design Thinking Methodology to co-create innovative solutions that strives to meet the needs of the local community. Students have a sense of purpose in relating their disciplinary knowledge to solving real life problems. They also developed camaraderie working with students from various schools and also with students from overseas. Judging from the spontaneous forming of Facebook groups among students, this will contribute some way in establishing lasting friendship among ASEAN students; which is an important outcome, given the prospect of having all 10 ASEAN countries to complete the ASEAN economic integration by 2015. With contacts established with partnering institutes and goodwill extended with the villages, the Singapore Polytechnic will continue to focus on more underprivileged communities within South East Asia countries. It is our hope to nurture students with a gung-ho and "can do" spirit, to work and play in an interconnected world.

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Biographical Information

Kim_Fai Soh is a Manager (Teaching and Learning Unit) and a Senior Lecturer in the School of Mechanical and Aeronautical Engineering at the Singapore Polytechnic. He teaches Computer Aided Design, Engineering Design and Wind Energy. His current pedagogic interests are Project-based learning.

Noel Kristian (Dr) is a lecturer in the school of chemical and Life Sciences at the Singapore Polytechnic. He teaches Chemical Product Design and Development, Biomass and Fuel cell Technology and Chemical Plant Design. His current pedagogic interest is designing Experiential Learning activities.

Corresponding author

Mr. Kim_Fai Soh
Singapore Polytechnic
50 Dover Road
Singapore
65-6870-4789
skimfai@sp.edu.sg



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