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Sustainability Science as a Neo-normal: A Case Study

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Abstract The traditional classroom could not offer substantial learning experience when the learning concepts and contents are becoming complex in the context of social issues which transcending across learning borders. In this article, it tries to find out that normal science conducted in traditional classroom environment could still provide learning but not enough to substantiate knowledge and skills needed to deal with socio-scientific issues complexities. This study assesses and evaluates the level of engagement of learners in the re-oriented learning activity which is beyond the classroom and engages the real community and environment that was introduced through socio-scientific approach by utilizing the concept of the school-based learning project (SBLP). The pilot schools in 3 from the 5 countries involved (Thailand, Philippines, and Indonesia) a year after the project conclusion. The methods used were the actual and unstructured interview for the students and focus group discussion for the teachers involved. Sustainability science framework and the outputs-outcomes continuum were used as tools to measure the engagement level of the students and teachers in the SBLP. The results suggest that there was significant relevance when the teachers understood better which enable them to provide more re-orientation between the normal science in a traditional classroom and post-normal science in the current environment.

Keywords Socio-scientific Issues, Sustainability Science, Post-normal, Neo-normal

1. Background

The concept of sustainability science comes primarily from how the society interacts with nature. It is generally perceived as an emerging discipline but in an integrated way of doing learning on the way towards a sustainable society. We adopted the concept of sustainability science [5] to facilitate and guide a multidisciplinary team of teachers to develop school-based learning project (SBLP) that will identify and address socio-scientific issues centered on climate change integrated education.

Global warming and climate change issues are shaping the horizon that people will experience events that beyond historical perspective. As doing business as usual is not anymore considered normal at present times [8] as normal science is becoming post-normal as [4] said, at present, there is no agreed description of what the future will bring, but there is a general sense that much of our intellectual inheritance now lies firmly in the past. Now there is the contention that the intellectual and knowledge of the past cannot solve the societal problems at presents Albert Einstein said that "no problem can be solved from the same consciousness that created it. We have to learn to see the world anew" as cited by [1]. Therefore it is clear that we need to move on and even unlearn the past and relearn something new to reorient ourselves to the new horizons as supported by Alvin Toffler that the illiterate of the 21st century are not those who cannot read and write but those who cannot learn, unlearn and relearn.

In this 'normal' state of science, uncertainties are managed automatically, values are unspoken, and foundational problems unheard of" [4]. The post-modern phenomenon can be seen in one sense as a response to the collapse of such 'normality' as the norm for science and culture. So thus an innovative climate change education building adaptive capacity for the next generation adopts the new normal science as a concept of sustainability for the 21st century.

2. Objectives

- To find out if the pilot schools were able to sustain the implementation of the School-based Learning Project (SBLP) facilitated by RECSAM-APN education model,
- Evaluate the outputs and outcomes from the implementation of the SBLP then draw philosophical perspective of sustainability science from their own experience, and
- Explore the inclusion of local knowledge based science that may predict sustainability.

3. Methodology

The case study is making use of the climate change integrated education promoted by RECSAM-APN entitled the "Climate Change Integrated Education Model: Building Adaptive Capacity for the Next Generation, with Malaysia, Philippines, Indonesia, Thailand and Lao PDR" [2] was designed and developed by RECSAM, an initiative which was funded by the Asia-Pacific Network for Global Change Research (APN) in Japan from May 2011 to December 2012. Twenty-two (22) pilot schools were set up in 2011 in five countries to host the introduction of the integration of climate change issues into the learning system in the context of every country learning approaches. After 2 years of trial and error in the application of the concept of integration, there were notable pilot schools able to sustain the implementation of integration of climate change issues and contents and even go beyond from what were expected from them. The research and development of RECSAM initiate to push further to develop the concept of integration of climate change issues in the wider and comprehensive schools and community engagement through "Sustainability Science". Sustainability science as defined by [5] had to be above all else integrative science committed to bridging both the barriers separating the traditional scientific disciplines and the sectoral distinctions between interconnectedness of human activities against its immediate environment. As the level of uncertainties increased due to the impact of climate change, teachers and educators considered a higher stake decision to create a learning environment that will provide comprehensive learning journey and outcomes to achieve resilient and sustainable society.

4. Design and Procedure

The researcher used the literature review approach to gathering as much as information and philosophies to study and analyze a regional capacity building research project on as funded by the Asia-Pacific Network for Global Change Research (APN).

Criteria for Post Evaluation of the APN-RECSAM Pilot projects in Indonesia, Thailand and Philippines will be based on the framework of Sustainability Science as reflected in Figure 1 and the Outputs and Outcomes methodologies as shown in Table 1.

The Traditional Classroom level as shown in Figure 1 (low stakes-low uncertainty/unpredictability situation) it refers to the current conventional classroom practices in our schools today. Although Education for Sustainable Development (ESD) integration processes are evident however occurring only at the sphere of the classroom environment. Moreover, the conduct and delivery are characterized by low level of space of thinking and exploration and with low or manageable uncertainty level thus, learners are less engaged.

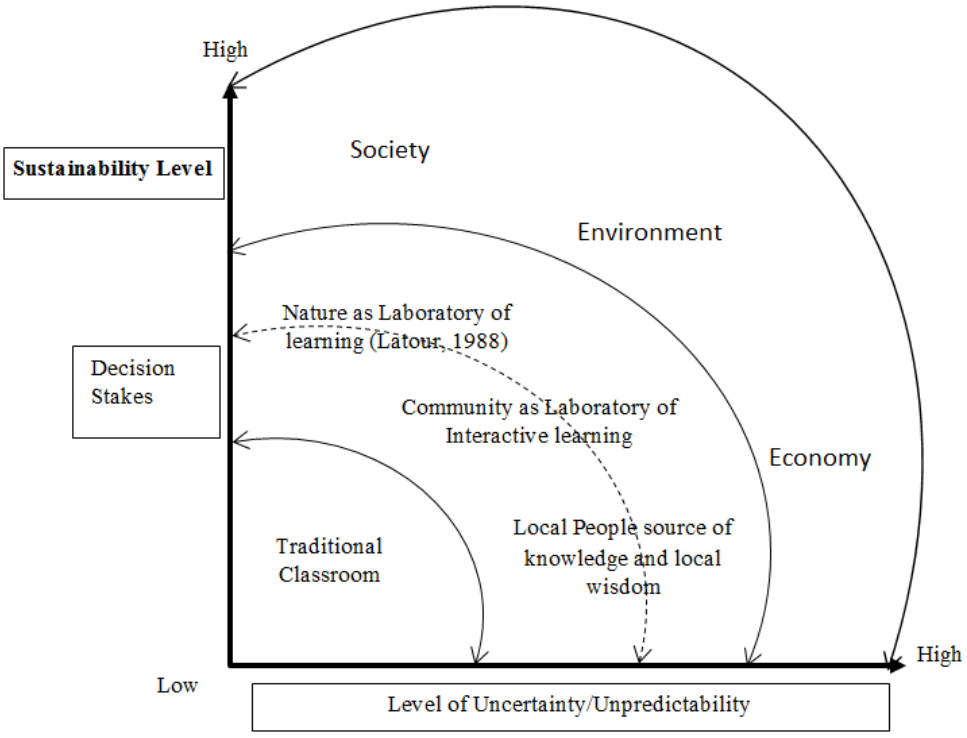

Figure 1. Sustainability Science Conceptual Framework

Table 1. The Outputs and Outcomes Methodologies Model with criteria and indicators as an Evaluation Tool

	Outputs		**Outcomes-Impact**		
Schools (Secondary)	Activities	Participation	Short Term	Medium Term	Long Term
	What we do	Who we reach	What the short term result are;	What the medium term results are;	What the long term results are;
Pilot Schools	Conduct Workshop Training Develop Pedagogy Curriculum Resources	Teachers Educators Students Research and Decision makers	*Learning* Awareness Knowledge Attitude Skills Opinions Aspirations Motivations	*Action/Practice* Behavior Practice Decision making Policies Social Actions	*Condition* Social Economic Civic Environment

The Beyond Classroom level (high stakes high uncertainty/unpredictability situation) it refers to the condition where ESD integration processes extend beyond the classroom to the community environment. The engagement with the community may come in the form of utilizing local people as a source of knowledge and local wisdom to re-enforce contextual scientific understanding; the community as a laboratory for interactive dialogue to enrich the learning journey of the learners. In this level, there is a high demand for thinking and processing of information leading to a higher and critical thinking that will help disposed of an informed sound decision so as to cope with high uncertainties involved. Eventually, learners acquire deep understanding not only of the theory and content but the process itself in interaction with the local people and economic community and environment; but also development of social consciousness and social responsibility as manifestation of what has been learned and practiced and when it is becomes a culture then it would be a pre-cursor to a higher level of engagement with economy, environment, and the society by itself in the "sustainability" level.

The framework helps to simplify the concept of sustainability as well as to evaluate the knowledge of individual about sustainability. This is highly promoted for ASEAN-based scientific knowledge and likewise, serves as a framework for implementation and evaluation of ESD (Figure 1.).

Table 1 shows the methodologies and parameters of evaluation between the outputs and outcomes. These parameters (outputs and outcomes) will help the researcher categorize the different level of learning journey of the students involved in the project on building the capacity of the next generation of young people.

5. Results and Discussion

Climate Change Integrated Education Model: Building Adaptive Capacity for the Next Generation (Malaysia, Indonesia, Thailand, Philippines and Lao PDR) was funded by the Asia-Pacific Network for Global Change Research (APN) from 2011-2012. A year thereafter the researcher decided to revisit some of the pilot school sites to look for himself what has been done after the project (SBLP) were implement.

Reiterating the main purpose of conducting the post-project evaluation was to revisit and immersed in school community such as schools officials, teachers, and students if they were able to sustain the "school-based learning project" (SBLP)? Was there anything done a year after the project was completed? What are some philosophical perspectives that can be generated from the post-project evaluation? Actually, the result was encouraging and promising.

The indicator (Sustainability Science Framework)

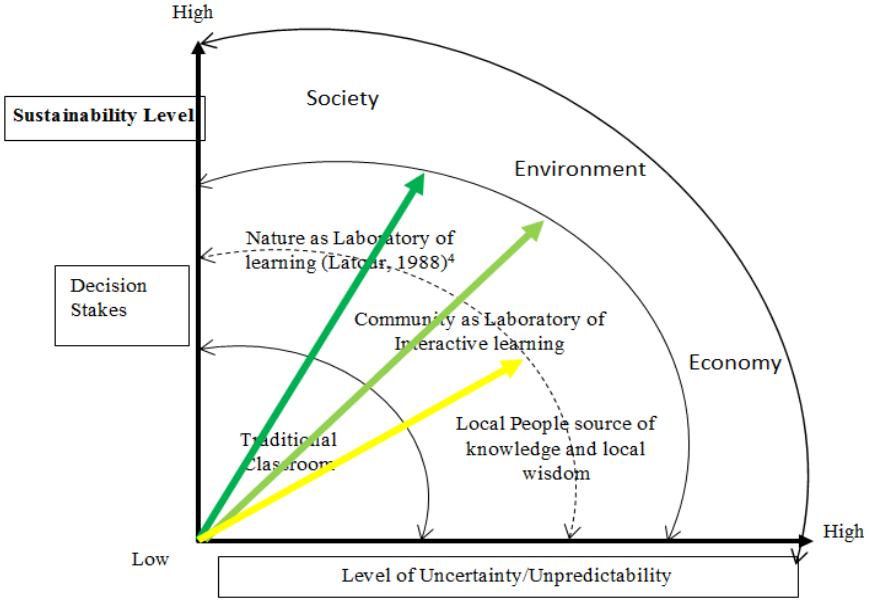

Figure 2. Sustainability Science Conceptual Framework

Legend:

- Indonesian Schools
- Thailand Schools
- Philippine Schools

Sustainability Science as defined by [5] that is the immediate interaction of between the society and environment, thus Figure 2 shows the indicator from the 3 countries participated in the post-project evaluation. The 2 secondary school in Bandung, Indonesia were able to balance out the learning and practiced of what they have learned, as well as the 2 secondary school from Thailand, however another 2 schools from the Philippines were able to connect to the community only in terms of data gathering for their research, they don't have an interactive engagement, so the indicator reach the middle level only. These data were gathered last November 2013, so in order to monitor and evaluate the outcome of it, it will take for sometimes (3-5 years) before the sustainability behavior level can be observed.

Table 2. Post Evaluation of the School Based Learning Project (SBLP) Implemented by the six schools in three (3) countries (Indonesia, Thailand, and Philippines).

Schools (Secondary)	Country	Outputs		Outcomes-Impact		
		Activities	Participation	Short Term	Medium Term	Long Term
				Learning	Action/Practice	Condition
SMP Negeri 4 Lembang	Bandung, Indonesia (rural)	Organic Farming (vegetables)	School and Community	Learning stage	Action/Practice	
36 Junior High School Bandung	Bandung, Indonesia (urban)	Garbage collection and conversion to usable materials (compost…)	School and Community	Learning stage	Action/Practice	
Praphamontree II School	Samut Prakan, Thailand	Developing learning resources	School and community	Learning stage		
BenchamaRat Rungsarit School	Muang Chachoengsao, Thailand	Developing learning resources		Learning stage	Action /Practice	
Leon National High School	Iloilo, Philippines	Making biophysical research (data gathering)	Conducting community survey on the historical background of the project (Historical research on Ilog2 creek)	Learning stage		
Alimodia Comprehensive High School	Iloilo, Philippines	Measuring the diameter of the trees to quantify the CO2 and other pollutants absorb and Oxygen release or produce	Students and few members of the community outside the school	Learning stage		

The evaluation of the School Based Learning Project (SBLP) Table 2 clearly showed the outputs of the activities which are considered as the tangible output but not yet the outcomes. The color indicates which part or level of the outcomes where they able to reach. So the learning journey partially showed the outcomes up to the level of learning and start practicing of what they have learned but of course in the behavioral change level could not yet be observed, it will take for sometimes (3-5 or even 10 years) as suggested by the Organization for Economic Cooperation and Development [9] on their suggested evaluation of the learning outcomes entitled "Understanding Social Outcomes of Learning-SOL".

Summary and Way Forward

The fundamental guide of this post-project evaluation is to revisit and re-immerse in school community such as schools officials, teachers, and students if they were able to sustain the "school-based learning project" SBLP as we commonly called in their school and community. The few RECSAM-APN pilot schools were revisited from the following countries: Indonesia, Thailand, and Philippines.

The six (6) pilot schools were able to continue and sustain the implementation of SBLP at their own volition because of the reasons that what they are doing really providing an effective learning because according to them it is experiential by nature so their students felt so much engaged in the activity.

The philosophical perspective that was drawn on the SBLP first if the learner understood what are the problems being addressed and they become part of the solution and second they are given the freedom to think what to do (critical thinking exercise) the rate of engagement is much higher. Students discussed during the forum that they come to know the real issues (socio-scientific issue-SSI) when they engaged with the community, this phenomenon proved that students and community people have engaged in interactive dialogue, they could get much sensible information than only talking with their teachers in the classroom only. Therefore this phenomenon proved that school and community engagement should be the way forward.

Those experiences and knowledge learned together by the teachers and students is just simply a manifestation of the strategic approaches utilized by the SBLP in planning, strategizing, and implementation. The whole concept of this strategic approach in learning has been used as the fundamental principles in developing the ESD (Education for Sustainable Development) Mainstreaming project proposal entitled: "Achieving Sustainable ASEAN Society through Education for Sustainable Development (ESD) Mainstreaming into the National Education System: A Support to ASEAN 2015"submitted to ASEAN Foundation bidding for funds to implement the initiative in the 10 SEAMEO member countries.

Appendices

Photo Story

Photo Image 1. This is the greenhouse that the community entrepreneurs provided to the school as a place of actual engagement of students in producing organic vegetables while learning the concept of ecosystem, the biology of plants and insects, the chemistry of healthy soil, and other scientific component of vegetable production under greenhouse environment (Lembang, Bandung, Indonesia)

Photo Image 2. Julito Aligaen interacting with the students about the plants they are working on, under the greenhouse environment and plastic mulching (Lembang, Bandung, Indonesia).

Photo Image 3. Julito Aligaen, Education Specialist at RECSAM interacts with the students/learners on the field on how the natural enemies suppressed the population of pests in a vegetable production balance ecosystem. (Lembang, Bandung, Indonesia).

Photo Image 4. This is the site where the students brought their harvest from their own production and learning site for post harvesting preparation to be ready to be delivered to the domestic market, public and mall. (Lembang, Bandung, Indonesia)

Photo Image 5. Students of 36 Junior High School Bandung, Indonesia, interact during the visit of the evaluator (Julito Aligaen).

Photo Image 6. Students and the teacher of 36 Junior High School Bandung, Indonesia showed to the evaluator the product of the composting project of the school wherein the students learned the process of decomposition with the help of Effective Micro-organism (EM)

Photo Image 7. Some of the products from fermentation from the bio-degradable waste from the school and some taken from the landfills. One of the product was the Effective Micro-organism (EM) which they also to hasten decomposition process in the compost making. (Bandung Indonesia)

Photo Image 8. This is the product from the compost making project which students sell it to the community in the both the rural and urban areas. (Bandung, Indonesia)

Photo Image 9. This is the Benchama RatRungsarit School in Thailand. They used the "Mudskipper" fish as local species of fish as bioindicator to monitor the population of their own species and its immediate environment and ecosystem. With the community engagement, students learned that this species is important to monitor the ecosystem. This group of teachers and their students were invited by the Ministry of Education to present their SBLP in the National Science Congress, Thailand.

Photo Image 10. This teacher presented to us (RECSAM Evaluator with IPST GLOBE Project Officer) the second project that their students were conducted after the RECSAM-APN SBLP, (Praphamontree II School, Samut Prakan, Thailand).

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