

## **TITLE**

### **Crossing Borders: Teaching and learning inquiry science in different cultures and religions**

Lilia Halim

The purpose of the research was to investigate how Japanese teachers teach secondary science and to what extent inquiry method is used in the classrooms. Hofstede cultural framework was used as a lens to understand how major cultural orientation of a society contributes to the formation of teaching and learning culture of that society and its' impact on inquiry based learning. The main objective of the research is mainly addressed through interviews with science teachers. Sources regarding how inquiry learning is being promoted among students are obtained from interviews with other agencies too such as teacher training centers. Observation of classroom teaching and school environment also provides data on understanding of inquiry learning in science in Japanese classrooms.

Thus, the activities conducted during the fellowship period in Nagoya and Tokyo (6<sup>th</sup> February to 8<sup>th</sup> March 2017) involved interviewing and observing trainers and science teachers through formal visits to teacher training centers and schools. It is without doubt that quality science teachers will lead to quality science education and Japan is known for its quality training of their teachers. Hence, I visited to three types of teacher training institutions: Prefectural, National and University levels to enquire how and what makes their teachers practice inquiry teaching and learning in schools.

#### **Training centers**

My first visit was to Aichi Prefectural Education Centre. The purpose of the visit was to gain information on the role of the education center in teachers' professional development with an emphasis on promoting inquiry teaching. One interesting and significant observation was that there is a department of research. The Department of Research collaborates with academia from universities. Teachers conduct classroom based research, investigating into their own practice, present to others and document their findings. Reports that are placed in the library are for reference for teachers from all over the Prefectural. Educational research from other cities in the Prefectural are also sent to this center. I had the chance to observe two research presentations on that day on teaching and learning mathematics. Teachers took a year to complete the research. Their research topics are on promoting thinking skills and active learning which are part of inquiry teaching.

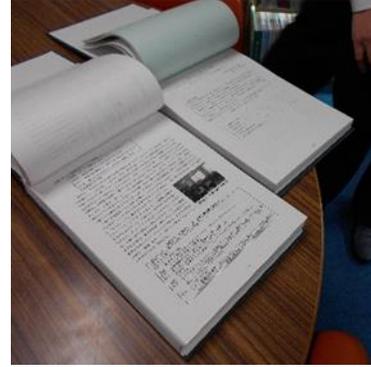


Visit to Training Centre at Aichi Prefectural Level

L-R: Deputy Director, Director, Lilia, Prof Shibata Nagoya University



Research presentation from a teacher on his classroom based research



Outcome of findings documented and placed in the center's library. Reports as old as 30 years are found in the library. Thus teaching is informed by research for at least 30 years.

Aichi Prefectural Education Centre is for in- service training. Pre-service science training is equally important and my Indonesian collaborator ( Prof. Murni) from Sebelas Maret Univeristy, Solo and I visited Prof Ohshika a biology educator at Aichi University of Education. I met him in a Science Education conference in 2016 in Tokyo and in our two (hours) conversation on science teacher and training, he had shared his views on training of science teachers and pointed out the significant role of the science textbook.

A significant observation was that Japanese textbooks at least at the primary and junior high school promotes inquiry skills gradually. For example: for grade 3 – the focus is on skills to do comparison- such as comparing between insect versus non insect. In grade 5, the focus is on the skills on controlling variables and influencing factors. While in grade 6, the focus is on skills of making conclusion. Thus, in addition to teachers' teaching competencies namely questioning techniques for promoting inquiry, resources like effective textbooks play equal important role in promoting and inculcating inquiry skills. The textbooks at least at the primary and junior high school emphasized on inquiry activities.

Prof. Ohshika also mentioned that Japanese curriculum is undergoing review to encourage active learning among students at high school with the aim of improving Japanese students' competencies beyond 21st century. Active learning is already in practice at the primary and junior high school but active learning should be encouraged more at the secondary level so that students are not only active cognitively but also verbally (i.e. through communication which is one of the 21<sup>st</sup> century skills). Nevertheless being active in a physical way (i.e. moving around the classroom) does not mean learning is happening. This concern was also mentioned by a teacher in the research presentation at the Aichi Prefectural Training Centre. Inquiry learning needs both activity 'hands on' and 'minds on'.



L-R: Prof Murni, Prof Ohshika, Lilia  
At Department of Science Education  
Acihi University of Education



Training centre for school leaders at the national level. Self-reflection and self-assessment is the key to school continual improvement.



L-R: Deputy Director, Lilia, Murni, Liasion officer in NCTD Tsukuba

I then visited the National Centre for Teacher (NCTD) Tsukuba Tokyo to enquire how teachers are trained and specifically on inquiry teaching. Discussion with Deputy Director of NCTD highlights that Japanese schools practice self-assessment culture. Schools conduct self-reflection on the results of their self-assessment and national assessment leading towards continual improvement- a process that will inculcate accountability among school members. Self-improvement through self-reflection leads to a more effective improvement rather than improvement based on evaluation by outsiders such as by School Inspectorate a practice from the British educational system that is still adopted by some Commonwealth countries such as Malaysia. However, the Malaysian Inspectorate system is changing the role of inspectors towards being a facilitator rather than an evaluator. Self-reflection practice expected of teachers by the Prefectural and National training centers enhance further the inquiry mindset of teachers and it is evidenced in their practice as found through my visit to schools.

## School visits

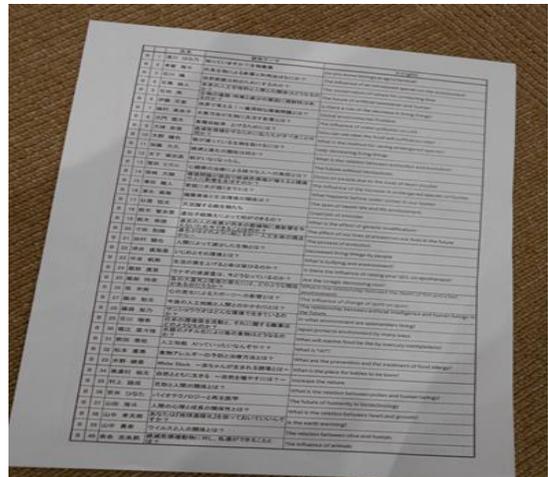
Interview with teachers from Nagoya Affiliated School, Asahigaoka High School, Handa High School and Sashima Public Junior High School respectively. Three of the four schools were with Super Science High School status (the main aim is to promote science and technology among junior and high schools students) and one public junior school. Teachers interviewed were experienced science teachers (15- 20 years) on their views and practices on promoting inquiry in their science lessons. The interviews were analyzed and the important themes emerged from the interview are:

- a. Main factor hindering students to inquire is the need for them to fit in to peer-group membership; thus need peers' endorsement thus do not want to show weaknesses- especially students are in SSH –where most students are high achieving students.
- b. Inquiry environment is set up by teachers and school environment by: a) creating and allowing students to carry out inquiry projects that are driven by students' interest, b) creating safe learning environment by matching teaching style with students' readiness for inquiry such as posing multi-level question difficulties and c) teachers' themselves are resourceful and behaves as researcher with the aim of how to improve their inculcation of inquiry activities and thinking among students.

### School 1: Nagoya Affiliated School



From R to L: Mina Hattori, Ishikawa-sensei, Lilia Halim, Yuri (Indonesian Graduate Student)



List of topics of scientific investigation determined by students' themselves. Students' project presentation is also open to parents viewing and participation.



Students presenting their science projects to peers



The topic of research is determined by the students' own interest and it is inquiry based.

School 2: ASAHIGAOKA Senior High School



Founder of Asahigaoka Senior High School, Nagoya



Back R: M. Miyake , Miyazaki sensei  
Front Row: Principal Yukio, Lilia Halim , Mina Hattori

### School 3: HANDA High School



L-R: Mina Hattori, Lilia Halim , M. Miyake, Principal Sawada



Uno-sensei with 30years teaching experience believes that it is the role of teacher to encourage learning- thus a teacher must self-reflect on how to improve teaching towards inquiry.



School Main Entrance

Principal Sawada and Uno-sensei were very supportive in the interview sessions.

#### School 4: SASHIMA Public Junior High School



At the front gate of the school.



L-R: Mina Hattori, Principal Suzuki, Teacher, Lilia

The teacher believes that the questioning technique of a teacher is important to initiate inquiry lessons. With regard to culture dimensions- the power distance between teacher and student is low thus teacher allows questions and even allow students to challenge teachers' views, explanations or answers.

#### *Classroom observations*

Observation was conducted on the teaching and learning by Miyazaki on a topic called cell culture. Her main aim was to encourage students to ask questions about the cell that is being investigated. Students are asked to prioritize questions to ask anything regarding the cell ( e.g. Patterns, color, size etc.) and discuss with friends of what important questions to ask. The teacher is promoting students to observe (high an important process skills) and to ask questions about it before they actually test their hypothesis. In sum, she is preparing the students to conduct the experiment which will complete in a year. Also the learning objectives were for students to inquire.



Miyazaki sensei and Prof Murni from Sebelas Maret University, Solo, Indonesia.



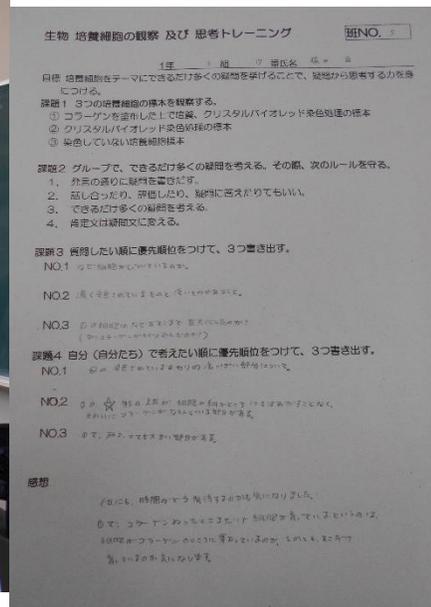
Sample of tissue cultures obtained from the various marine institutions and universities in Tokyo



Each table is provided a microscope- not many schools will have such facilities



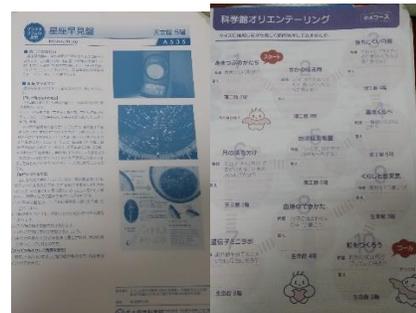
Students to observe cell in groups and discuss questions to be investigated through experiments in the next class. One of the basic of inquiry skills, making observations, is being enforced for the whole lesson. Group discussion encourages students to learn from peers. Three to four students to sit in a group and each of them has access to the microscope for sample observation,



Students to pose questions as many as possible based on the observation. Then to identify three most important questions to discuss and present that will guide the experiment in the next lesson.

So far the visits have been formally done through interviews and observations both at the training centers and schools. However, as we know the education of a child occurs in various settings: formal (e.g. schools), non-formal (e.g. science museums) and informal (e.g. through interaction with parents or the community park). During my fellowship visit to Nagoya, I also searched to what extent inquiry learning environment is offered in the non-formal and informal settings.

**Science Museums:** exhibitions and science shows are avenues for stimulating and enriching students' experience in applying and learning about science in an inquiry way.



Inquiry orientation in science learning could also be inculcated informally through informal learning context such as the Science Museum.

Science shows demonstrating the application of science principles and laws in a fun and exciting way- a very educational experience both for children and adults. In a way public is also being educated as a scientific literate citizen.

Worksheets are provided at each exhibition gallery- as a more systematic guide to understand exhibits while doing hands-on activities related to the exhibits.

## Toyota Museum

Even though it is aimed to demonstrate the history of the evolution of the automobile industry, but the museum also provides spaces and wisdom of words that reflect the inquiry mind. Teachers and parents could use the resources to teach science in an inquiry way.



Workshop at the Toyota Museum itself. An informal setting that indirectly promotes inquiry learning at an early age.

Automobiles don't just come about as the result of a single engineer's hobby. What we have created was born of painstaking research and knowledge accumulated in various fields by many people, and of efforts and numerous failures spanning long years.

Toyota News, No. 10 (November 1936)

Inquiry based learning – involves research activities- key to any innovations in Science and Technology- such as the Toyota Industry

Toyota Museum in Aichi Prefectural is an example where inquiry learning related to science and technology is promoted to children and public



## Collaborators at School of Education, Nagoya University

Last but not least, the fellowship activities would not be possible without the collaborators at School of Education, Nagoya University. They not only assist me to have access the visits to teacher training centres and schools, but the daily conversation and a special small scale seminar has given me further inputs to how and why inquiry orientation in the teaching and learning in science is achievable. Continuous discussion on identifying schools and agencies as well as arrangements to visit was conducted with research collaborators Prof Mina Hattori, Mr Miyake, Prof Sarkar Arani, Prof Shibata, Prof Kuno, Prof Nishino and Prof Murni (Sebelas Maret University, Solo). In addition, continual reflection with collaborators on outcome at the end of each time field work was conducted that allowed the researchers to improve interview questions and clarifying research scope. Graduate students from Nagoya University also helped out in being a translator in two of the many visits either to school or teacher training. The Dean was also welcoming and exchange views and strategies on how to internationalize the School's activities and academia. Continuous discussion with multidisciplinary experts of the Japanese collaborators has enrich the approach and interpretation of the research. It has also formed many collegial relationships.

Prof Mina Hattori, an Anthropology Education expert, is the main collaborator in Nagoya University. She speaks Indonesia well as her research focus on education and development particularly in Indonesia. She and I have frequent briefing session before and after data collection hence we are able to refine the interview questions and research scope.

Her expertise in field of anthropology and culture also enlighten why and how these culture dimensions- namely avoidance failure and power distance are prevalent in the Japanese society. These dimensions emerged from the interviews as an explanation of how Japanese teachers may able to cross borders of teaching science using inquiry method –which is often refer to a Western construct in an Asian culture.



Lilia Halim, Mina Hattori



Seminar on Crossing Borders

L-R: Lilia Halim (speaker 2), Prof Otani (speaker 1), Mina Hattori, Prof Shibata (speaker 3), Prof Sarkar Arani (co- speaker 3)

	Theme	Subtheme	Others' self pride
Findings Malaysia	1. Success	Love science	Individual self pride Listen attentively Respect for authority
	2. Educator-learner relationship	Autocratic image of the educator	Classroom control Submission to an authority figure Educator as knowledge transmitter
		Democratic image of the educator	Educator as facilitator Educator as motivator
	3. Balance in learning approaches	Conventional teaching approaches	Deductive approach Student academic achievement
Contemporary teaching approaches		Students empowerment Forthright yet reserved	
4. Culture avoidance	Failure bring shame		

Culture dimensions that influence the inculcation of inquiry teaching and learning- findings from the Malaysian respondents.



M. Miyake- a contract lecturer on Educational Issues. He was instrumental in getting access into schools and setting up interviews with science teachers.



Prof Nishino- a comparative expert and shared resources on Comparative Education.



Prof Arani- a classroom research based expert. Discussed on Japanese education system from pre-school to higher education as well as issues related to Japanese students' competencies.

In conclusion, the fellowship activity is part of a larger study involving science teachers in Malaysia and Indonesia as well. It is found that inquiry mindset are inculcated in Japanese teachers and principals in the form of self-reflection disposition. Inquiry thinking are promoted in all realms of the daily lives either in formal and non-formal settings. Nevertheless, inquiry science learning identified in this study is also sensitive to the Japanese culture- through creating a safe environment for inquiring minds and practices. Future projects would involve a) surveying the prevalence of influence of cultural dimensions identified through the interviews and questionnaire piloted to a larger population of Japanese science teachers – and to do comparative study with Malaysia and Indonesia, b) to create culturally sensitive science pedagogy based on best practices and information from students' interviews, and c) to interview students on the existence of cultural dimensions in promoting or inhibiting inquiry based learning as well to identify further sub cultures among the students ( as hypothesized in the seminar) in the 21st century and beyond.