



SEAMEO
INNOTECH

**NURTURING CRITICAL
AND CREATIVE THINKERS
THROUGH INQUIRY-BASED
TEACHING AND LEARNING IN
EARLY CHILDHOOD CARE AND
EDUCATION**



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Acronyms

4Cs	Critical thinking, creativity, communication, collaboration (21st century skills)
4IR	Fourth Industrial Revolution
5Es	Engage, Explore, Explain, Elaborate and Evaluate (Teaching and Learning Model/Instructional Model)
ANPS	Anuban Nakhon Pathom School (Thailand)
ARNEC	Asia-Pacific Regional Network for Early Childhood
CPDD	Curriculum Planning and Development Division (MOE, Singapore)
DepEd	Department of Education (Philippines)
ECCE	Early Childhood Care and Education
ECCD Council	Early Childhood Care and Development Council (Philippines)
ESL	English as Second Language
FGDs	Focus Group Discussions
IBSE	Inquiry-Based Science Education
IBTL	Inquiry-Based Teaching and Learning
ICT	Information and Communication Technology
IPC	International Primary Curriculum
IPST	Institute for the Promotion of Teaching Science and Technology (Thailand)
K to 12	Kinder through Grade 12 (Philippines)
KIIs	Key Informant Interviews
LAMAP	La main à la pâte (a French foundation)
MOEs	Ministries of Education (Brunei Darussalam Malaysia, Singapore, Thailand, Vietnam)
MT4T	Mobile Technology for Teachers

P4C	Philosophy for Children
PAL	Programme for Active Learning (Singapore)
PBM	Paaralan ng Buhay ng Maabay (Philippines)
PLC	Professional Learning Community
SDG	Sustainable Development Goal
SEA	Southeast Asia
SEAMEO	Southeast Asian Ministers of Education Organization
SEAMEO INNOTECH	Southeast Asian Ministers of Education Organization Regional Center for Educational Innovation and Technology
SKJ	Sekolah Kebangsaan Jalan 3 (Malaysia)
SKPP8	Sekolah Kebangsaan Putrajaya 1, Presint 8 (Malaysia)
SMSS	Seri Mulia Sarjana School (Brunei Darussalam)
SNP	Supervised Neighborhood Play (Philippines)
SPN 21	Sistem Pendidikan Negara Abad Ke-21 (National Education System for the 21st Century, Brunei Darussalam)
SRKMG	Sekolah Rendah Kampong Mata-Mata Gadong (Brunei Darussalam)
STEM	Science, Technology, Engineering and Mathematics
TEIs	Teacher Education Institutions
TPR	Total Physical Response
UNESCO	United Nations Educational, Scientific and Cultural Organization

FOREWORD



In September 2014, the Southeast Asian Minister of Education signed a joint statement on the education agenda for the region. The 20-year agenda identified seven priority areas to be pursued by the Southeast Asian Ministers of Education Organization (SEAMEO) from 2015 to 2035. One of the seven priority areas is “adopting a 21st century curriculum”...that will be needed to effectively respond to the changing global context, and more particularly, to the ever-increasing complexity of the Southeast Asian economic, socio-cultural, and political environment.

As one of the 24 specialist institutions of SEAMEO, the Regional Center for Educational Innovation and Technology (SEAMEO INNOTECH) embraces the seven priority areas and has built around it the Center’s Ninth Five-Year Development Plan (9th FYDP) covering the period 2016-2021. One of the Center’s thematic areas under the 9th FYDP – inclusive quality education – supports development of solutions and provision of learning services focused on helping Ministries of Education enhance and sustain improvement in quality of learning outcomes, including strengthening 21st century learning within the context of Southeast Asia.

Under this thematic area, SEAMEO INNOTECH embarked on the study, ***“Nurturing Critical and Creative Thinkers through Inquiry-Based Teaching and Learning in Early Childhood Care and Education,”*** to look at examples of how inquiry-based teaching and learning (IBTL) is delivered in learning sessions with children ages three to eight. IBTL is a pedagogy that encourages students to learn by exploring, investigating, analyzing and asking questions. The practice helps hone the learner’s critical thinking, creativity and imagination. The study looks at the various factors contributing to IBTL, such as national and school-based policies, learning materials, learning environment, parental engagement, teacher preparation, assessment, and monitoring and evaluation. It also probes into how inquiry-based teaching and learning helps foster the natural state of inquisitiveness and creativity of young learners.

The study offers several real-life examples of IBTL as practiced in some schools in selected Southeast Asian countries. It is hoped that these examples can serve as models that can be replicated or adapted to support development of 21st century skills which are critical in gearing up young learners in Southeast Asia for the Fourth Industrial Revolution and increasing regional and global integration.


Ramon C. Bacani
Center Director



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SEAMEO INNOTECH (2016)

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The Center is grateful to the school heads, teachers, students, and parents of the following schools who unselfishly imparted their first-hand experiences in practicing IBTL in their own school-communities:

- ◎ **Brunei Darussalam:**
 - Sekolah Rendah Kampong Mata-Mata Gadong
 - Sekolah Rendah Panaga
 - Seri Mulia Sarjana School
 - Stella's School

- ◎ **Malaysia:**
 - Sekolah Kebangsaan Jalan 3
 - Sekolah Kebangsaan Putrajaya 1 Presint 8

- ◎ **Philippines:**
 - Paaralan ng Buhay ng Maabay
 - Supervised Neighborhood Play (Block 10 and Smart Tower)
 - Manila Waldorf

- ◎ **Singapore:**
 - Punggol View Primary School

- ◎ **Thailand:**
 - La Orutis Demonstration School
 - Anubhan Nakhom Pathom
 - Yooyenwitthaya School

- ◎ **Vietnam:**
 - Dong Da Preschool
 - Kim Lien Primary School
 - Vietkids School

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EXECUTIVE SUMMARY

For decades, the top-down approach to teaching and learning has been the accepted norm in many schools across Southeast Asia. The teacher is regarded as the bearer of information, the source of knowledge, and the undisputed authority in the sphere of education. Students, on the other hand, are expected to master content by paying attention, following directions, and absorbing and retaining information imparted by the teacher. To a large extent, this pedagogical approach has thrived in Southeast Asia because of its compatibility with the Asian culture of respect for hierarchy.

Educators, education scholars and cognitive scientists, however, note that this traditional teacher-oriented approach to learning has become less effective in the face of today's vastly transformed environment. Twenty-first century society is fast-paced, globally interconnected, and technology-driven, especially at the wake of the Fourth Industrial Revolution that ushers in more complex interconnection of technology, society, and even the human bodies. For individuals to successfully integrate in 21st-century life, they must be able to think critically and creatively, solve problems, communicate ideas, and collaborate with others. They must be flexible, adaptable, curious and eager to learn, culturally literate, and socially aware. Inquiry-based teaching and learning (IBTL) has been proposed as an alternative path for cultivating many, if not all, of these 21st-century skills.

IBTL is a pedagogical approach in which students construct knowledge by pursuing answers to questions which are often open-ended or by working out problems. They are encouraged to explore, investigate, analyze and ask more questions. The role of the teacher is to facilitate or guide the students' activities and discussions, prompt them to extend or deepen their thinking, direct them to relevant resources, and create a supportive learning environment. While the outcome of the inquiry is important, IBTL places as much value on the process of inquiry. It is through the inquiry process that students hone critical thinking or the ability to organize, evaluate, connect and synthesize data and information; exercise their creativity and imagination; and develop their ability to identify and assess various options to tackle the problem and take necessary action.

Against this backdrop, the Southeast Asian Ministers of Education Organization Regional Center for Educational Innovation and Technology (SEAMEO INNOTECH) embarked on a descriptive research project on "Nurturing Critical and Creative Thinkers through Inquiry-based Teaching and Learning in Early Childhood Care and Education" aimed at documenting various inquiry-based teaching and learning practices in selected learning institutions (i.e., schools and community learning centers) in selected countries in Southeast Asia. Anchored on the central question, "How does inquiry-based teaching and learning nurture critical and creative thinking skills of children ages three to eight years in selected Southeast Asian learning institutions?" the research project specifically aimed to:

1. Document selected learning institutions' inquiry-based teaching and learning policies and practices at the early childhood care and education (ECCE) level (for children ages 3 to 8). The study considered IBTL practices that are not subject-specific.
2. Explore the variables that affect/underpin the practice of IBTL in ECCE, such as curriculum, enabling policies, teaching-learning methodology that includes partnership of parents and teachers, students' learning assessment, learning materials, and learning environment.
3. Propose possible approaches in inquiry-based teaching and learning that may be contextualized and replicated by other interested pre-school or early grade learning institutions.

School heads, teachers, students, and parents from 16 schools from Brunei Darussalam, Malaysia, the Philippines, Singapore, Thailand and Vietnam participated in the study. Visits, key informant interviews and focus group discussions were held in selected schools. Representatives from a teacher education institution and Ministries of Education from said countries were also interviewed.

IBTL Practices

One of the most recognized and applied IBTL models is the 5E Instructional Model (Engage, Explore, Explain, Elaborate and Evaluate). The study adapted the model and combined it with other related research on IBTL to develop the IBTL Process Framework. The framework is divided into three fundamental phases, namely: Phase I: Engagement, Phase II: Exploration, Explanation, and Elaboration, which are grouped together in one phase, and Phase III: Evaluation. Phase IV: Modification, a non-compulsory phase, is added as an opportunity for teachers to enhance the teaching approach for a specific lesson, either in case the lesson needs to be repeated for the same class or for implementation in other future classes. **Section III** of the research report illustrates the phases of the IBTL Process Framework, while **Section IV** details the various IBTL practices documented in selected schools in the six countries mentioned above.

Research Findings

The following outlines key findings from the study:

- 1. National Policy Environment.** The governments of Brunei Darussalam, Malaysia, Philippines, Singapore, Thailand and Vietnam all initiated measures in the past decade to align their respective educational systems with 21st century requirements. They recast their educational frameworks and overhauled their basic education curriculum to place stronger emphasis on cultivating their young citizens' critical thinking skills, creativity and innovation, problem-solving abilities, communication skills, socio-cultural awareness and participation, and other life skills. These initiatives are anchored on laws, education development plans/blueprint, and curriculum framework.

However, while there is a clear preference for IBTL as an alternative learning method, most of the countries' national policies and plans fell short of indicating how the teachers will be capacitated or trained to use IBTL to deliver content. Only the Brunei Darussalam education ministry provided details on its professional enhancement plans for teachers.

In addition to the lack of details on teacher preparation, it is worth noting that except for Singapore and Malaysia, none of the countries have specified in their national plans how student assessments will be done under an inquiry-based learning environment.

- 2. School Policy on IBTL.** For the 10 public schools included in the study, state policy is the impetus for integrating inquiry as a pedagogical approach. The six private schools in the study, on the other hand, had more autonomy in terms of the timetable for introducing IBTL, the model used, and the level and content area where IBTL would be practiced.
- 3. Type of IBTL Practiced.** Research results show that there is no one type or model of IBTL practiced in the schools under study. Some schools follow the 5E model, while a few other schools are committed to the project-based approach. Still, other schools were unable to define the type of IBTL that their teachers are pursuing. On further examination, these are schools that have no explicit policy on IBTL and/or have no IBTL-oriented training program for teachers, but nonetheless encourage their teachers to use inquiry as one of their instructional strategies. Teachers with no formal training but were into IBTL were mostly self-taught and gained knowledge from their own supervisors/coordinators or from fellow teachers who are trained.

4. **Level and Content Area.** Most of the schools have incorporated IBTL as early as pre-school, although some were unclear on whether it is confined to pre-school or applied in other grades as well. At least three public schools are using the inquiry approach to teach science; this practice is evidently a reflection of many Southeast Asian governments' policy to promote the sciences toward the production of more STEM graduates. Other schools ventured to use IBTL or elements of inquiry in other learning areas, such as math, reading, language, and the arts. Two private schools, meanwhile, have integrated the inquiry mode in all learning areas.
5. **Student Evaluation or Assessment.** None of the schools have instituted a systematic method for assessing the specific outcomes of IBTL. The benefits mentioned by school administrators, teachers and parents are all casual/informal observations.
6. **Benefits and Challenges.** All the school administrators/representatives interviewed reported observing positive behavioral changes in children exposed to the inquiry approach. Most mentioned that children seemed to have gained more confidence in communicating with others; became more independent thinkers and learners; and were more observant, inquisitive and adventurous. Some school administrators also mentioned that IBTL made learning fun and enjoyable for children.

Most parent-informants positively view the inquiry-based approach since they reported observing noticeable changes in their children. Moreover, student-informants generally said that they enjoy and learn from IBTL activities in their schools. Children who were interviewed for this study mentioned that they had fun and learned new things by doing hands-on activities (science experiments, cooking, writing on the board, art activities), listening to stories, using picture cards, and playing games.

However, effective implementation of IBTL is hampered by the following factors:

- **Resources** - lack of space and other learning resources for IBTL activities, such as science apparatus and internet connectivity
- **Teacher attitude, preparation and experience** - lack of experience and preparation; lack of adequate knowledge and training on the IBTL process
- **Complexity of the inquiry process** - planning lessons, identifying and organizing interesting activities, preparing visual aids and other learning materials, and crafting appropriate questions are all time-consuming tasks; limited time allocation for each subject, which does not support the long-drawn process of inquiry practice
- **Parental knowledge and attitude** - lack of technological knowledge, unfamiliarity with the syllabus, and necessity of doing research to address the questions posed by their children

Section V discusses in detail the research findings.

Recommendations

The study offers the following recommendations drawn from the various discussions with school heads, teachers, students, parents, representatives from teacher education institutions, and other education authorities during the study.

- 1. Teacher Preparation.** National education authorities need to facilitate the convergence of efforts by Ministries of Education and teacher education institutions toward the goal of institutionalizing IBTL as a teaching practice. At the pre-service level, the inquiry process should be highlighted as an approach for learning, transitioning to the immersion of student-teachers on the application of IBTL theories to diverse learners in different contexts in laboratory and regular schools. Regular in-service training programs (i.e., professional development), such as distance education and school-based programs, for teachers and school administrators are likewise suggested to be offered collaboratively by national education authorities. The school head plays an important role as instructional leader in mentoring and coaching, especially in this type of training. Hence, instructional leadership skills of school heads, in areas such as leading curriculum implementation and contextualization, delivering planned learning outcomes, local language materials development, and instructional mentoring/coaching should also be strengthened. Knowledge-sharing among teachers and school heads/supervisors by establishing IBTL communities of practice; initiating and sustaining personal and professional learning networks through mobile devices, collaborative applications, blogs and social media; conducting lesson studies or learning action cells; and holding and participating in learning exchange programs can also be introduced to support professional development of both teachers and school administrators.

Education authorities are also encouraged to integrate the newly developed ECCE Teacher Competency Framework for Southeast Asia and the Regional Competency Framework for Teachers in Southeast Asia in pre-service and in-service training programs (i.e., professional development) for ECCE teachers. Professional development for teachers should likewise include development of both tangible skills, such as facilitating the development of learners' life and career skills, facilitating learning, preparing appropriate lesson plans in line with the school vision and mission, creating a conducive learning environment, developing and utilizing teaching and learning resources, developing higher order thinking skills, and enhancing and integrating ethical and moral values in all learning areas, and soft skills including rekindling and sustaining passion for teaching.

- 2. Learning Materials.** Schools intending to pursue IBTL should identify and invest in the required resources and make these resources available to children to enrich their learning experience. Teacher-made materials or improvised teaching materials using locally available materials can also be applied if financial support is limited. It is also recommended for education authorities and teachers to closely examine how technologies support and impact the inquiry-based learning process. A useful resource is SEAMEO INNOTECH's Mobile Technology for Teachers (MT4T), which orients teachers on the features of and the educational tools available in mobile gadgets (i.e., smart phones and tablets). The resource kit includes learning packets on digital citizenship that teachers can use to help children develop critical thinking and socio-emotional skills, and to learn how to overcome cyber risks and use ICT for learning, adapting and creating.

- 3. Learning Environment.** Creating a conducive, learner-centered environment is one of the competencies identified in the competency frameworks for Southeast Asian school heads and teachers. Apart from identifying learning spaces where class activities (e.g., exploration, outdoor games) can be held, it is important to ensure that the learning environment stimulates inquiry and critical thinking and fosters love for learning. Pictures, maps, posters and educational toys are just some materials that can be made available for learners inside the classroom or within the learning area to facilitate learning. The learning environment should also be maintained as a safe space for children – physically safe (e.g., clean and green, free from hazardous materials), socially safe (e.g., free from bullying and discrimination) and emotionally safe (e.g., children are free to ask questions without prejudice) – to help enrich the learning experience.
- 4. Parental Engagement.** Schools and teachers should be made aware of and consider the limitations expressed by parents (lack of time, lack of technological know-how to help children with their projects) when they develop their IBTL program. Schools should try to engage the child’s parental figure, be it a relative or a caregiver. Teachers are encouraged to further reach out to, and if need be, provide extra guidance to the child. It is important to orient parents (or the parental figure) on IBTL to familiarize them on the goals and strategies of IBTL; to clarify and manage their expectations, misconceptions and/or apprehensions; and to help them better understand their roles as learning partners of the school.
- 5. Assessment of Children’s Progress.** Further study needs to be undertaken on how practitioners of IBTL in Southeast Asian schools assess children’s progress. In general, involving students in their own assessment is a principle of IBTL. This principle is consistent with formative assessment methods which rely on constant and reciprocal feedback between the student and the teacher. Moreover, IBTL practitioners employ a range of tools and strategies that allow them to make a more holistic assessment of the breadth and depth of each student’s learning for the duration of the course or class. These include authentic assessment strategies (e.g., community projects, performances, stories, presentations, audio-visual work), non-traditional techniques (e.g., student portfolio, which typically includes student journals, reflection pieces, and samples of best work), use of rubrics to assess student outputs, peer assessment, informal interviews, and class observations. Since national education policies still place much importance on standardized tests to measure learning outcomes, schools and teachers committed to IBTL are advised to design an assessment system that balances national requirements with student-centered/student-inclusive and holistic assessment that is aligned with the inquiry-based approach.
- 6. The 5E Instructional Model and Other Instructional Approaches.** Informants from the study note that the 5E Instructional Model and other permutations of IBTL (e.g., problem-based, project-based learning) encourage children’s curiosity, stimulate thinking, foster imagination, and give children opportunities to explore new ways of learning and ask questions to seek knowledge. There is also consensus that through simple experiments, learners develop the habit of investigating and validating the information they come across. Moreover, informants attest to the socio-emotional benefits of IBTL; that is, it hones interpersonal skills; instills different mindset; builds initiative, independence and self-direction; improves self-confidence; and builds learning to learn skills among children.

For the 5E model and other IBTL instructional approaches to be effective, schools should be able to recognize how these approaches can be contextualized to suit their realities taking into consideration the differences in culture, available resources, teacher preparation and national or school-level policies on IBTL.

Further studies and documentation are also needed to be able to directly link better academic performance and positive behavior with the inquiry approach, and to determine the sustainability of its benefits.

- 7. Enabling Policies.** Apart from national policies, schools should also develop their own policies on IBTL that are aligned with the national and/or regional/provincial/district policies, guidelines and standards. The critical role of the school head in instructional leadership, managerial leadership, strategic thinking and innovation, stakeholder engagement, and including personal excellence, should be underscored to support IBTL. Schools (and teachers) intending to introduce IBTL or expand its scope will need to craft a comprehensive plan, which identifies what IBTL model to follow (based on the school's assessment and experience of what works and considering the school's philosophy and culture); in which grades/levels and learning areas (i.e., specific lessons or competencies) to integrate the inquiry approach; how the inquiry approach can be integrated into the existing curriculum; what resources are available to teachers and students; what capacity building do teachers require to practice IBTL; and how to assess student progress. In addition, schools should be able to commit to investing in the in-service training of teachers and other resources needed to support and sustain IBTL practice.
- 8. Monitoring and Evaluation.** Education authorities should develop a monitoring and evaluation framework for IBTL practice—one that can be used across schools—which includes indicators to track changes/progress, methods and frequency of data collection, and method of analyzing data. Initial data from different implementing schools, such as documentation of practices, can be utilized to design the framework.

Action research, at the national or school level, may also be undertaken not only to establish tangible impact, but also to identify gaps and weaknesses in improving learning outcomes. National education authorities are encouraged to partner with teacher education institutions, schools, teacher associations, parent associations, and other stakeholders to define research priorities and facilitate the conduct of research. One important area of research is to determine the factors affecting children's engagement with IBTL, such as the language with which to effectively deliver inquiry-based learning. Other areas of research may include teacher preparation, actual day-to-day IBTL practices, assessment methods, and link between child-rearing practices and pre-disposition for inquiry, to name a few. These studies can become part of a national data network on IBTL, which can provide wider understanding of and lead to progress in the field.

Evaluation studies that provide evidence of positive impact are particularly critical if IBTL advocates and practitioners are to convince schools to integrate the inquiry practice in their system or to widen its scope to include all grades or learning areas (not just the sciences) for both monograde and multigrade schools.

Detailed recommendations can be found in **Section VI**.

Conclusion

Developing higher order thinking skills as part of the 21st-century learning is one of the education goals in all countries where the study was conducted. All participating countries recognize IBTL as one of the promising approaches that can be used to enhance critical and creative thinking skills among children. Each country uses IBTL in different ways depending on their context, available resources, level of teacher readiness, and existing policies. The study also reveals that IBTL can be practiced not only in science but also in other learning areas such as mathematics, language, literacy and numeracy, arts and crafts, and life skills. IBTL promotes holistic development of children, imbued with critical thinking, creativity and other 21st century skills.

Acknowledging the benefits derived from the practice as shared by selected Southeast Asian schools that have embraced the inquiry approach, IBTL is an area that national education authorities are suggested to systematically investigate to scale-up the reported encouraging results among children. It is beneficial to inculcate the inquiry practice among children at an early age to nurture their natural state of inquisitiveness. Ultimately, these fundamental skills will prepare them for future jobs that are needed to propel the society's growth in the wake of the Fourth Industrial Revolution and increasing regional and global integration.



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KRISTINE CLEMENTE-JIMENEZ (2016)

I. OVERVIEW

For decades, the top-down approach to teaching and learning has been the accepted norm in many schools across Southeast Asia. The teacher is regarded as the bearer of information, the source of knowledge, and the undisputed authority in the sphere of education. Students, on the other hand, are expected to master content by paying attention, following directions, and absorbing and retaining information imparted by the teacher. To a large extent, this pedagogical approach has thrived in Southeast Asia because of its compatibility with Asian culture. With respect for hierarchy deeply ingrained in the culture, Southeast Asian students are inclined to show deference and obedience towards their *guru* (Malay), *guro* (Filipino) or *giáo viên* (Vietnamese).

Educators, education scholars and cognitive scientists, however, note that this traditional teacher-oriented approach to learning has become less effective in the face of today's vastly transformed environment. Twenty-first century society is fast-paced, globally interconnected, technology-driven, and beset with complex problems. Traditional classrooms—with their emphasis on the central role of the teacher, standardized instruction and mastery of factual knowledge—are more suited to training students for yesterday's economy and society rather than preparing them to navigate present-day realities and future challenges in the wake of the Fourth Industrial Revolution (4IR) that ushers in more complex interconnection of technology, society, and even the human bodies (Schwab, 2016). For individuals to successfully integrate in 21st-century life, they must be equipped with different skill-sets and competencies. They must be able to think critically and creatively, solve problems, communicate ideas, and collaborate with others. They must be flexible, adaptable, curious and eager to learn, culturally literate, and socially aware. The education sector, on the other hand, needs to reboot its learning system to prepare the ground in cultivating many, if not all, of these 21st-century skills that are significantly employed in future jobs in the sphere of 4IR.

Inquiry-based teaching and learning (IBTL) has been proposed as an alternative path for nurturing these 21st-century skills among children in their early stage of development. The development of IBTL was influenced by several 20th-century studies on how children learn, their interests and motivations, and their school achievement. Philosopher and educator John Dewey, for example, found that children are naturally inquisitive and learn best by “doing.” He observed that formal schooling has stifled children's innate curiosity; thus, he proposed an alternative instructional approach that encourages children to explore and actively participate in their own learning.

No one has ever explained why children are so full of questions outside of the school (so that they pester grown-up persons if they get any encouragement), and the conspicuous absence of display of curiosity about the subject matter of school lessons. Reflection on this striking contrast will throw light upon the question of how far customary school conditions supply a context of experience in which problems naturally suggest themselves. No amount of improvement in the personal technique of the instructor will wholly remedy this state of things. There must be more actual material, more stuff, more appliances, and more opportunities for doing things, before the gap can be overcome. And where children are engaged in doing things and in discussing what arises in the course of their doing, it is found, even with comparatively indifferent modes of instruction, that children's inquiries are spontaneous and numerous, and the proposals of solution advanced, varied, and ingenious. (Dewey, 1916)

Similarly, psychologist Jean Piaget observed that children are active learners. He noted that children are constantly constructing (and reconstructing) their knowledge of the world as their brain matures and as they interact with their environment and experience new things. Piaget proposed allowing children to learn by exploring and discovery as this leads to deeper understanding and knowledge retention.

Children should be able to do their own experimenting and their own research. Teachers, of course, can guide them by providing appropriate materials, but the essential thing is that in order for a child to understand something, he must construct it himself, he must re-invent it. Every time we teach a child something, we keep him from inventing it himself. On the other hand that which we allow him to discover by himself will remain with him visibly. (Piaget, 1972)

Inquiry-Based Teaching and Learning: Principles and Practices

IBTL, also often referred to as inquiry-based learning or inquiry-guided learning, is a pedagogical approach in which students construct knowledge by pursuing answers to questions which are often open-ended or by working out problems. The students may address the question/problem by conducting experiments, participating in hands-on activities, joining group discussions and exercises, and using other research methods. They are encouraged to explore, investigate, analyze and pose more questions.

The role of the teacher is to facilitate or guide the students' activities and discussions, prompt them to extend or deepen their thinking, and direct them to relevant resources. The teacher is also expected to create a supportive learning environment so that students feel safe and confident to participate in class activities and articulate their views and ideas.

While the outcome of the inquiry is important, IBTL places as much value to the process of inquiry. It recognizes that knowledge is ephemeral and is constantly being updated, and the more crucial factor is for students to understand how knowledge was arrived at. It is through the inquiry process that students hone critical thinking or the ability to organize, evaluate, connect and synthesize data and information; exercise their creativity and imagination; and develop their ability to identify and assess various options to tackle the problem and take necessary action. The IBTL process also promotes teamwork as it encourages students to communicate and collaborate with others.

IBTL is a term that encompasses various models or strategies that apply the principles of inquiry. One of the most recognized and applied IBTL models is the 5E Instructional Model (Bybee, et al., 2006; Duran and Duran, 2004). The 5Es—Engage, Explore, Explain, Elaborate and Evaluate—are said to represent the natural cycle or progression of inquiry. Teachers structure their lesson plan along this cycle so that students gradually build on their knowledge and skills. The first stage involves surfacing the students' prior knowledge and experiences, while the succeeding stages involve giving students an opportunity to investigate and create their own understanding of the phenomenon or issue at hand; introducing or clarifying concepts and ideas; and promoting the application of new knowledge in other contexts (Bybee, 2015). This model was originally developed by Rodger Bybee for teaching science subjects but has since been applied in other learning areas.

Another leading inquiry-based approach is Philosophy for Children (P4C). Developed by Matthew Lipman (2003), P4C encourages children to ponder philosophical concepts and ideas (e.g., equality, freedom life, death), and use reason to justify their view or position. Teachers and their students are said to form a "community of inquiry." The inquiry session is initiated through the introduction of a stimulus, such as a story, music, object, image, video or activity, followed by the construction of open-ended and stimulating questions with philosophical potential. With the guidance of the teacher, students select

one question that they will tackle in class. Students are encouraged to articulate their thoughts and opinions, relate experiences, take a position and present sound arguments, and weigh in on opposing or alternate views. While P4C is commonly used by schools as a strategy for teaching values or moral education, it has also been applied in other learning areas, such as language and science.

IBTL is also associated with two other approaches—the problem-based learning and the project-based learning. Problem-based learning is said to be a subset of IBTL (Kahn and O’Rourke, 2004; Spronken-Smith et al, 2008). In this IBTL permutation, students are presented with a real-world scenario or dilemma for which there is no one solution or correct answer. Students are usually divided into groups and asked to deliberate on a given problem and work collectively to propose creative solutions. Project-based learning, meanwhile, is an approach in which knowledge transfer or learning occurs while completing a project or activity (Larmer, Mergendoller and Boss, 2015; Bell, 2010). The project output or product is meant to serve as a practical solution to a problem or an application of the students’ newly-acquired knowledge and skills in the real world. Projects are often completed through collaboration among students or peers.

Inquiry in Early Childhood Care and Education

The existing body of literature on early childhood care and education points to a common finding—that human brain develops faster and is more receptive to learning during early childhood than at any other time in life. From the first year of life, children are constantly processing information and constructing meaning based on what they see, hear, feel, taste and touch, and based on their interaction with others (Bransford, et al, 2000; Institute of Medicine and National Research Council, 2015). The first three to five years of life are particularly crucial as it is during this period that the brain’s core wiring, which is needed for a wide range of cognitive functions and lays the foundation for more complex learning, is formed (Bransford, et al, 2000; Winter, 2010; Harvard University, n.d.; Sixpence Early Learning Fund, n.d.).

Studies found that children who receive appropriate stimulation and quality learning early in life become successful and capable adults. They perform well in school, pursue thriving careers and earn higher incomes (Barnett, 1998; Ruhm and Waldfogel, 2011; Australian Council for Educational Research, 2016; McCoy, et al, 2017). They are also healthier and more socially integrated (Winter, 2010; Vandenbroeck, et al, 2018).

Proponents of IBTL aim to capture this critical window in a child’s life by introducing inquiry as an approach to teaching and learning starting at the pre-school level. The inquiry approach gives children space to express their innate curiosity and explore and discover the world around them. By engaging their senses through exploration, play and hands-on activities, children learn more meaningfully. They process and absorb information better and understand concepts more deeply, facilitating knowledge retention and even application.

The inquiry approach also takes into consideration and builds on the prior knowledge of children. Hence, their misconceptions, pre-conceived ideas and other stored erroneous information are disproved or corrected more effectively through questioning techniques. Since learning is cumulative, having a strong conceptual foundation and factual knowledge is critical for the absorption of more complex knowledge and mastery skills.

IBTL is also capable of instilling important mental habits in children, such as a passion for learning, inclination to ask questions, use of scientific approach to analyze problems and find solutions, use of logic in arguments, and openness to new ideas and experiences, among others. These habits could change their character and set them up for life and equip them to rise to the challenges and opportunities of 21st-century life.

Linking Inquiry to 21st-Century Skills

Several empirical studies in various countries lend support to the link between inquiry-based education and 21st-century skills, such as critical thinking, communication, and problem solving. For example:

- Lehrer and Chazan, in a 1998 study, noted that the alternative approach to teaching geometry “helped second-grade children to represent or visualize three-dimensional forms in ways that exceeded the skills of a comparison group of undergraduate students at a leading university” (Bransford et al, 2000, p. 12).
- Conezio and French (2002), who developed the ScienceStart! Curriculum observed that inquiry fosters the development of literacy and language skills.
- Wilson, et al (2009), who conducted a controlled experiment involving 60 students (aged 14-16) from 24 US schools, noted that the group that was taught science content using the 5E Instructional Model performed better than the group that was taught with the usual teaching strategies in the areas of non-routine problem solving, complex communication, and systems thinking.
- A 2009 study by Simsek and Kabapinar (2010) showed a significant increase in the conceptual understanding and scientific process skills of fifth graders in a private school in Turkey after an eight-week exposure to the inquiry approach.
- A study undertaken by a research team from Durham University, United Kingdom (2015) found that the year-long exposure of Key Stage 2 students (aged 7 to 11) to P4C’s community of inquiry approach resulted in observed changes in students’ behavior, such as greater confidence to ask questions and speak in class and improved ability to communicate with their peers during group tasks.

There are also studies showing that the inquiry approach leads to better understanding of content, which in turn translates to higher achievement levels in school. For instance:

- Schneider, Krajcik, Marx, & Soloway (2002) found in their study that tenth and eleventh grade students who received project-based science instruction scored higher than the national sample on 44 percent of the science test items in the 12th-grade 1996 National Assessment of Educational Progress.
- Maxwell, Lambeth and Cox (2015) showed that after six weeks of science instruction using IBTL, fifth grade students in one class scored higher on content knowledge and showed greater level of engagement than their counterparts who received traditional instruction.

II. THE RESEARCH PROJECT

As the body of research on the benefits of IBTL continues to grow, the inquiry approach has also gained traction among Southeast Asian schools. However, little is known about the enabling environment for and actual practice/implementation of IBTL among early grade learners in Southeast Asia.

Rationale

The Southeast Asian Ministers of Education Organization Regional Center for Educational Innovation and Technology (SEAMEO INNOTECH) thus embarked on a research project titled “Nurturing Critical and Creative Thinkers through Inquiry-based Teaching and Learning in Early Childhood Care and Education.” The research project responds to one of the Center’s priority areas under its 9th Five-Year Development Plan 2016–2021, particularly supporting current and emerging needs of Southeast Asian learners in the context of educational reforms, i.e., the development of 21st century skills.

The research project also aligns with the SEAMEO 7 Priority Areas for Southeast Asian Education Agenda 2015–2035, focusing on Priority 7: Adopting a 21st Century Curriculum. Moreover, the research supports Sustainable Development Goal (SDG) 4 in providing learning opportunities for developing 21st century skills, such as creativity and critical thinking, among students.

Objectives

The study intends to document various inquiry-based teaching and learning practices in selected learning institutions (e.g., schools, community learning centers) for early grade learners in selected countries in Southeast Asia.

Specifically, the study aims to:

1. Document selected Southeast Asian learning institutions’ inquiry-based teaching and learning policies and practices at the early childhood care and education (ECCE) level (for children ages 3 to 8). The study considered IBTL practices that are not subject-specific;
2. Explore the variables that affect and underpin the practice of IBTL in ECCE in selected Southeast Asian countries, such as curriculum, enabling policies, teaching-learning methodology that includes partnership of parents and teachers, students’ learning assessment, learning materials, and learning environment; and
3. Propose possible approaches in inquiry-based teaching and learning that may be contextualized and replicated by other interested pre-school or early grade learning institutions.

Methodology

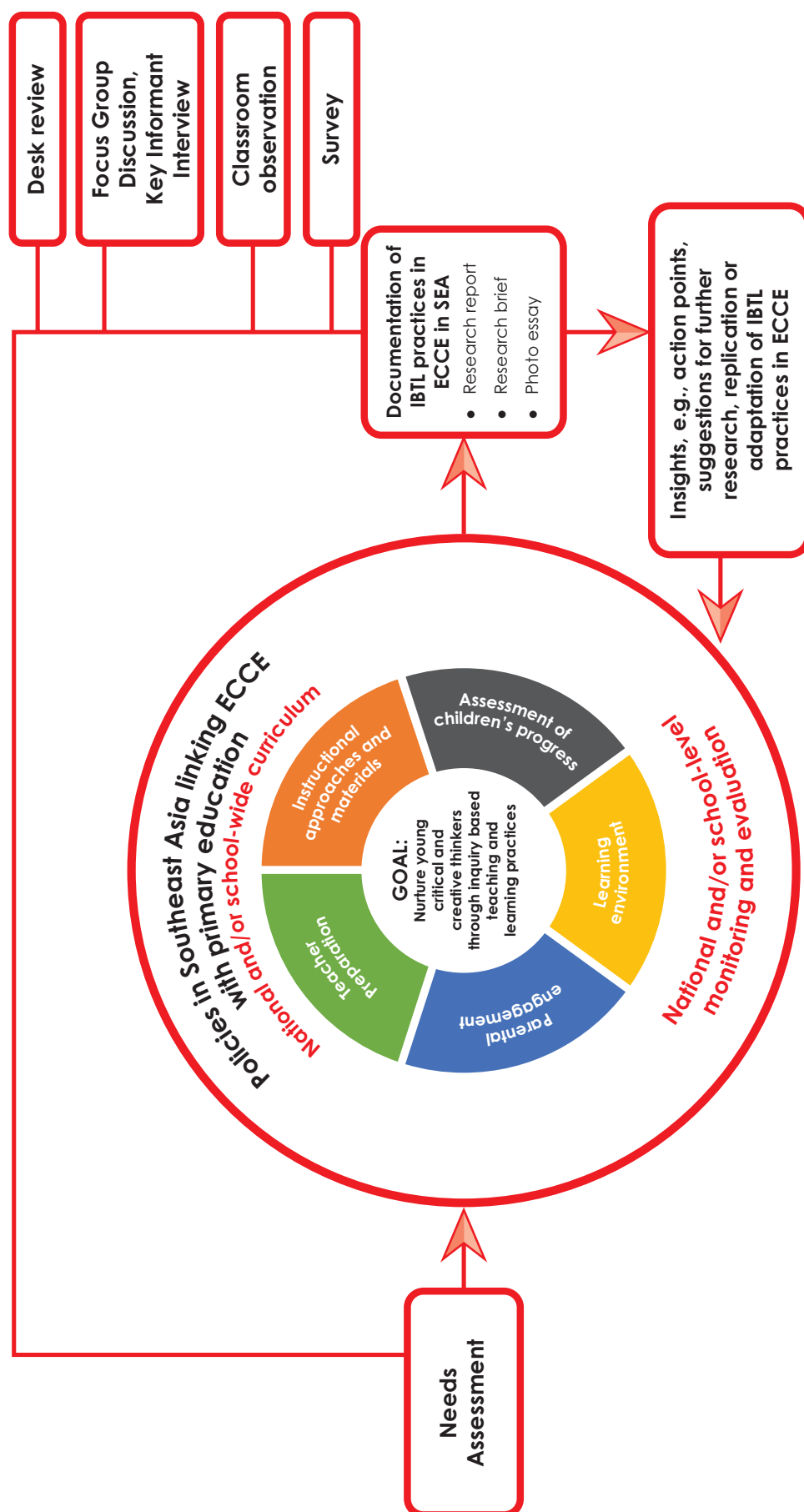
This descriptive research pondered on the central question: How does inquiry-based teaching and learning nurture critical and creative thinking skills of children ages 3 to 8 years in selected Southeast Asian learning institutions? The study posits that exposing children as early as ages 3 to 8 to inquiry-based learning gives them avenue to express their natural curiosity, makes inquiry a mindset and learning a lifelong habit, and lays a solid foundation for critical thinking and other higher order thinking skills.

The study also posits that IBTL in ECCE that is not anchored on a specific subject area and provides equal importance to the process and content allows for smooth transition and continuity of learning from pre-school, to early primary grades, to succeeding educational levels.

The need to strengthen elements that support effective early childhood care and education was articulated in a report (2012) by the Asia-Pacific Regional Network for Early Childhood (ARNEC). These elements include (1) continuity between pre-primary and early primary grades, (2) teacher preparation, (3) instructional approaches and materials, (4) assessment of children's progress, and (5) monitoring and evaluation. Moreover, literature suggests that (6) learning environment and (7) parental engagement are also crucial to achieve effective ECCE. Although focusing primarily on instructional approaches and materials, the study looked at how these seven elements contribute to nurturing young critical and creative thinkers through inquiry-based teaching and learning in selected schools in selected countries in Southeast Asia.

Figure 1 illustrates the conceptual framework of the study.

Figure 1: Conceptual Framework of the IBTL Study



Source: SEAMEO INNOTECH (2016)

The study carried out a literature review; surveyed selected Ministry of Education (MOE) officials, school heads and teachers; and visited selected pre/primary schools from January to March 2016 to conduct focus group discussions (FGDs), key informant interviews (KIIs), and classroom observations in selected countries in Southeast Asia.

Research instruments, such as interview guide questions, school and teacher profile survey forms, and classroom observation checklist were used to facilitate data gathering (see Annex A). Key informants included key officials from national/sub-national ECCE institutions and representatives of MOEs involved in the provision of ECCE; representatives from teacher education institutions (TEIs); and heads, teachers, parents, and students of selected learning institutions.

The development of research instruments and selection of informants were guided by variables that underpin the practice of IBTL in ECCE. These variables were based on the ECCE elements mentioned in the ARNEC report and related literature.

The main outputs of the study include this research report, a summary of the report or the research brief, and a photo essay.

Insights gained from the study could be used as action points to inform future research agenda, and to modify, replicate or adapt various IBTL practices to effectively support ECCE in Southeast Asian countries.

Scope and Limitations of the Study

The study covered selected schools and ECCE institutions in six SEAMEO Member Countries, namely, Brunei Darussalam, Malaysia, Philippines, Singapore, Thailand, and Vietnam. Literature review reveals that these countries have strongly institutionalized ECCE in their basic education curriculum toward improving access of all children to quality education (more detailed discussion under **Section IV**).

A total of 16 public and private schools and ECCE institutions were selected through the assistance of MOEs (**Table 1**). All selected schools have been practicing IBTL for at least a year. The research team visited these learning institutions to conduct FGDs, KIIs, survey administration and classroom observations.

Table 1: Participating Schools/Classes in the IBTL Study

Schools/Centers	School/Center Profile (as of 2016)	Children's Ages	Subject Areas	Learning Objectives
Brunei Darussalam				
Sekolah Rendah Kampung Mata-Mata Gadong	Type: Public Year established: 1978 Source/s of Funds: Ministry of Education Medium of instruction: Bahasa Melayu, English	7	Science	Investigating health and unhealthy food
Panaga Primary School (Sekolah Rendah Panaga)	Type: Public Year established: 1974 Source/s of Funds: Ministry of Education Medium of instruction: Bahasa Melayu, English	5 to 6	English Language	Producing the sound of the letter "p"
Seri Mulia Sarjana School	Type: Private Year established: 1992 Source/s of Funds: Students' fees Medium of instruction: English	4 to 5	English Language	Producing the sound and writing the form of the letter "c"
Stella's School	Type: Private Year established: 1969 Source/s of Funds: Students' fees Medium of instruction: Bahasa Melayu, English	7	Science	Exploring healthy and unhealthy food
Malaysia				
Sekolah Kebangsaan Jalan 3	Type: Public Year established: 1995 Source/s of Funds: Ministry of Education Medium of instruction: Bahasa Melayu, English	5 to 6	Science	Identifying the basic tastes and parts of the tongue
		8	English Language	Constructing "what" and "why" questions
Sekolah Kebangsaan Putrajaya 1, Presint 8	Type: Public Source/s of Funds: Ministry of Education Medium of instruction: Bahasa Melayu, English	5 to 6	Bahasa Melayu	Combining letters to form words, combining syllables to form words and tracing different letters
Philippines				
Paaralan ng Buhay ng Maabay	Type: Public Year established: 1946 Source/s of Funds: Department of Education Medium of instruction: Filipino, Hiligaynon, English	7 to 8	English Language	Forming compound words
Supervised Neighborhood Play (Block 10 and Smart Tower)	Type: Public community learning center Source/s of Funds: Local government unit Medium of instruction: Filipino	3 to 4	Listening Skills	Discovering modes of transportation in the community
Manila Waldorf	Type: Private	3 to 6	Life Skills	Setting the table and changing one's own clothes

Schools/Centers	School/Center Profile (as of 2016)	Children's Ages	Subject Areas	Learning Objectives
Singapore				
Punggol View Primary School	Type: Public Year established: 2013 Source/s of Funds: Ministry of Education Medium of instruction: English	7 to 8	Outdoor Education	Using senses to investigate signs of life in the garden
Thailand				
Anubhan Nakhon Pathom	Type: Public Year established: 1953 Source/s of Funds: Ministry of Education, local government units Medium of instruction: Thai, English, Standard Mandarin	5 to 6	Science	Investigating the effects of planting without sunlight
Yooyenwitthaya School	Type: Private Year established: 1994 Source/s of Funds: Ministry of Education, students' fees Medium of instruction: Thai, English	4 to 5	Literacy and Numeracy	Identifying, naming and counting the ingredients for cooking pumpkin custard
La-Orutis Demonstration School	Type: Public	3	Mathematics	Learning the concept of weight and weighing scales
Vietnam				
Vietkids School	Type: Private Year established: 2009 Source/s of Funds: Students' fees Medium of instruction: Vietnamese	5 to 6	Life Skills	Simulating different occupations
		6 to 7	Vietnamese Language	Reading and writing words with 'iêp' and 'uôp' sounds
Dong Da School	Type: Public	4 to 5	Arts and Crafts	Creating artworks using different materials
Kim Lien Primary School	Type: Public Year established: 1961 Source/s of Funds: State budget, students' fees Medium of instruction: Vietnamese	8	Mathematics	Understanding the concept of place value of 4-digit numbers

In addition to the common criteria for selection of target schools, the study initially intended to select schools that also reflect the uniqueness of each country's ECCE programs. Examples of country-specific criteria include:

- Brunei Darussalam : active parental engagement; promoting cultural values
- Malaysia : multi-ethnic school community
- Philippines : home-based program; disaster-affected area; active parental engagement; urban poor area; rural multigrade
- Singapore : technology-enhanced learning

- Thailand : indigenous group promoting indigenous knowledge; conflict-affected area
- Vietnam : community-based program; ethnic minority group; mother tongue-based bilingual education

While some of the country-specific criteria were observed, many were not met due to the following reasons:

- schools targeted were not recommended by some officials of the MOEs;
- limitations of resources; and
- unavailability of key informants.

As a result, the research team modified the research design to follow the original criteria, i.e., schools that implement IBTL at ECCE and early primary grades, whether the schools also meet the country-specific criteria or not.

There are two important caveats when reading the results of this research. Firstly, the learning institutions selected were not representative of IBTL-oriented schools in each country. Secondly, the findings, especially the responses of stakeholders, could not be generalized since the teacher- and parent-respondents from each school were quite limited and do not represent/speak for their group. At best, the information generated indicate general patterns and set the parameters for a more in-depth study on IBTL.



PHOTO CREDIT:
SEAMEO INNOTECH (2016)

III. ABOUT INQUIRY-BASED TEACHING AND LEARNING

Inquiry-based teaching and learning is a learner-centered approach that allows students to gain knowledge by engaging them to formulate questions about a topic, encouraging them to probe and use evidence to find or create solutions to problems, promoting the use of new knowledge in a context that they can relate to, and foster sharing of knowledge with others. In IBTL, teachers or instructors serve as facilitators of information-processing rather than the sole sources of information.

IBTL incorporates many learning approaches, such as project-based learning, design thinking, hands-on learning or field work, case studies, and investigations. The Lutheran Education Queensland outlines the following as hallmark characteristics of IBTL:

- *“Equal emphasis on process (communicating, reflecting, collaborating, analyzing, etc.) and content;*
- *Genuine curiosity, wonderment and questioning (by teachers and students) are central;*
- *Student ‘voice’ is evident such that elements of the curriculum or learning are negotiated and student questions are taken seriously and addressed;*
- *Prior knowledge is ascertained and built upon;*
- *Significant concepts and essential questions are identified which unify knowledge and understandings;*
- *Students are actively involved in constructing understandings through hands-on experiences, research, processing and communicating their understanding in various ways;*
- *Learning takes place in a social context wherein students learn from each other, together with others, and from those outside of the classroom context;*
- *There is an assumption that understandings are temporal and are constantly reviewed and refined on the basis of new learning and questions;*
- *Reflection, metacognition and depth of thought are valued and planned for;*
- *Assessment is on-going and clear criteria link performances or products to rigorous curriculum goals; and*
- *Learning leads to action, e.g., informing or sharing with others, implementing change, advocacy or taking up further questions or learning.”*

The 5E Instructional Model

One of the conceptual frameworks of IBTL is the 5E Instructional Model (Bybee, et. Al, 2006), which provides a framework for teachers to facilitate development of students’ understanding of ideas and concepts. The model is divided into five phases, namely: **Engagement**, wherein the teacher accesses the learner’s prior knowledge and experiences. Short activities that make connections between past and present learning experiences are conducted to promote curiosity and organize students’ thinking toward the learning outcomes of the planned activities. **Exploration** allows students to undertake experiments or other activities that help them use prior knowledge to generate new ideas, explore questions and possibilities, and design and conduct research. In the **explanation** phase, teachers can directly introduce a concept, process or skill. Teachers also seek students’ understanding using probing questions, and students explain or clarify their understanding of the concept. During the **elaboration** phase, teachers challenge and extend students’ understanding and skills. Students apply new understanding to new problems or another context. Finally, **evaluation** allows teachers to assess whether students are developing an understanding of concept/s. Using the 5E model, students produce outputs that they share for classroom observation (Chitman-Booker and Kopp, 2013; Bybee, et. al., 2006).

Table 2 provides a summary of instructional emphases under each phase of the 5E Instructional Model.

Table 2: Summary of the 5E Instructional Model

Phase	Summary of the Instructional Emphasis
Engagement	The teacher or a curriculum task accesses the learners' prior knowledge and helps them become engaged in a new concept using short activities that promote curiosity and elicit prior knowledge. The activity should make connections between past and present learning experiences, expose prior conceptions, and organize students' thinking toward the learning outcomes of current activities.
Exploration	Exploration experiences provide students with a common base of activities within which current concepts (i.e., misconceptions), processes, and skills are identified, and conceptual change is facilitated. Learners may complete laboratory activities that help them use prior knowledge to generate new ideas, explore questions and possibilities, and design and conduct a preliminary investigation.
Explanation	The explanation phase focuses students' attention on an aspect of their engagement and exploration experiences and provides opportunities to demonstrate their conceptual understanding, process skills, or behaviors. This phase also provides opportunities for teachers to directly introduce a concept, process, or skill. Learners explain their understanding of the concept. An explanation from the teacher or the curriculum may guide them toward a deeper understanding, which is a critical part of this phase.
Elaboration	Teachers challenge and extend students' conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills. Students apply their understanding of the concept by conducting additional activities.
Evaluation	The evaluation phase encourages students to assess their understanding and abilities and provides opportunities for teachers to evaluate student progress toward achieving the educational objectives.

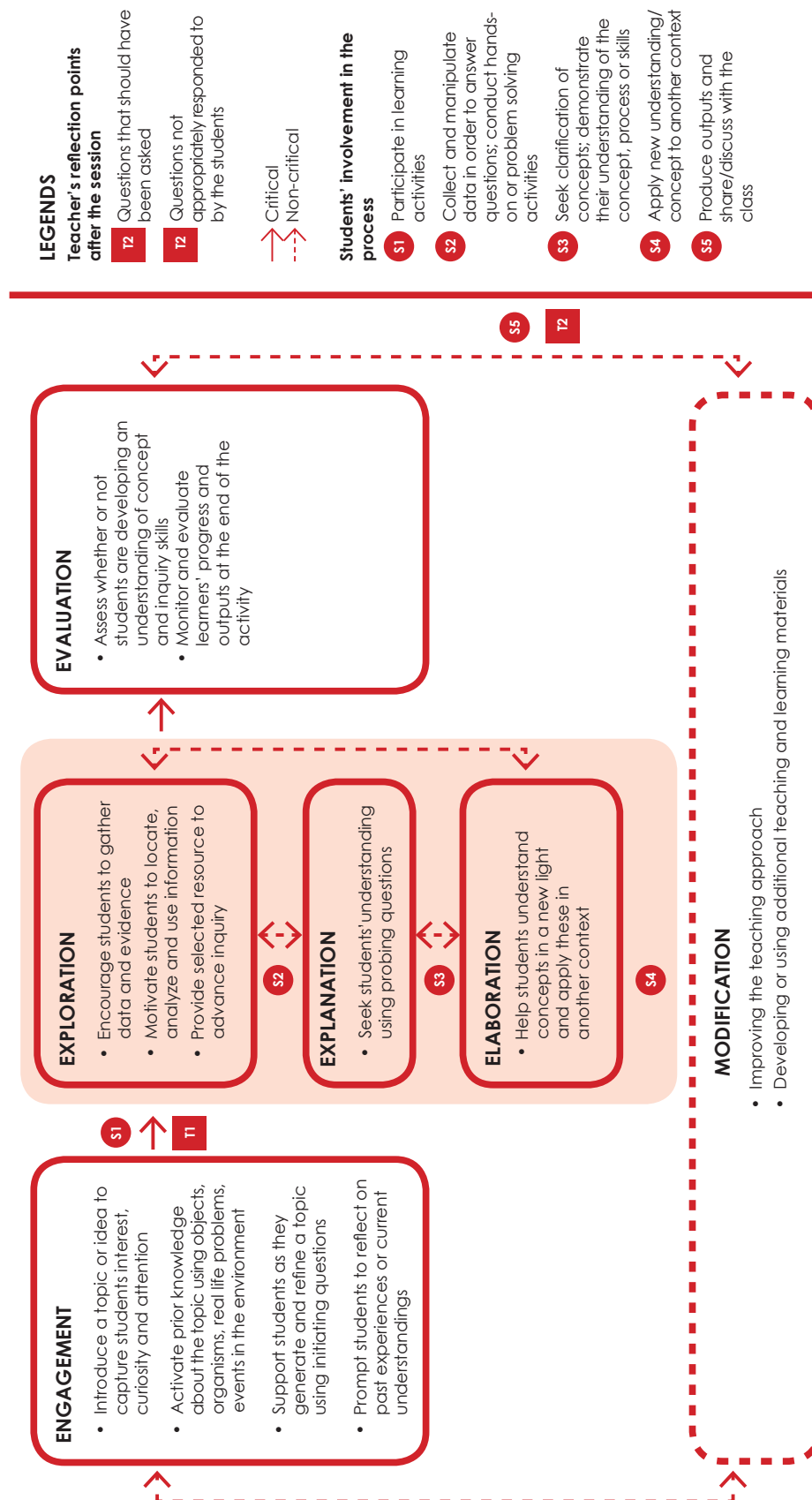
Source: Bybee, et. al. (2006). The BSCS 5E Instructional Model: Origins, Effectiveness, and Applications

The 5E Instructional Model is mostly used in teaching science. But as noted in various classroom observations conducted in six countries under this study, the competencies for each phase can be applied in teaching other learning areas such as language (English, Bahasa Melayu, Vietnamese), listening skills, outdoor education, literacy and numeracy, arts and crafts, mathematics, and life skills.

The IBTL Process Framework

In conducting this study, SEAMEO INNOTECH developed and used the IBTL Process Framework, which adheres to the 5E Instructional Model and combines other related research on IBTL. The framework is divided into three fundamental phases, namely: 1) Phase I: Engagement, 2) Phase II: Exploration, Explanation, and Elaboration, which are grouped together in one phase, and 3) Phase III: Evaluation. Phase IV: Modification, a non-compulsory phase, is added as an opportunity for teachers to enhance the teaching approach for a specific lesson, either in case the lesson needs to be repeated for the same class or for implementation in other future classes. Reflection points for teachers and expected involvement of students in the process are identified along both critical (i.e., mandatory) and non-critical paths within the framework.

Figure 2: IBTL Process Framework



Source: SEAMEO INNOTECH (2016)

Phase I: Engagement

As in the 5E Instructional Model, the IBTL Process Framework suggests that the teaching and learning process starts with engagement, where the teacher aims to capture students' interest, curiosity and attention as a topic or idea is introduced. During this phase it is important that links between past and present learning experiences are established. To set off students' prior knowledge about the topic, teachers use short priming activities including but not limited to the use of photos, storytelling, puppetry, and hands-on activity. Teachers also refer to real-life context by asking about objects, organisms or events in the environment that students can relate to. Students are prompted to reflect on their past experiences or prior conceptions and are encouraged to ask questions and to clarify any misconceptions. Given that the activities and questions asked by the teacher are related to students' prior knowledge about a topic, students are expected to be thoroughly involved in the learning activities.



For instance, in *Paalaran ng Buhay ng Maabay* in the **Philippines**, the teacher showed two different photos (e.g., horse and shoe) that were common to the students (eight years old), which when combined, form a new word (e.g., horseshoe). The activity was conducted to introduce a lesson on compound words in the English language. Students were later able to give more examples of compound words by combining different photos.



In the case of *Anubhan Nakhom Pathom School* in **Thailand**, the teacher used a puppet show as a learning activity to introduce the effects of planting without the benefit of sunlight. To foster curiosity and trigger discussion about the three basic needs (water, air, sunlight) of plants, the teacher asked the students, who were five to six years old, to answer guide questions, such as “Why did the ‘morning glory’ grow?” and “What do you think will happen if the ‘morning glory’ did not get sunlight?”

From engagement, it is necessary to go through the next phase – exploration, explanation, and elaboration. This transition is represented by a critical path in the diagram (refer to **Figure 2**), identified with a reflection point for teachers. The reflection point prompts the teachers to think of other questions that should have been asked during the engagement phase that could further heighten students’ interest and curiosity, or easily capture or sustain their attention. The teacher also addresses the learning gaps in the subsequent phases.

Phase II: Exploration, Explanation, Elaboration

This clustered phase aids in developing a deeper understanding of a topic or idea among students through exploration, explanation, and/or elaboration. While the phase is a compulsory step in the IBTL Process Framework, there are non-critical paths within the cluster.

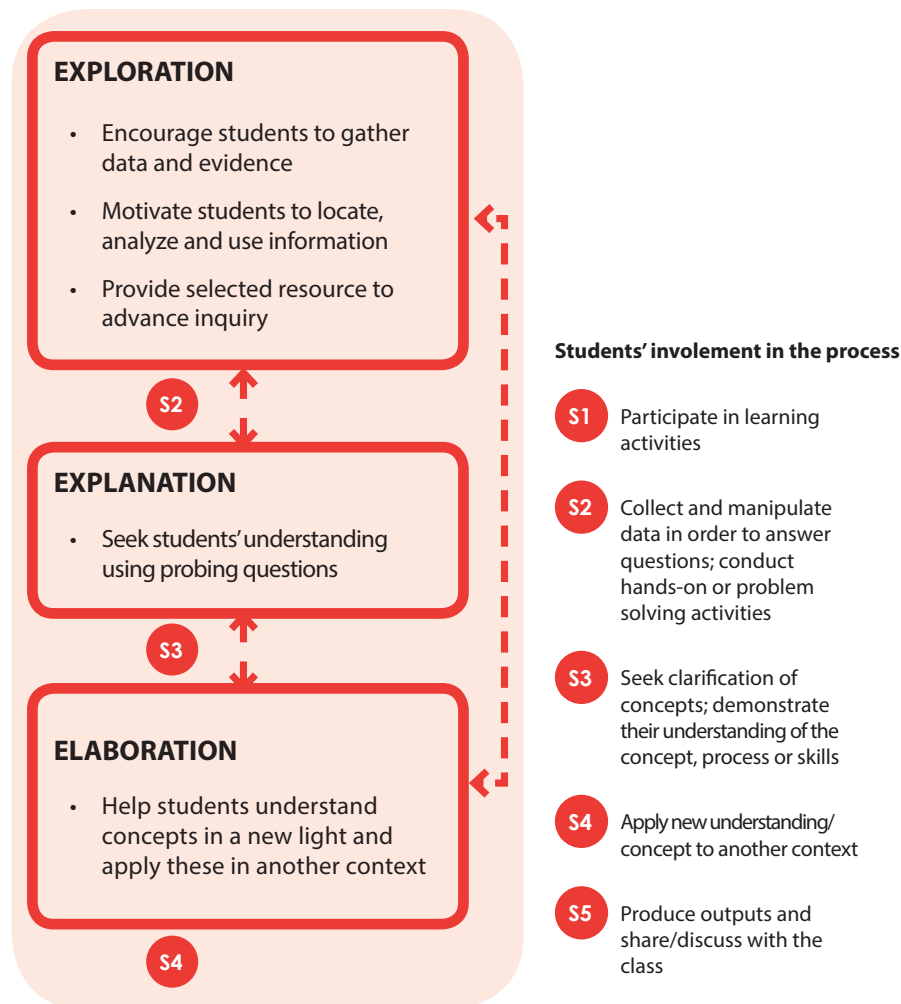


Figure 3: IBTL Process Framework (Phase II)

Zooming in on this phase (**Figure 3**), it can be noted that non-critical paths connect the three sub-phases (exploration, explanation, elaboration). Depending on the level of understanding the students have developed regarding a certain topic or idea, the non-critical paths indicate that the three sub-phases can be applied interchangeably. From engagement phase, teachers can go into elaboration, to explanation, then end the phase with exploration. Alternatively, from engagement, teachers can opt to apply exploration, elaboration, and finally, explanation. The framework, however, proposes that at least two of the three sub-phases should be applied, with exploration being a constant sub-phase, before moving to evaluation phase.

Exploration

Exploration is deemed to be the anchor of inquiry-based teaching and learning. Exploration allows the students to gain deeper understanding of a topic, generate new ideas, investigate other possibilities, and subsequently develop or strengthen critical and creative thinking, through hands-on learning activities such as experiments, demonstrations, simulations, and games. Teachers encourage students to gather evidence, and locate, analyze and use information from books, videos, and real objects that will help them answer questions posed or present related inquiry. Teachers likewise provide carefully selected resources that can be used in the inquiry process. Students should be able to collect and manipulate information to answer questions or think critically and creatively.



Punggol View Primary School

PHOTO CREDIT:
SEAMEO INNOTECH (2016)

To illustrate how exploration works, the Grade 2 students (seven to eight years old) of *Punggol View Primary School* in **Singapore** simulated a nature scavenger hunt as part of their outdoor education. Students were asked to find specific animals such as spiders and butterflies. They were also asked to find other objects such as something pointy, something beautiful, and something red and green, encouraging them to come up with different answers. Through experiential learning, the students discovered that there is great diversity in nature, and that some living things, like animals and butterflies, are mobile and are thus difficult to find or pin down.



Vietkids School

PHOTO CREDIT:
SEAMEO INNOTECH (2016)

In **Vietnam**, kindergarten students (five to six years old) of **Vietkids School** were treated to a magic show as part of their lesson on life skills, using different occupations as a theme. The students were encouraged to simulate the work of a magician by performing different magic tricks. Through this simulation, the students became more interested and involved in learning the tasks and skills of a magician.

Explanation



Seri Mulia Sarjana School

PHOTO CREDIT:
SEAMEO INNOTECH (2016)

Explanation provides an opportunity for teachers to further seek students' understanding of a topic or idea usually through explicit instruction and use of probing questions. Teachers ask students to apply new knowledge and observable evidence to interpret the topic or idea. Students are expected to seek clarification or explain/demonstrate their understanding of the topic or idea.

In *Seri Mulia Sarjana School* in **Brunei Darussalam**, the teacher instructed the students (four to five years old) on the form and sound of the letter "c" as part of their reading lesson for beginners. To develop independent learning, the teacher allowed the students to practice writing the letter "c."



Sekolah Kebangsaan Jalan 3

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In *Sekolah Kebangsaan Jalan 3* in **Malaysia**, Grade 2 students (8 years old) were given the opportunity to clarify their ideas after listening to the story of *The Very Hungry Caterpillar*. The students were asked to write down ‘what’ and ‘why’ questions. Some of the questions raised by the students were as follows: “Why were the eyes of the caterpillar big?” and “What was the name of the caterpillar?” Using these questions, the teacher encouraged the students to delve deeper into the story. The teacher then added some reflective questions such as “Do you think the eyes of the caterpillar are big?” and “Why don’t we name the caterpillar after the author to give him credit?”

Elaboration

Elaboration helps students understand a topic or idea in a new light and apply this in another context. Teachers encourage students to use new understanding to address new problems. Students are expected to extend their conceptual understanding by applying it to another context independently.

To illustrate this task, Grade 2 students (seven years old) of *Stella’s School* in **Brunei Darussalam** were asked to create a healthy menu after learning the concept of healthy and healthy food in a previous lesson. The activity entailed selecting and cutting photos of healthy food and drinks and pasting them in their workbooks.



Stella’s School

PHOTO CREDIT:
SEAMEO INNOTECH (2016)



Vietkids School

PHOTO CREDIT:
SEAMEO INNOTECH (2016)

In *Vietkids School* in **Vietnam**, Grade 1 students (six to seven years old) learned to use the 'iếp' and 'uớp' sounds. They were taught to read and write new words by combining sounds. Students were later asked to use the words in another context following the teacher's example. For instance, one student said he likes making 'tiếp ướp' (invitations) for social events or gatherings.

Phase III: Evaluation

After going through engagement, and exploration, explanation and elaboration phases (at least two of the 3Es), the evaluation phase provides teachers opportunities to monitor and assess students' understanding of a topic or idea. Students are encouraged to discuss their outputs in class and to reflect and comment on others' ideas. Teachers are tasked to carefully reflect on questions not appropriately responded to by the students.

Kindergarten teachers from *Sekolah Kebangsaan Putrajaya 1* in **Malaysia** divided a class of five to six years old into three groups based on the level of their reading ability in Bahasa Melayu. In one group (beginners), the teacher asked the students to trace the outline of plastic letters onto their drawing pads. In another group (intermediate), students combined syllable cubes to create words. In the final group (advanced), students were actively engaged in the formation of words using Velcro letters.

Through this differentiated group activity, the teachers were able to focus on the different levels of assistance that students need based on their skill level. The beginners required more help in identifying and familiarizing themselves with letters. The intermediate students needed guidance in pronouncing the syllables, while students in the advanced group worked almost independently.



Beginner



Intermediate



Advanced

Sekolah Kebangsaan Putrajaya 1

PHOTO CREDIT:
SEAMEO INNOTECH (2016)



In **Singapore**, Grade 2 students of *Punggol View Primary School* were asked to present in class the photos they had taken in their nature scavenger hunt. The teacher facilitated peer evaluation by asking other students to verify if the photos presented were included in the scavenger hunt list.

Phase IV: Modification Phase

Teachers practice critical reflection during the entire teaching and learning process. Looking at the IBTL Process Framework (**Figure 2**), it can be noted that tracks from and leading to the modification phase are represented by non-critical paths. While these are non-critical, the paths suggest how the teaching and learning process could be further enhanced.

For instance, after the engagement phase, teachers reflect on and think about questions that should have been asked to further stimulate curiosity among students and elicit their prior knowledge. Teachers can also note if questions asked foster higher order thinking skills (e.g., why, how, what else, what if). As necessary, learning gaps are addressed in the subsequent phases. Teachers can engage students more actively by helping them clarify their thinking through paraphrasing or talking through tasks.

After the evaluation phase, teachers review the entire process and modify, as necessary, the teaching approach for the next learning session, keeping in mind that teachers should be able to model the inquiry process (i.e., show as well as tell). Safe and orderly learning areas should also be maintained, and new or additional teaching and learning materials prepared as may be needed.

Some modifications or enhancements on lesson delivery identified by teachers in selected schools are illustrated in **Table 3**:

Table 3: Modifications by Teachers

School	Identified Learning Objective	Modification/s
Brunei Darussalam		
Sekolah Rendah Panaga	Producing the sound of the letter “p”	Teaching jolly phonics using mother tongue (Bahasa Melayu) instead of English
Sekolah Rendah Kampong Mata-Mata Gadong	Investigating healthy and unhealthy food	Using video clips showing different ways of cooking (e.g., with and without oil) and what makes food healthy or unhealthy
Philippines		
Supervised Neighborhood Play (Block 10 and Smart Tower)	Discovering modes of transportation in the community	Conducting a field trip; requesting children to bring toy cars or other toy vehicles as examples
Thailand		
Yooyenwitthaya Preschool	Identifying, naming and counting the ingredients for cooking pumpkin custard	Increasing the amount of materials to be used in class (e.g., ingredients); letting the children have more hands-on participation in the activity; inviting more resource persons to help in the activity
La Orutis Demonstration Schools	Learning the concept of weight and weighing scales	Increasing the level of difficulty of activities (e.g., cutting) and using other materials (e.g., scissors)
Vietnam		
Kim Lien Primary School	Understanding the concept of place value of 4-digit numbers	Providing the students with more cues and suggestions
Dong Da Preschool	Creating artworks using different materials	Revising some of the questions to make it easier for children to understand; improving questioning technique to be able to probe deeper

These various phases of the IBTL Process Framework are illustrated in more details in sections covering documentation of IBTL practices in selected learning institutions in selected SEAMEO Member Countries.



IV. IBTL PRACTICES IN SELECTED SEAMEO MEMBER COUNTRIES

This section reviews the different national education policies of the six (6) SEAMEO Member Countries to determine the extent to which IBTL has been mainstreamed in these policies. These policies pertain to their education laws, national education plans, and/or 21st-century education blueprints which were sourced from the websites of the MOEs. The section also illustrates some IBTL practices of the selected learning institutions in these six countries. Information were gathered through various research activities like desk review, in-country focus group discussions, key informant interviews, and classroom observations.

Brunei Darussalam

Brunei Darussalam is one of the countries that initiated a reform of its educational system to respond to the requirements of the 21st century. In 2009, its government unveiled the National Education System for the 21st Century (Sistem Pendidikan Negara Abad Ke-21), or SPN 21, which contains Brunei's new educational goals, directions, and strategies. According to Brunei's Ministry of Education, SPN 21 serves as the country's "platform to realize the many objectives of Wawasan Brunei 2035, the national vision" (2013, p. 38).

SPN 21 has articulated as among its new goals, the development of 21st-century skills among its students and meeting the social and economic development needs and challenges of the 21st century (MOE Brunei Darussalam, 2013, p. 19). These 21st century skills and abilities include numeracy, communication, thinking and problem-solving, self-management, aesthetic, physical, worship (for Muslim learners), and know-how in ICT (p. 48).

Incorporation of Inquiry-Based Learning in SPN 21

In terms of pedagogy, SPN 21 advocates a shift to student-centered approaches where students are treated as active learners and where the teacher assumes the role of facilitator and counselor. It expects teachers to use diverse teaching and learning methods or styles as appropriate to the purpose(s) of learning and to suit different types of learners. It promotes methods that are "Experiential (e.g. group work, pair work, simulation, interactive video, field trip, game, role play, analysis of data or results); Reinforcement (e.g. model, chart, poster, leaflet, magazine article, newsletter); and, Integrative (e.g. conference, forum and seminar)" (p. 79).

To prepare Brunei teachers for this pedagogical shift, the Ministry of Education sponsored in-service training of teachers on various instructional models, among them inquiry-based science education (IBSE). The training program was designed and administered by the La main à la pâte (LAMAP), a French Foundation whose mission is to "improve the quality of science and technology teaching in primary and middle schools" (<http://www.fondation-lamap.org/en/international>).

The LAMAP-designed training program on IBSE was implemented in phases. The first phase included the training of two batches of science teachers (on April 2008-July 2009 and on July-September 2011), and the conduct of an assessment on the impact of this training on government schools in Brunei. The second phase, which began in 2013, is focused on training the trainers, capacity-building for the

development of IBSE resources, establishing a repository for teaching resources (<http://ibse.moe.gov.bn/~second/>), and addressing problems that surfaced during the first phase (Tuah, n.d.; Interview with the MOE's Inquiry-based Science Education Support Team).

According to the Ministry's Inquiry-based Science Education Support Team, IBSE ultimately aims to enhance the quality of science education to capture and sustain the interest of students. This is in response to the dwindling number of Brunei students entering the science stream.

Project-Based Learning in Early Childhood Education

The use of alternative learning strategies, including IBTL, at both the elementary and secondary levels is generally advocated under SPN 21. Apart from the IBSE training by LAMAP, the Ministry of Education is also promoting the project-based model. According to informants from the Ministry's Early Childhood Care and Education (ECCE) Unit:

Pre-schoolers like to investigate... The project approach involves children in the study of things nearby that interest them and are worth knowing about. Teachers use the project approach to meet most of the themes from the curriculum. The projects that the children are doing involve holistic development and integrates...socialization, creativity, physical, ICT.

The Ministry's ECCE adds that implementing inquiry-based learning is necessary to create confidence in children and make them more creative in problem solving.

The Practice of IBTL in Brunei Darussalam Schools: Some Examples

Box 1: Demonstration of IBTL, Sekolah Rendah Kampong Mata-Mata Gadong



PHOTO CREDIT:
SEAMEO INNOTECH (2016)

Age:	7-year-old students
Subject Area:	Science
Topic:	Food and Nutrition
Learning Objective:	For students to be able to identify healthy and unhealthy food items
Materials:	Oil paper, chips donut, broccoli, apple, carrot

Observed Inquiry Activity:

1. The teacher paired up the students.
2. The teacher asked the children to hypothesize which of the food items (chips, donut, broccoli, apple, carrot) listed in their textbook are "not oily" and which are "oily."
3. The teacher then distributed oil papers and the actual food items listed in the textbook. The students were asked to place and roll each food item on top of their oil paper. They were then asked to identify which item left a mark on the oil paper.
4. The teacher asked the pairs to compare their hypothesis of what is oily/not oily with the results of their experiment.
5. The teacher explained that oily food is considered unhealthy.

Sekolah Rendah Kampong Mata-Mata Gadong (SRKMG). This public school has been using inquiry-based learning for at least four years. It practices inquiry-based science education in accordance with the government curriculum. The practice, however, is mainly confined to the upper elementary grades (Grades 4 to 6). Science teachers were trained through the LAMAP training workshops organized and sponsored by the Ministry of Education.

The school administrator interviewed said that apart from science, elements of IBTL have also been adopted in other subjects such as math and in other grade levels. The teacher-respondents from the lower elementary grades affirmed that while they have not attended any formal IBTL-related training, they have incorporated elements of inquiry-based learning into their classes, such as posing more open-ended questions and introducing lessons through hands-on activities and group discussions. For example, teachers asked the students to try activities on their own first, before showing them the actual process.

The teacher-informants said that the main challenge in using IBTL is planning and writing down their lesson plans. In addition, they said that science apparatus and materials for experiments are sometimes not available. More funds, they said, should be allocated for learning resources. The school administrator similarly said that lack of resources is a problem and that some teachers go the extra mile of providing the materials needed.

Box 2: Demonstration of IBTL, Panaga Primary School

Age:	5-6-year-old students
Subject Area:	English
Topic:	Phonics
Learning Objective:	For students to be able to produce the sound of the letter 'p'
Materials:	Letter cards, worksheets iPad, TV Monitor, different objects



Observed Inquiry Activity:

1. The teacher reviewed the past lesson by showing letter cards of previously studied letters (s, a, t, i) and asked the students to produce the sound of each letter.
2. The teacher divided the class into two groups.
3. One group worked independently – coloring and tracing the letter 'p'. Another group used an iPad. The group was given a basket with different objects. Working in pairs, the students were asked to choose and take photos of objects that start with the 'p' sound, such as paper, pencil, paint, purple paint.
4. The teacher then connected the iPad to the TV monitor to show selected students' outputs to the rest of the group.

Panaga Primary School. The Panaga Primary School has been implementing IBTL since 2016. Inquiry is applied in the teaching of science at the upper elementary grades (Grades 4 to 6) pursuant to the government-prescribed curriculum. The science teachers received training on inquiry-based science learning from the LAMAP under the sponsorship of the Ministry of Education.

While the school prioritizes inquiry-based science education, the use of IBTL in other levels and subjects is also encouraged. The teacher-informants said that what they need is further preparation to make their lessons more interesting and think “out of the box” when designing activities for children. The teacher-informants mentioned that the Panaga School also involves parents in the learning process under its School and Family Engagement Program. For example, students were asked to bring home storybooks for both parents and students to read together and discuss. This activity aims not only to cultivate the habit of reading among students, but also to help them get used to answering questions and to spend more quality time learning with their parents.

The Panaga Primary School administrator said that IBTL promotes independent learning. One of the major barriers to the implementation of IBTL is the use of English as medium of instruction. She said that students, whose mother tongue is Bahasa Melayu, have difficulty articulating their ideas in English.

Box 3: Demonstration of IBTL, Seri Mulia Sarjana School



PHOTO CREDIT:
SEAMEO INNOTECH (2016)

Age:	4-5-year-old students
Subject Area:	English
Topic:	Phonics
Learning Objective:	For students to be able to produce the sound of the letter ‘c’
Materials:	Pillow, a bag with different fruits, music, the story of <i>Coco the Caterpillar</i>

Observed Inquiry Activity:

1. The teacher asked the students to pass the pillow around.
2. The teacher played music. The student holding the pillow when the music stops was asked to get a fruit from the bag.
3. The teacher asked the student holding a fruit to describe the fruit by using his/her senses, i.e., smell, taste, texture, color.
4. The teacher used the game to introduce the story *Coco the Caterpillar*. The teacher explained that the fruits were some of the things that Coco ate.
5. The teacher then introduced the sound and form of the letter ‘c’.

Seri Mulia Sarjana School (SMSS). In 2014, SMSS transitioned to the International Primary Curriculum (IPC) for its early education program. The IPC aims to meet the learning needs of the current generation with inquiry as one of its components. The school administrators said that all their teachers went through formal training by the IPC consultant even before the school shifted to the new curriculum. Moreover, their teachers were sent to Universiti Brunei Darussalam to attend a workshop on play and literacy.

The school administrators interviewed for the study noted that the transition to IPC was met with several challenges, such as changing the mindset and practices of old teachers. Teachers particularly had difficulty connecting the required sequence of activities (entry– knowledge–big subject research–exit) and planning the flow of the lesson.

The teacher-respondent mentioned three challenges in applying the inquiry-based approach. First is the language barrier. Students cannot articulate their ideas well and engage in discussion in English. Second, resources for IBTL are not readily available in the school, such as a playground, sand and water area, and other outdoor facilities. Third, parents do not understand or favor IBTL activities such as play-based approach to teaching and learning. They are more concerned about their children's academic standing.

Meanwhile, a common complaint among the parent-informants is the amount of time they had to devote to school projects and activities. The parent-informants from the Seri Mulia Sarjana School remarked that the IPC curriculum is a "double-edged sword," i.e., while it has brought many positive effects on their children, it also demands a lot from the parents. Under the IPC curriculum, parents must be actively involved in their children's assigned projects, which is quite difficult to do since most children have parents who are working full time.

Box 4: Demonstration of IBTL, Stella's School

Age:	7-year-old students
Subject Area:	Science
Topic:	Food and nutrition
Learning Objective:	For students to be able to identify healthy and unhealthy food items
Materials:	Workbook, scissors, glue



PHOTO CREDIT:
SEAMEO INNOTECH (2016)

Observed Inquiry Activity:

1. The teacher reviewed the past lesson on healthy and unhealthy food.
2. The teacher asked the students to give examples of healthy meals.
3. The students were then asked to identify and cut photos of healthy food and drinks, and to paste them in their workbooks to create a healthy menu.

Stella's School. The school began using the project-based method in 2014. Teachers had no formal training on IBTL and coordinators served as mentors.

The school head said that IBTL equips children with life skills, such as handling money. It also brings socio-emotional benefits to children; that is, they become more independent and they are more inclined to ask questions, search for answers, make comparisons, and rationalize.

The school head mentioned that the practice of IBTL has been hampered by a lack of space for undertaking some hands-on activities, such as gardening. On the part of the teacher-respondent, the challenges are the limited time allocated for each subject, the unreliability of internet connection for the conduct of research, and lack of formal training on the inquiry approach.

The parent-informants generally had positive things to say about IBTL. Some parents said that they noticed their children becoming more aware of their environment and asking more questions. The children were also reported as becoming more compassionate and sensitive to the needs of others.

Table 4 summarizes the key features of IBTL practices in selected schools in Brunei Darussalam.

Table 4: Features of IBTL in Four Schools in Brunei Darussalam

	Sekolah Rendah Kampung Mata-Mata Gadong	Panaga Primary School	Seri Mulia Sarjana School	Stella's School
Type of school	Public	Public	Private	Private
Start of implementation of IBTL	before 2013	2016	2014	2014
IBTL model/variation	LAMAP inquiry-based science education	LAMAP inquiry-based science education	IBTL integrated in the International Primary Curriculum	Project-based approach
Grade level implemented	LAMAP IBSE in Grades 4-6; IBTL promoted in lower grades	LAMAP IBSE in Grades 4-6; IBTL promoted in lower grades	Kindergarten	Primary
Training on IBTL	LAMAP's IBSE training sponsored by Brunei MOE	In-house training conducted by a fellow teacher (focal person for IBSE)	2013-2014 training conducted by an IPC consultant; 2013 workshop on play and literacy	No formal training; supervision by coordinators

Like other countries in Southeast Asia, the Malaysian government introduced wide-ranging reforms to its education sector. These reforms, embodied in the Malaysia Education Blueprint 2013-2025 (Preschool to Post-Secondary Education), are meant to prepare Malaysian children for 21st century needs as well as to steer the Malaysian economy forward.

The development of thinking skills is cited as one of the six (6) attributes needed by every student to be competitive in the global economy. Hence, under the Blueprint, the education sector endeavors the following:

Every child will learn how to continue acquiring knowledge throughout their lives (instilling a love for inquiry and lifelong learning), to be able to connect different pieces of knowledge, and to create new knowledge. Every child will master a range of important cognitive skills, including critical thinking, reasoning, creative thinking, and innovation. This is an area where the system has historically fallen short, with students being less able than they should be in applying knowledge and thinking critically outside familiar academic contexts (Malaysia MOE, 2013, p. E10).

Inquiry in Science, Technology, Engineering and Mathematics (STEM)

The Malaysian government believes that STEM is an engine of growth and can propel the country into joining the ranks of developed nations. The government thus aims for a stronger delivery of STEM at the basic education level. It seeks to achieve this through inquiry-based learning which can stimulate children's interest, motivate them to take the STEM stream, and develop their skills in analyzing, critical thinking, hypothesizing, and decision-making (Malaysia MOE, 2013, p. 4-7).

According to informants from the Malaysian education ministry, they intend to adopt project-based and 5E models especially in science education. They likewise intend to pilot test IBTL in four different schools, with the end goal of duplicating successful models in other schools and in other subject areas.

The MOE informants also said that they plan to conduct in-service teacher training, which shall underscore the role of teachers in an IBTL set up, and orient teachers on purposeful design and inquiry (asking the right questions).

The Practice of IBTL in Malaysian Schools: Some Examples

Box 5: Demonstration of IBTL, Sekolah Kebangsaan Jalan 3



Age:	5-6-year-old students
Subject Area:	Science
Topic:	Five Senses
Learning Objective:	For students to learn about the sense of taste and be able to identify the four major tastes.
Materials:	Samples of different food items

Observed Inquiry Activity:

1. The teacher asked the class which part of the body can taste food. She also asked what kinds of tastes they know or have tried out.
2. The teacher then drew a “taste map,” indicating which parts of the tongue can detect sweetness, bitterness, saltiness and sourness.
3. The teacher displayed different food items on the table: slices of lemon, a bowl of sugar, a bowl of coffee granules, cookies, and salted egg.
4. The students were asked to taste each food item and determine to which category each item belongs.
5. The teacher distributed activity sheets with illustrations of different food items. The students were asked to color the images, cut them out, and paste them into the correct taste categories.

Sekolah Kebangsaan Jalan 3 (SKJ). The public school was established in 1995. The school head interviewed for the study said that there is no school policy requiring inquiry-based learning. However, teachers are encouraged to use this approach as one of their strategies. She mentioned that in 2013, science teachers began using the project-based approach for 10 to 12-year-old students.

In terms of benefits, the school head said that project-based IBTL has improved students’ curiosity and adventurous spirit, enhanced their observation skills, and built their confidence to ask teachers when they discover new things.

The school head mentioned that teachers find it challenging to apply IBTL because they want to maximize their contact time with students to finish the comprehensive syllabus. They prefer to use the modules for learning. The issue of time was affirmed by the teacher-respondent who said that preparing materials alone is time-consuming. She also mentioned that IBTL may not always be the best approach in teaching themes.

The respondents added that IBTL is taught comprehensively with practical activities in pedagogy courses for all teacher trainees in teaching colleges/universities before they join the service. The length of training programs varies from 2 to 4 years. In-service training requires teachers to undergo a minimum of seven days per year of personnel training (i.e., staff development program) on various fields of education wherein IBTL is one of the focus areas, together with other pedagogical approaches. Teachers also create a Professional Learning Community (PLC) where they discuss pedagogical techniques and review teaching sessions to gather constructive feedback from peers (i.e., micro-teaching) to share knowledge among colleagues.

The parent-informants, meanwhile, observed that schools in Malaysia in general tend to be exam-oriented, with a drive to enhance the critical thinking method. The schools' endeavor of encouraging students to apply what has been learned in class in real-world context has provided a different perspective of learning. Although the teachers' goal is to finish the syllabus, parent-informants felt that the practice of critical thinking in subject areas could be further improved by engaging other stakeholders, such as parents and the school-community. For instance, to minimize the burden of teachers, parent-informants mentioned that parents and the school-community can provide better learning environment for the children. The respondents also noted that obtaining high grades at the national examination should not be the only indicator of students' performance. This effort could be loosely implemented if there is no cooperation from all stakeholders – school head, teachers, parents, school-community. The parent-informants expressed that the school-community must perform its part in ensuring a healthy learning environment for the students to avoid the seeming frustration of parents that their children are not getting enough from schools.

Box 6: Demonstration of IBTL, Sekolah Kebangsaan Putrajaya 1, Presint 8

Age:	5-6-year-old students
Subject Area:	Bahasa Melayu
Topic:	Reading
Learning Objective:	For students to be able to combine letters to form words, combine syllables to form words, and trace different letters
Materials:	Plastic letter figures, syllable cubes, drawing pad/paper, pencil, activity pad with Velcro letters



Observed Inquiry Activity:

1. The teacher divided the class into three groups, with each group assigned an ability-based activity and facilitated by a teacher or assistant teacher.
2. In one group (beginners), students traced the outline of plastic letters onto their drawing pads. The students were then asked to identify the letters that they traced.
3. In another group (intermediate), students were taught to combine syllable cubes to create words. The students were asked what each syllable means (if it meant anything) and what words can be formed when the syllables were put together.
4. In the final group (advanced), students were engaged in forming words using Velcro letters.

Sekolah Kebangsaan Putrajaya 1, Presint 8 (SKPP8). The pre-school of SKPP8 started operating in 2007. The headmistress noted that IBTL is one of the techniques used by teachers to reinforce 21st-century skills. According to her, the practice of IBTL has made students happier and allowed them to explore, learn things independently, become more creative, and perform excellently.

The teachers undergo in-service training programs on IBTL two to three times a year. Senior subject experts also conduct classroom observation occasionally. Still, some of the teachers were reported not having enough experience to use IBTL while some are not subject experts. Class size is also a challenge since there is not enough space for students to move around.

For the pre-school teacher-respondent, time constraint is an issue. She said that teachers exert more effort to teach students. They must gauge their students' ability, mood, and responses to the planned activities. She said that it is difficult for teachers to adjust the activities based on learners' needs.

The four parent-informants mentioned that they observed their children to be more active, extrovert, sharing, independent, and inquisitive. They also tended to read more, asked for an explanation, and solved problems. However, one said that it was difficult to catch up with her child on the use of technology. Another said that her lack of familiarity with the syllabus made it difficult to answer her child's questions.

Table 5 summarizes the key features of IBTL practices in selected schools in Malaysia.

Table 5: Features of IBTL in Two Schools in Malaysia

	Sekolah Kebangsaan Jalan 3	Sekolah Kebangsaan Putrajaya 1, Presint 8
Type of school	Public	Public
Start of implementation of IBTL	2013	Not indicated
IBTL model/ variation	Project-based approach	Not indicated
Grade level implemented	Pre-school and elementary level	Pre-school
Training on IBTL	Two to four years of pre-service training; 7 days per year of in-service training on various pedagogical approaches, including IBTL; sharing of knowledge in a Professional Learning Community	In-service training conducted 2-3 times/year; class observation by senior subject experts

In 2012 and 2013, the Philippine government laid the groundwork for sweeping reforms in the educational system. Republic Act 10157, or the “Kindergarten Education Act” approved in January 2012, mandates children who are at least five years old to attend kindergarten before entering Grade I. The enactment of the Republic Act 10533 entitled “Enhanced Basic Education Act of 2013” signed in May 2013 signaled the lengthening of basic education from 10 to 12 years consisting of one (1) year of kindergarten education, six (6) years of elementary education, four (4) years of junior high school, and two (2) years of senior high school education. The passage of Republic Act 10410, or the “Early Years Act of 2013” signed in November 2013, recognizes the age from zero (0) to eight (8) years as the first crucial stage of educational development of which the age zero (0) to four (4) years shall be the responsibility of the Early Childhood Care and Development (ECCD) Council, while the five (5) to eight (8) years shall be under the care of the Department of Education (DepEd).

Along this adjustment in the basic education cycle, the law mandates the Philippine government to “make education learner-oriented and responsive to the needs, cognitive and cultural capacity, the circumstances and diversity of learners, schools and communities...” Towards this, it directs DepEd to develop a basic education curriculum that uses “pedagogical approaches that are constructivist, inquiry-based, reflective, collaborative and integrative,” while the ECCD Council shall establish program standards that reflect developmentally appropriate practices for children 0 to 4 years old, which shall interface with the kindergarten curriculum.

Inquiry in the Kindergarten Curriculum Framework

Republic Act 10157, or the “Kindergarten Education Act,” requires DepEd to:

Develop teaching strategies using the unique feature of the mother tongue-based multilingual education which shall include, but not limited to, the following: (1) The two-track method (storytelling and reading, listening story, oral communication activities); (2) Interactive strategies; (3) Use of manipulative games; and (4) Experiential, small group discussions and total physical response (TPR) among others.

Following the two laws, the DepEd devised a framework for kindergarten education which is child-centered and geared towards children’s holistic development (i.e., socio-emotional development, value formation, physical health and motor development, creative/aesthetic expression, language and communication skills, environmental awareness and exploration). The framework promotes the use of constructivist, inquiry-based, integrative, collaborative, and play-based approaches to deliver kindergarten education.

Teaching K to 12 Content Areas Using the Inquiry Mode

In line with the Enhanced Basic Education Act of 2013, DepEd’s new K to 12 Basic Education Program is anchored on strengthening the 21st century skills of learners. Accordingly, DepEd has sought to incorporate inquiry as an approach to teaching content areas in Kinder through Grade 12. IBTL was specifically mentioned in the curriculum guides for science, math, social studies (Araling Panlipunan), and the arts.

The science curriculum guide identifies IBTL as the principal strategy for students to: (1) understand and apply scientific knowledge in both local and global contexts; (2) demonstrate scientific processes and skills; and (3) develop and demonstrate scientific attitudes and values. Similarly, IBTL, along with experiential and situated learning, reflective learning, and cooperative learning, is the mode of choice to impart conceptual understanding and process skills, such as estimating, computing and solving; visualizing and modeling; representing and communicating; conjecturing, reasoning, proving and decision-making; and applying and connecting, in K to 12 mathematics.

Under the social studies curriculum guide, inquiry (pagsisiyasat) is identified as both a desired competency and an instructional strategy to achieve the goals of deepening students' understanding of their national identity and preparing them to become productive national and global citizens. A hands-on and inquiry approach is also prescribed for art education which is focused on exposing children to Philippine art and cultural heritage.

According to local DepEd informants interviewed for the study, IBTL is expected to hone children's skills in formulating and reacting to questions, facilitate pupil-to-pupil interactions, and higher order thinking skills. By asking questions and expressing themselves freely, students are expected to develop self-confidence.

The DepEd informants, however, cited the need to improve the capacity of teachers to competently deliver IBTL, noting the intricacies of guiding the students through the process. They also mentioned the need to assess the suitability of IBTL in different school contexts, e.g., multigrade schools. They noted the financial constraints for capacity building of teachers, especially the new ones who have not been trained in IBTL.

Play-Based Strategy of the Pre-Kindergarten Curriculum (three to four years old)

The child development worker interviewed for this study described play-based learning as a developmentally appropriate approach where children learn at their own pace through the natural process of play. The play activities expose young children to self-initiated endeavors that promote problem solving, exploration, discovery, collaboration and the desire for learning.

In a classroom that supports play-based learning, children are given the opportunities to engage in unstructured free-play. By taking advantage of this engagement, the teacher can develop appropriate skills in a stimulating setting, such as the introduction of language, mathematics and science concepts in a subtle but meaningful context – a strategy must be learned and practiced by child development teachers and workers under the pre-kindergarten curriculum.

The Practice of IBTL in Philippine Schools: Some Examples

Box 7: Demonstration of IBTL, Paaralan ng Buhay ng Maabay

Age:	7-8-year-old students
Subject Area:	English language
Topic:	Compound words
Learning Objective:	For students to be able to form compound words
Materials:	Picture words, worksheets with photos, scissors, glue



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SEAMEO INNOTECH (2016)

Observed Inquiry Activity:

1. The teacher showed photos of two different objects (e.g., horse and shoe) to illustrate how to form compound words.
2. Using their worksheets, students were then asked to give more examples of compound words by combining different photos. Students cut and pasted pictures that form compound words when put together.

Paaralan ng Buhay ng Maabay (PBM). In 2013, PBM (a multigrade school, i.e., having two to three grade levels in one class) became a partner school of the ABS-CBN Knowledge Channel—a private cable television network that develops and airs curriculum-based shows for basic education learners. This partnership was made possible by an earlier memorandum of agreement between the Philippine Department of Education and ABS-CBN Knowledge Channel in which the latter committed to develop and supply educational resources, such as interactive games, animated programs, and multimedia resources to public schools and provide training on student-centered learning.

The PBM head teacher interviewed for the study said that IBTL allows students to discover things for themselves, gather information, and ask questions. The initial implementation, however, was difficult for both teachers and students. Teachers especially had a hard time managing group activities. They had to lay down rules for better class management. After the adjustment period, however, teachers observed that students began enjoying group activities, differentiated activities, video clips, etc. Another teacher said that using IBTL in a multigrade setting is a challenge. This is because of the constant need for multigrade teachers to balance time and multi-task when addressing different learning needs of groups and individual students. With students from several grade levels all sitting in the same classroom, it is also difficult to create a learning space for each grade level to keep the students engaged in a meaningful activity while ensuring that they are not distracted by on-going activities for the other grade level/s.

The PBM head teacher also noted that teachers devote the bulk of their time preparing lesson plans, leaving them little window to develop visual aids and other appropriate materials for IBTL. She added that the budget for materials is very limited.

Box 8: Demonstration of IBTL, SNP Muntinlupa



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Age:	3-4-year-old students
Subject Area:	Listening Skills
Topic:	Modes of Transportation
Learning Objective:	For students to be able to recognize the different modes of transportation in their community
Materials:	Book, toy vehicles

Observed Inquiry Activity:

1. The teacher read the story, *Si Jepoy Dyip* (Jepoy the Jeepney).
2. Prompted by the teacher, the children named the other modes of transportation they know.
3. Toy vehicles, such as bus, motorcycle, car, were placed on the table and shown to children.

Supervised Neighborhood Play (SNP) Muntinlupa. SNP is a pre-school program run by the local government in collaboration with the private sector. It has been implementing play-based learning since 2001, in line with the early learning framework developed by the Early Childhood Care and Development (ECCD) Council. Teacher training was supported by the ECCD Council.

The teacher-respondent from SNP Muntinlupa observed that children enjoy the learning process. According to her, the challenge is in modifying the ECCD curriculum to suit the context of the community.

According to parent-informants, the play-based approach has improved the confidence and independence of their children. They participated more in class and played with other children. Moreover, they developed listening skills, tended to ask more questions, and became interested in reading. The parents remarked that their children constantly bombard them with questions which can be a boon and a bane at the same time.

Manila Waldorf. This private school implements the Steiner/Waldorf pedagogical method. This method focuses on exploration and hands-on activities and integrates art/creative expression and play in the teaching of different subject areas to capture and sustain the interest of children. Teachers were trained on this method by mentors from Waldorf schools abroad.

Parent-informants from Manila Waldorf noted that their children liked to explore their environment, manipulate things, and replicate what they learned in school (e.g., storytelling). In terms of attitude, they were curious, empowered, and able to express themselves freely. One parent cited the 'slow parenting' approach of Waldorf as a challenge because it goes against the fast-paced modern life. Examples of the 'slow parenting' approach are allowing children to explore the world around them at their own speed, and emphasis on promoting children's overall well-being rather than academic and material success.

Table 6 summarizes the key features of IBTL practices in selected schools in the Philippines.

Table 6: Features of IBTL in Three Schools in the Philippines

	Paaralan ng Buhay ng Maabay	SNP Muntinlupa	Manila Waldorf School
Type of School	Public (Multigrade)	Public (Local Government Unit)	Private
Start of implementation of IBTL	2013	2001	Since establishment
IBTL model/variation	Differentiated instruction strategies	Play-based	Steiner/Waldorf method
Grade level implemented	Multigrade classes	Pre-school	All levels
Training on IBTL	Training provided by private sector partner; classroom observations	Training provided by the Early Childhood Care and Development Council	Training provided by mentors from Waldorf School

Singapore

For years, Singaporean students have been topping international tests in math, science and other subjects—outperforming students from more advanced countries. Some attribute the high test scores to schools’ emphasis on memorization of factual knowledge and drill approach to problem solving rather than on improving children’s conceptual understanding and application of knowledge in real-world contexts (Abrol and Gupta, 2018; Jayaraman, 2017; Yong, et al, 2008; Barr and Skrbiš, 2008).

Singapore’s Ministry of Education introduced its vision, “Thinking School, Learning Nation” in 1997. The vision ideates an education tem that fosters learners’ creativity, critical thinking and passion for lifelong learning. Guided by this vision, the Ministry launched the “Teach Less, Learn More” initiative in 2005 aimed at improving the quality of interaction between the teacher and the learner, making the learning engaging and more meaningful for the learner (Singapore MOE, 2013).

In support of this endeavor, the 21st Century Competencies Framework was instituted by the Ministry in 2010 (Singapore MOE, n.d.) to intensify its ongoing efforts to cultivate students’ critical and inventive thinking skills, along with honing their capacity for communication, collaboration, civic literacy, and cross-cultural and global awareness. This framework is the linchpin of the basic education curriculum. The shift in orientation of the curriculum is envisioned to prepare Singaporean youth not only to become high achievers, but also to develop skills, values and attitudes that will carry them through current-day realities and challenges.

Inquiry as the pedagogical approach to developing thinking skills and other 21st-century competencies was explicitly stated in the Ministry’s curriculum frameworks for two subjects: social studies and science. For other subjects, however, IBTL is just one of the options for delivering content. According to informants from a teacher education institution, more advocacy and evidence-based studies must be undertaken for IBTL to gain more advocates and practitioners.

Inquiry is likewise the recommended approach for the Programme for Active Learning (PAL), a new learning area developed by the Ministry of Education. PAL is a compulsory non-academic program for first and second graders.

Inquiry Approach to Developing Future-Ready Singaporean Citizens

The Curriculum Framework for Social Studies was modified by MOE's Curriculum Planning and Development Division (CPDD) in 2011. Its overarching goal is to prepare students "to be citizens of tomorrow by helping them to better understand the interconnectedness in Singapore and the world they live in and appreciate the complexities of the human experience" (CPDD, 2011, p. 1).

The syllabus recommends inquiry as the main approach for students to build fundamental understanding of historical, cultural and civic concepts, and acquire the necessary skills and values to transform into "informed, concerned, and participative citizens with a global outlook" (CPDD, 2011, p. 3). It discusses two forms of inquiry that teachers can apply in the classroom—process-oriented inquiry or the scientific method and the discussion-oriented form of inquiry which encourages the articulation of students' views, exchange of ideas, and dialogue. Teachers are expected to devote time and resources into coaching students to master the habit and skill of inquiry.

Learning Science through Scientific Inquiry

The Science Curriculum Framework, revised by the CPDD in 2013, declares science as an inquiry. It aims to "nurture the student as an inquirer" and the "teacher as the leader of inquiry" (CPDD, 2013, p. 2). Through IBTL, students are expected to comprehend basic science concepts, phenomena and principles. It is also expected to equip them with science process skills, such as observing, classifying, inferring, predicting, and analyzing, and instill positive attitudes, such as curiosity, open-mindedness, perseverance, and creativity.

Introduction of Program for Active Learning in Primary School

The Singapore Ministry of Education mandated schools to incorporate the Programme for Active Learning based on a 2009 recommendation by the Primary Education Review Committee. PAL is a non-academic, non-disciplinary program designed to expose children to sports, outdoor education, performing arts, and visual arts. It is intended to balance the curriculum and allow the development of well-rounded Singaporean children. Informants from the school note that IBTL is the prescribed method for delivering PAL.

Schools are mandated to include two hours of PAL per week for all Primary 1 and Primary 2 students. Primary 3 to 6 students, meanwhile, may be given an option to continue with PAL or take a co-curricular activity in their specific area of interest. All schools are expected to offer and fully implement PAL by 2017.

The Practice of IBTL in a Singaporean School

Punggol View Primary School. The Punggol View Primary School uses the inquiry mode mainly to deliver PAL, which the school introduced in 2014. According to the school administrator interviewed for the study, the application of IBTL in other disciplines is optional. Representatives from the Ministry of Education train the teachers and likewise conduct visits to observe and provide feedback. A core group of IBTL practitioners share their experiences with other teachers. The school administrator said that not all teachers are comfortable using IBTL.

The teacher-respondent mentioned that IBTL requires well-thought out open-ended questions that can lead to the topic at hand. Thus, the main challenge for teachers is preparing “facilitating” questions and anticipating possible answers so that discussion can be controlled. Teachers also need to evaluate themselves to determine if there are opportunities for improvement.

Box 9: Demonstration of IBTL, Pungol View Primary School



Age:	7-8-year-old students
Subject Area:	Outdoor Education
Topic:	Nature
Learning Objective:	For students to be able to explore and appreciate things found in nature
Materials:	Storybook, tablet

Observed Inquiry Activity:

1. The teacher narrated the story, *We're Going on a Leaf Hunt*.
2. The teacher related the story to the activity of the day—scavenger hunt. In preparation for the scavenger hunt, the teacher divided the class into groups of three. Each group was tasked to choose a leader. The groups were then given a scavenger hunt list as well as a tablet with which to take the photo of all items found.
3. The students embarked on an outdoor scavenger hunt.
4. Upon returning, the representative of each group was asked to stand in front of the class to show the photos they had taken.
5. Students were asked questions about their experience (e.g., what senses were used during the hunt).
6. Students were given worksheets to write down what they learned from the scavenger hunt. They were then asked to read their reflection.

Table 7 summarizes the key features of IBTL practices of the Punggol View Primary School in Singapore.

Table 7: Features of IBTL in Punggol View Primary School, Singapore

Punggol View Primary School	
Type of school	Public
Start of implementation of IBTL	2014
IBTL model/variation	Program for Active Learning
Grade level implemented	Primary 1 and Primary 2
Training on IBTL	Training provided by the Ministry of Education; mentoring by core group of IBLT practitioners

Thailand

The Thai government authorized the implementation of the new basic education curriculum in 2008. The Thai Ministry of Education cited “rapid economic and social change” along with “scientific and technological advancement” as rationale for the changes in the curriculum.

The new curriculum seeks to develop five key competencies to prepare students for the 21st century as follows: communication capacity, thinking capacity, problem-solving capacity, capacity to apply life skills, capacity for technological application. The new curriculum likewise aims to veer away from content-based and centralized curriculum to a standards-based and contextualized curriculum.

Teaching Science through Inquiry

Under the new curriculum, content is proposed to be delivered through learner-centered and highly contextualized approaches. For science, specifically, curriculum standards cite inquiry as key to learning scientific concepts in increasing levels of complexity, and to linking scientific knowledge with the scientific process. The Thai MOE and the Institute for the Promotion of Teaching Science and Technology of Thailand (IPST) developed and produced science textbooks and teacher’s manuals that are anchored on the 5E cycle and includes inquiry-type experiments (Srisawasdi, 2016).

Draft National Lifelong Learning Plan

The Ministry of Education recently crafted a national plan that specifically focuses on lifelong learning and caters to all age groups. The plan aims to develop the character of Thai citizens and equip them with skills for the 21st century as well as help Thailand escape from the middle-income trap. Seven strategies will be pursued under the plan including the 1) development of high-quality curricula and teaching and learning processes, 2) professional enhancement of educators, 3) development of manpower for research and innovation, 4) information system and digital technology development, 5) creation of a learning society, 6) development of management systems, and 7) development of a financial system for education.

The Practice of IBTL in Thai Schools: Some Examples

Box 10: Demonstration of IBTL, Anuban Nakhon Pathom School



Age:	5-6-year-old students
Subject Area:	Science
Topic:	Plants
Learning Objective:	For students to identify things plants need to survive and grow
Materials:	Plastic tray, foam, morning glory seeds, drawing paper, pen, crayons

Observed Inquiry Activity:

1. The teacher put on a puppet show about morning glory. Afterward, the teacher asked the children what made the morning glory grow.
2. The teacher recalled the previous week's activity where the children planted morning glory seeds in two places: soil and plastic bottle with cotton and water. The children observed that some of the morning glory grew faster and taller than the others.
3. The teacher explained the next experiment which involves trying to grow the morning glory in darkness. The teacher drew students to a discussion on how this experiment should proceed.
4. The teacher next divided the class into groups of four to conduct the experiment.
5. The students were asked to hypothesize how the morning glory will turn out.
6. The teacher asked all groups to reflect on what they learned in class, illustrate their reflections in the drawing paper, and share their respective outputs in class.
7. Students were asked to sing about eating morning glory.

Anuban Nakhon Pathom School (ANPS). The school has been using the inquiry-based method for over ten years. Specifically, the 5Es is practiced in pre-school as well as in elementary-level science and math classes. Independent study and research approach, meanwhile, are used in other learning areas in the elementary grade.

The school adopted the 5E approach in line with the policy of the Thai Ministry of Education. The school head interviewed for the study said that ANPS teachers were trained on 5E techniques and participated in learning exchanges and workshops. She also said that the school has become a Centre for Science and Mathematics learning, and that teachers from other schools would often come to the school to observe. The lone teacher-respondent said that it is not hard to use the 5Es and in fact, uses this method to tackle each topic in class.

The school head noted that the use of 5Es has made learning fun for children. The children also exuded more confidence in communicating with others and asking questions in class. The only drawback, according to the school head, is that the process of connecting the “Es” usually takes a long time. She also mentioned the lack of readiness of some children as one of the challenges.

On the part of one parent-respondent, the difficulty is in answering the questions posed by her child and the necessity of doing research to answer these questions.

Box 11: Demonstration of IBTL, Yooyenwithhaya



Age:	4-5-year-old students
Subject Area:	Literacy and Numeracy
Topic:	Naming and counting ingredients
Learning Objective:	For students to be able to identify, name and count the ingredients for cooking pumpkin custard
Materials:	Coconut milk, eggs, pumpkin, palm sugar, pandan leaves

Observed Inquiry Activity:

1. The teacher used a song ('pumpkin song') to introduce the activity.
2. The teacher asked the students to identify and describe (color, shape) the ingredients on the table.
3. The teacher asked follow-up questions such as 'Where does the coconut milk come from?' and 'How does the palm sugar taste?'
4. The teacher then asked the students to smell and taste the palm sugar.
5. The class was divided into small groups to play a game. The groups were asked to arrange the letters to spell the ingredients (sugar, egg, milk).
6. The groups were asked to read out the spelling of the word.
7. The teacher asked the rest of the class to listen to check if the words were spelled correctly.
8. The class started cooking the pumpkin custard after the teacher illustrated how it should be done (beat the eggs, cut the pumpkin using small plastic knives, mix all other ingredients).

Yooyenwithhaya School. Learning through the project approach has been the practice in Yooyenwithhaya since 1998. The approach was adopted to develop students' critical thinking skills. The school invited some professionals from outside (the school) to train its teachers.

The school head said that the project approach improves children's cognitive and socio-emotional skills and teaches children to work together in groups. The pre-school teacher-respondent said that through IBTL, children learn to do things on their own, even outside of the classroom.

The main challenge reported by the pre-school teacher-respondent is in preparing the learning materials, inviting resource persons, organizing the research activities of children. The Grade 2 teacher-respondent, meanwhile, said that it was difficult to implement IBTL in the beginning because it takes more time for the children to understand the lesson. In addition, some parents preferred their children to read books to get good grades in school. Only when they saw the results of this process that they realized that IBTL is the better approach.

Parents of pre-school students said that IBTL allows their children to have fun, relate what they learned in school with their daily lives, have confidence in asking questions, and communicate with their teacher. They further observed that children are very eager to go to school, even on times when they were sick.

Parents of Grade 2 pupils said that learning by doing is better than reading about the topic. It allows their children to learn new things more quickly and to integrate and use their knowledge. The major challenge cited by the parent-informants is learning what their children are studying in school so that they can provide the necessary guidance and support.

La-Orutis Demonstration School. La-Orutis, a laboratory school managed by the Suan Dusit Rajabhat University, adopted the project approach beginning 2015 in accordance with the policy of the Thai Ministry of Education. According to the school representative, the project approach allows children to learn about topics and find answers for themselves. She said that it supports the mission of the school to develop critical thinking among students. Teachers were trained before the school started and they also participated in a learning exchange with another school.

The lone teacher-respondent admitted that implementing the project approach has been challenging. She found it difficult to answer children's questions in the way that they will understand at their age. She also said that she needs to know more about the project approach, such as theories, concepts and the methodology.

Parent-informants observed that their children ask more questions, especially about what they learned in school, which in turn drives parents to seek information and learn new "systems." In addition, parent-informants said that they have learned to allow children to learn not only from books, but also from the environment. They also now encourage their children to learn from playing. Parent-informants raised the necessity of establishing a good relationship with their children's teacher for constant feedback and support. This is specifically applicable for parents who are working so that they know what kind of support their children require.

Table 8 summarizes the key features of IBTL practices in selected schools in Thailand.

Table 8: Features of IBTL in Three Schools in Thailand

	Anuban Nakhon Pathom School	Yooyenwitthaya School	La-Orutis Demonstration School
Type of School	Public	Private	Public
Start of implementation of IBTL	Mid-2000s	1998	2015
IBTL model/variation	5Es in science and math	Project-based approach	Project-based approach
Grade level implemented	Pre-school; Primary	Pre-school; Primary	Pre-school
Training on IBTL	In-service training; participating in learning exchanges and workshops	Training provided by an external consultant	In-service training; learning exchange with another school

In 2005, Vietnam passed its Education Law which lays down the objectives, principles and structure of Vietnam education, and outlines the roles and responsibilities of state agencies, political organizations, school administrators, teachers, students, parents, and other stakeholders in education.

Under the law, the overarching goal of the national education system is to ensure the holistic development of Vietnamese people in support of state goals, to wit:

The goals of education are to train Vietnamese into comprehensively developed persons who possess moral qualities, knowledge, good health, aesthetic sense and profession, and are loyal to the ideology of national independence and socialism; to shape and foster personality, quality and capacity of citizens, satisfying the national construction and defense requirements (Article 2, Education Law, 2005).

The law further prescribes teaching and learning methods that will bring out the students' "activeness, consciousness, self-motivation and creative thinking of learners; foster the learners' self-study ability, practicing ability, learning eagerness and will to progress" (Article 5, Education Law, 2005).

Renovating teaching methods under the 2011-2020 education development plan

The Vietnamese government crafted an education development strategy for 2011-2020 to align the training received by students with the human resource requirements of an increasingly knowledge-based economy. It also strives to endow students with life skills and creative abilities to be able to cope in a globally integrated modern society.

The Vietnamese government cited the highly theoretical content and outdated teaching methods as among the areas that need to be addressed to attain these goals. Under the 10-year strategy, education authorities intend:

To renovate methods of teaching and evaluation of learning and practice performance toward promoting learners' activeness, self-discipline, initiative, creativity and self-learning capacity. To enhance the application of information technology and communication in teaching and learning (Section V.3.d., Decision No. 711/QĐ-TTĐ, June 13, 2012, Vietnam).

The Practice of IBTL in Vietnamese Schools: Some Examples

Box 12: Demonstration of IBTL, Vietkids School



Age:	5-6-year-old students
Subject Area:	Life Skills
Topic:	Occupations
Learning Objective:	For students to learn about and appreciate a specific occupation in the community
Materials:	Videos, deck of cards, balloon, needle, box, egg, pink paper, stick, coin

Observed Inquiry Activity:

1. The students sang about what they want to be when they grow up.
2. The teacher showed the video of a magician performing magic tricks. She then proceeded to ask the students to describe what they saw in the video.
3. The teacher performed some simple, sleight-of-hand magic tricks (e.g., disappearing coin, card guessing, magic box, balloon popping).
4. The teacher explained that the work of a magician is not easy and involves a lot of practice.
5. The teacher showed another video exposing how the magic tricks were done.
6. The class was divided into four small groups, with two groups given the materials for the balloon popping trick and the other two groups given the materials for the disappearing coin trick. The teacher asked the children to try the simple magic tricks performed in the video.
7. After giving the students enough time to practice, the teacher asked for volunteers to perform the trick in front of the class.

Vietkids School. The pre-school began implementing the hands-on approach when it was established in 2009 to engage the children in class and improve learning outcomes. The head master observed that children who are subjected to IBTL are more focused and involved in class, have more opportunities to show their talents, become better communicators, and work more independently.

The head master interviewed for the study commented that teachers often talk too much instead of letting their students ask questions, and struggle to convey their message in the manner that pre-school pupils can grasp. The teacher-informants similarly mentioned the difficulty of explaining ideas to students, as well as in preparing suitable activities for and capturing the attention of students.

At the primary level, the school head said that it is important for teachers to master the 'questioning technique' to encourage students to articulate what they have learned. This means designing and asking questions that are suitable to children's different levels of ability. This concern was likewise aired by the teacher-respondent who said that teachers must ensure that advanced students are given challenging questions to sustain their interest. Teachers also must also anticipate and prepare for questions or answers that come from students.

Box 13: Demonstration of IBTL, Dong Da School



Age:	4-5-year-old students
Subject Area:	Arts and Crafts
Topic:	Local flowers
Learning Objective:	For students to be able to create artworks using different materials
Materials:	Paint, easel board, crayons, colored paper, cotton, dried leaves, twigs, glue



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SEAMEO INNOTECH (2016)

Observed Inquiry Activity:

1. Using local flowers as theme, the teacher asked her students which flowers they like best.
2. The students were divided into groups. Different kinds of materials (paint, crayons, paper, cotton, dried leaves and twigs, glue) were made available for the students to choose from.
3. With flowers as theme, students were asked to choose the art materials they want to use to express their creativity.

Dong Da School. The school started practicing IBTL in 2008 when the Hanoi City Department of Education selected it as one of the pilot schools. As a pilot school, Dong Da is invited to participate in the teacher training program that education authorities organize. As well, the Dong Da School Principal participated in the training program on IBTL conducted by the United Nations International School for select school heads.

The school head noted that IBTL has encouraged students to be more active as well as confident to express themselves and demonstrate what they know.

The school head cited as problem, the teachers who wanted to show off their knowledge and would keep on talking instead of interacting with the students. For the teacher-respondent, the lack of resources for teachers and the difficulty of preparing materials to implement IBTL are the major constraints.

Box 14: Demonstration of IBTL, Kim Lien Primary School

Age:	8-year-old students
Subject Area:	Mathematics
Topic:	Four-digit numbers
Learning Objective:	For students to understand the concept of place value of 4-digit numbers
Materials:	Square pads (a square pad consisting of small squares, e.g., matrix-type, magnetic white board, magnetic numbers)



PHOTO CREDIT:
SEAMEO INNOTECH (2016)

Observed Inquiry Activity:

1. The teacher asked the class to count the small squares that make up the square pads (totaling to over a thousand small squares).
2. The teacher then paired up the students and asked each pair to place the correct digits in the appropriate column on their magnetic white boards (e.g., place the digits of 1,423 under thousandths, hundredths, tens, ones).
3. The class was asked to continue answering the exercises in their book.
4. The students were asked to check their seatmate's work.

Kim Lien School. The school adopted the IBTL method in 1994 as a strategy to develop the students' creative thinking skills, allow them to work more independently, and make them active participants in the learning process. The teachers were introduced to IBTL in college, but they also get in-service training either from programs organized by the Kim Lien School or from those they sought independently. The school head mentioned that, in fact, the management uses IBTL as one of the measures to assess teacher performance. Moreover, the school promotes the demonstration of teaching practices and sharing of experiences among teachers.

The inquiry-based approach was reported having rendered students happier and more excited, and facilitated their active participation in class, according to the school head. The teacher-respondent said that more teachers will take the IBTL route if they are well-prepared and equipped with the technique. She added that crafting a set of questions that encourage the curiosity of students is the most challenging part of practicing IBTL.

Table 9: summarizes the key features of IBTL practices in selected schools in Vietnam.

Table 9: Features of IBTL in Three Schools in Vietnam

	Vietkids School	Dong Da School	Kim Lien School
Type of School	Private	Public	Public
Start of implementation of IBTL	2009	2008	1994
IBTL model/variation	Not indicated	Not indicated	Not indicated
Grade level implemented	Pre-school; Primary	Pre-school	Primary
Training on IBTL	Review of teachers' lesson plans; classroom observations; training by experts	Training arranged by the Hanoi City Department of Education	Pre-service and in-service training for teacher; teaching demonstrations

V. DISCUSSION

National Policy Environment

The governments of Brunei Darussalam, Malaysia, Philippines, Singapore, Thailand and Vietnam all initiated measures in the past decade to align their respective educational systems with 21st century requirements. They recast their educational frameworks and overhauled their basic education curriculum to place stronger emphasis on cultivating their young citizens' critical thinking skills, creativity and innovation, problem-solving abilities, communication skills, socio-cultural awareness and participation, and other life skills. These initiatives are anchored on laws, education development plans/blueprint, and curriculum framework.

One of the strategies identified to achieve these goals is to promote the use of student-centered pedagogical methods, such as the inquiry-based learning approach, along with facilitating access to learning tools and resources such as ICTs to support such methods. The governments of the six countries specifically advocated the application of the inquiry approach in science education. Some, such as Singapore and the Philippines, also saw the benefit of employing the inquiry mode in the teaching of social studies. Singapore, meanwhile, took it a step further by prescribing the application of the inquiry approach to its non-academic subject, Program for Active Learning.

In terms of grade level, most of the countries sought the application of IBTL as early as preschool. For example, the Philippines's pre-kindergarten and kindergarten education framework targets children's holistic development using constructivist, inquiry-based and play-based approaches, while Brunei Darussalam seeks to encourage socialization, build confidence and stimulate creativity of preschoolers through project-based learning.

While there is a clear preference for IBTL as an alternative learning method, most of the countries' national policies and plans fell short of indicating how the teachers will be capacitated or trained to use IBTL to deliver content. Only the Brunei Darussalam education ministry provided details on its professional enhancement plans for teachers. Specifically, it commissioned a European-based institution to conduct an in-service training program, beginning in 2008, on inquiry-based science education for science teachers at the elementary level.

In addition to the lack of details on teacher preparation, it is worth noting that except for Singapore and Malaysia, none of the countries have specified in their national plans how student assessments will be done under an inquiry-based learning environment. Since the process of inquiry is deemed just as important as the content or outcome of the inquiry, corresponding measures or tools to assess process skills and attitudes must necessarily constitute the overall performance evaluation of students. In the case of Singapore, its education ministry identified three areas of assessment in the science curriculum as follows: (1) assessment of knowledge, understanding and application of science concepts; (2) assessment of skills and process; and (3) assessment of ethics and attitudes. It also recommends diverse tools for evaluating student performance, such as projects, teacher observations, checklists, reflections/journals, model-making, posters, games and quizzes, debates, and drama, among others.

Inquiry-Based Learning Policies and Practices in Selected Schools

The practice of inquiry-based learning is a new development in nearly all schools included in the study, most emerging only in the past decade or so. The exceptions are two public schools, one in Thailand and another in Vietnam, which claim to have adopted IBTL as early as the 1990s.

School Policy on IBTL

For the 10 public schools included in the study, state policy is the impetus for integrating inquiry as a pedagogical approach. For example, in accordance with the reforms introduced by their respective national education authorities, the Anuban Nakhon Pathom School in Thailand and the Sekolah Rendah Kampong Mata-Mata Gadong, both government-funded schools, began pursuing inquiry-based science education within the timeline indicated in the reform plan.

The six private schools in the study, on the other hand, had more autonomy in terms of the timetable for introducing IBTL, the model used, and the level and content area where IBTL would be practiced. In the case of the Seria Mulia Sarjana School in Brunei Darussalam and the Manila Waldorf School in the Philippines, for instance, the inquiry process is embedded in their respective international curricula and is practiced across subjects. Inquiry is also not the sole pedagogical approach that teachers are encouraged to use in class.

Type of IBTL Practiced

Research results show that there is no one type or model of IBTL practiced in the schools under study. For example, the Anuban Nakhon Pathom School in Thailand follows the 5E model, while several other schools, such as Stella School in Brunei, Yooyenwitthaya in Thailand and Sekolah Kebangsaan Jalan 3 in Malaysia are committed to the project-based approach.

Still, other schools were unable to define the type of IBTL that their teachers are pursuing. On further examination, these are schools that have no explicit policy on IBTL and/or have no IBTL-oriented training program for teachers, but nonetheless encourage their teachers to use inquiry as one of their instructional strategies. Teachers with no formal training but were into IBTL were mostly self-taught and gained knowledge from their own supervisors/coordinators or from fellow teachers who are trained.

Level and Content Area

Most of the schools have incorporated IBTL as early as pre-school, although some were unclear on whether it is confined to pre-school or applied in other grades as well.

At least three public schools are using the inquiry approach to teach science. This practice is evidently a reflection of Southeast Asian governments' policy to promote the sciences toward the production of more STEM graduates.

Other schools ventured to use IBTL or elements of inquiry in other learning areas, such as math, reading, language, and the arts. Two private schools, meanwhile, have integrated the inquiry mode in all learning areas. In the case of Singapore, the public school employed inquiry in its Program for Active Learning subject.

Student Evaluation or Assessment

None of the schools have instituted a systematic method for assessing the specific outcomes of IBTL. The benefits mentioned by school administrators, teachers and parents are all casual/informal observations.

Benefits and Challenges of IBTL: Responses of Education Stakeholders

Participant-informants of the study mentioned notable results of IBTL practices in their respective schools. However, some challenges were also met during implementation.

School Administrators

All the school administrators/representatives interviewed reported observing positive behavioral changes in children exposed to the inquiry approach. Most mentioned that children seemed to have gained more confidence in communicating with others; became more independent thinkers and learners; and were more observant, inquisitive and adventurous. Some school administrators also mentioned that IBTL made learning fun and enjoyable for children.

For the school administrators, the effective implementation of IBTL is hampered by the following factors:

- *Resources.* Some school administrators commented on the lack of space and other learning resources for IBTL activities. One even mentioned that a few teachers had to shell out funds to obtain materials needed in class.
- *Language.* Some school administrators also said that the use of English as medium of instruction in the IBTL process has been problematic since many children cannot articulate well in English.
- *Teacher attitude, preparation and experience.* Teachers can be barriers to IBTL, especially those who stubbornly hold on to old mindset and practices, lack the experience and preparation, or do not understand the spirit of the inquiry process and continue to dominate class discussion.
- *Complexity of the inquiry process.* The preparation of materials and activities for IBTL and designing appropriate questions based on students' age and ability are grueling on the part of the teacher, according to some school representatives.

Teachers

Teacher informants cited several challenges to the practice of inquiry in their own class. These are as follows:

- *Resources.* According to teacher-informants, some of the learning resources needed to implement IBTL, such as science apparatus and internet connectivity, are not readily available.
- *Language.* A few of the teacher-informants echoed the concern raised by school administrators on the difficulty of using IBTL in a multilingual setting with English as the medium of instruction. Children who are not well-versed in the language have a hard time expressing themselves in class.

- *Teacher preparation.* Some teachers admitted that they do not have adequate knowledge and training on the IBTL process which makes them struggle to apply this in class. One respondent, for example, raised the need to learn about project-based theories, concepts and methodologies.
- *Complexity of the inquiry process.* The teacher-informants mentioned that planning lessons, identifying and organizing interesting activities, preparing visual aids and other learning materials, and crafting appropriate questions are all time-consuming tasks. Moreover, practicing inquiry in class can be a long-drawn process, which is problematic since the time allocated for each subject is limited.
- *Parental knowledge and attitude.* One teacher-respondent said that parents do not understand or were not too keen about the inquiry approach and were focused on how their children perform academically.

Parents

Most parent-informants positively viewed the inquiry-based approach since they reported observing noticeable changes in their children. They said that their children have become more aware of their environment, more sharing and compassionate, and sensitive to the needs of others. They also said that the children displayed readiness to learn—they are inquisitive and curious, are active in class, ask for explanations, and share and try to replicate what they learned in school. The parents also reported observing a general improvement in their children's personal demeanor—they are more expressive, and they act confident, empowered, and independent.

Many of the parent-informants expressed feelings of inadequacy regarding helping their children learn under an IBTL environment. They mentioned the difficulty of finding time to devote to their children's projects; lack of technological knowledge; unfamiliarity with the syllabus; and necessity of doing research to address the questions posed by their children.

Some parent-informants mentioned that while policy promoting critical thinking is in place, schools are generally focused on ensuring that students pass national exams rather than cultivating their children's thinking skills.

Children

Students who were selected to participate in focus group discussions generally said that they enjoy and learn from IBTL activities in their schools. Children who were interviewed for this study (aged five to eight) mentioned that they had fun and learned new things by doing the following:

- hands-on activities, such as:
 - science experiments (e.g., learning the concept of healthy and unhealthy food by putting a food item on top of an oil paper to observe if the food item will leave oil marks; growing a plant in different controlled environments to learn the effects of sunlight and water in plants)
 - cooking (e.g., learning numeracy and literacy by counting and spelling the names of ingredients)
 - writing on the board (e.g., improving spelling and pronunciation skills by writing a word on the board and reading it)
 - art activities (e.g., developing fine motor skills and encouraging creativity through coloring, painting and drawing);

- listening to stories (e.g., discovering how a caterpillar turns into a butterfly while listening to a story);
- using picture cards (e.g., forming compound words by combining two picture cards); and
- playing games (e.g., learning new words through word spelling game; reading and writing four-digit numbers through a group game).

Student-informants added that they like asking questions in class because they want to learn more. They also noted that they learn, too, when listening to their classmates, participating in class discussions, and answering questions.

Moreover, based on the interview with some students who participated in a cooking activity in class, it was noted that they seemed to be conscious of the effects of their action – being careful in breaking an egg to keep the yolk intact, and being independent; that is, being able to cut the pumpkin or breaking an egg without the help of others.



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VI. RECOMMENDATIONS

It is clear from the study that inquiry-based teaching and learning is not only recognized but is actively being promoted by national education authorities of the six Southeast Asian countries as an alternative approach to training their young citizens for a 21st-century economy and society.

While IBTL offers positive learning opportunities for children ages three to eight, the study acknowledges the challenges that education authorities face in implementing it. The following sub-sections provide conclusions and recommendations drawn from the numerous discussions with school heads, teachers, students, parents, representatives from teacher education institutions, and other education authorities during the study.

Teacher Preparation

One of the most obvious gaps highlighted by the study and may be indicative of the bigger picture is the seemingly inadequate professional development programs at the national and school levels to equip teachers to handle IBTL in the classroom. The importance of teacher's preparation and planning for IBTL was evident in the classes observed during the school visits. The difficulties mentioned by teacher-informants (e.g., preparation of materials and activities, crafting of questions) are often rooted in the lack of teacher preparation and support from a community of IBTL practitioners.

If IBTL is to become mainstream, the national education authorities need to facilitate the convergence of efforts of Ministries of Education and teacher education institutions toward the goal of institutionalizing IBTL as a teaching practice. At the pre-service level, the inquiry process can be highlighted as an approach for learning, transitioning to the immersion of student-teachers on the application of IBTL theories to diverse learners in different contexts in laboratory, multigrade and regular schools. Moreover, the study showed that IBTL can be adopted in almost any learning area, hence, teachers can re-purpose some activities regardless of grade level and individual skill level. Teachers must be able to recognize specific lessons or competencies that best suit the inquiry process.

Regular in-service training programs (i.e., professional development) for teachers and school administrators may be offered collaboratively by national education authorities. Distance education and school-based in-service training can build a critical mass of IBTL practitioners and at the same time, serve as a platform to discuss and resolve issues on IBTL implementation. The school head plays an important role as instructional leader in mentoring and coaching, especially in this type of training. Hence, instructional leadership skills of school heads including leading curriculum implementation and contextualization, delivering planned learning outcomes, local language material development, and instructional mentoring/coaching can also be strengthened. Knowledge-sharing among teachers and school heads/supervisors by establishing IBTL communities of practice; initiating and sustaining personal and professional learning networks through mobile devices, collaborative applications, blogs and social media; conducting lesson studies or learning action cells; and holding and participating in learning exchange programs can also be introduced to support professional development of both teachers and school administrators.

Education authorities are encouraged to integrate the newly developed ECCE Teacher Competency Framework for Southeast Asia in the pre-service and in-service training programs for ECCE teachers. Jointly developed by the UNESCO Asia-Pacific Regional Bureau for Education and the SEAMEO Secretariat,

the framework identifies four domains in which ECCE teachers must develop their competencies to be effective and responsive. These domains are as follows: (a) content knowledge, pedagogic practice, and assessment; (b) learning environment; (c) engagement and collaboration; and (d) professional development (UNESCO & SEAMEO, 2018). This framework complements the Competency Framework for Southeast Asian Teachers of the 21st Century, which was earlier crafted by SEAMEO INNOTECH in 2009. The second framework suggests developing the following skills essential for teaching in the 21st century: (a) facilitating the development of learners' life and career skills, (b) facilitating learning, (c) preparing appropriate lesson plans in line with the school vision and mission, (d) creating a conducive learning environment, (e) developing and utilizing teaching and learning resources, (f) developing higher order thinking skills, and (g) enhancing ethical and moral values. The framework covers 60 indicators, and while all are important, it is noteworthy to highlight the following indicators that underscore skills for IBTL:

- employ strategies that cater to students' learning styles and to elicit active learning;
- promote students' participation and collaboration;
- apply questioning and reacting skills;
- integrate HOTS in the lesson;
- promote a caring and learning-friendly environment; and
- motivate active learning.

Professional development of teachers may also include rekindling and sustaining their passion for teaching. This soft skill, together with the tangible skills mentioned above, are consistent with the more recent version of the Competency Framework for Teachers in Southeast Asia (Teacher Council of Thailand, et. al., 2017). This regional framework calls on teachers to know and understand what to teach, help students learn, engage the community and become "better teachers every day."

Learning Materials

The study showed that inquiry-based learning exacts or requires more resources than the usual didactic teaching style. For example, activities would often use art supplies, instruments, equipment, or communication devices. Some of the teachers interviewed for the study had pointed out some inadequacies in this aspect. Some teachers also mentioned that they had to use their own funds to purchase the materials needed for IBTL activities. Schools intending to seriously pursue IBTL should identify and invest in the required resources and make these resources available to children to enrich their learning experience. Teacher-made materials or improvised teaching materials using locally available materials can also be applied if financial support is limited.

Since information and communication technologies (ICTs) are ubiquitous at home and in school, including IBTL classrooms, it is recommended that education authorities and teachers closely examine how these technologies support and impact the inquiry-based learning process. Blumenfeld, et al. (1991) identified six contributions that technology, in general, can make to the learning process: 1) enhancing interest and motivation, 2) providing access to information, 3) allowing active, manipulable representations, 4) structuring the process with tactical and strategic support, 5) diagnosing and correcting errors, and 6) managing complexity and aiding production. In this study, it appears that learners were more engaged in class activities or projects that allowed them to explore and tinker with digital and mobile devices and the internet technology. Still, there is a need to further study which technologies (e.g., computers, tablets and e-book readers, multi-touch technologies, cameras, digital recorders, mobile phones) and web tools suit age groups and will create the most impact. Schools' and teachers' guidance on the use of technologies is still necessary—they must be used in the right way, under the right circumstances, by those trained in their use. Studies reveal that successful use of ICT in education relies on how ICT is integrated in the learning process (Innovations for Poverty Action, n.d.).

Recognizing the educational potential of mobile technologies, which are widely used in the region, SEAMEO INNOTECH developed the Mobile Technology for Teachers (MT4T), a resource kit that orients teachers on the features of and the educational tools available in mobile gadgets (i.e., smart phones and tablets). The MT4T resource kit is composed of e-books and web portals that introduce social networking sites and information-sharing platforms (e.g., Facebook, Edmodo); provide guides, tips, and examples on how to harness mobile technology in education; and provide annotated resources on 21st-century learning and higher order thinking skills. The kit likewise includes learning packets on digital citizenship that teachers can use to develop digital literacy, critical thinking and socio-emotional skills among children. The MT4T resource kit is one of SEAMEO INNOTECH's educational innovations which is consistent with the 21st-century goals articulated in SEAMEO INNOTECH's Competency Framework for Southeast Asian Teachers in the 21st Century and supports the Education Agenda for the SEAMEO Seven Priority Areas (2015-2035).



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Learning Environment

Some of the teachers interviewed for the study also noted that lessons would sometimes include exploration of the environment outside the classroom, story-telling, and outdoor games. The teachers are sometimes constrained in doing such activities because of lack of appropriate learning space where class activities can be conducted.

Creating a conducive, learner-centered environment is one of the competencies identified in the competency frameworks for Southeast Asian school heads and teachers. Apart from identifying learning spaces where class activities (e.g., exploration, outdoor games) can be held, it is important to ensure that the learning environment stimulates inquiry and critical thinking and fosters love for learning, which the natural environment offers. Moreover, pictures, maps, posters and educational toys are just some materials that can be made available for learners inside the classroom or within the learning area to facilitate learning. The learning environment should also be maintained as a safe space for children – physically safe (e.g., clean and green, free from hazardous materials), socially safe (e.g., free from bullying and discrimination) and emotionally safe (e.g., children are free to ask questions without prejudice) – to help enrich the learning experience.

Parental Engagement

For most children, parents are the constant factor in their journey to learning. Literature has shown that children perform better in school and are able to reach their full learning potential when they are supported by parents or parental figures as their learning partners. Most parents in this study appear to be supportive of IBTL and are cognizant of the positive impact of this approach on their children. Having this kind of support is already a huge step towards achieving the goals of IBTL since parents can be tapped to reinforce the inquiry mindset at home. But while parents in this study are supportive, they feel ill-prepared to help their children, citing the lack of time (among working parents) or lack of technological know-how to help children with their projects. Schools and teachers should be made aware of and consider these limitations when they develop their IBTL program.

In cases of absentee parents, schools should try to engage the child's parental figure, be it a relative or a caregiver. Teachers are encouraged to further reach out to, and if need be, provide extra guidance to the child. It is important for the school authorities to orient parents (or the parental figure) on IBTL to familiarize them on the goals and strategies of IBTL; to clarify and manage their expectations, misconceptions and/or apprehensions; and to help them better understand their roles as learning partners of the school.

Assessment of Children's Progress

Further study needs to be undertaken on how practitioners of IBTL in Southeast Asian schools assess children's progress. In general, however, involving students in their own assessment is a principle of IBTL. This principle is consistent with formative assessment methods (i.e., assessment for learning) which rely on constant and reciprocal feedback between the student and the teacher. These feedback sessions allow the teacher to identify students' learning difficulties, needs, and progressions, and to make the necessary adjustments in teaching. Moreover, depending on the level of readiness (maturity, skill) demonstrated by the students, reflective assessment (a formative process) may be undertaken by students themselves (i.e., peer assessment) as they work in pairs or in groups. Involving students in conversations about their learning also allows children to take responsibility for and be critics of their own work, as well as reflect on their academic strengths and weaknesses.

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Additionally, in an inquiry-based learning environment, numerical scores do not take center stage. While quizzes, exams and other summative assessment (i.e., assessment of learning outcomes) are important, these are not the sole measures of students' learning progress. IBTL practitioners also evaluate the skills and abilities that students have acquired in the process of inquiry, for example, investigative process skills in sciences, problem-solving skills, critical thinking, creativity, ability to collaborate (i.e., assessment as learning). Moreover, IBTL practitioners employ a range of tools and strategies that allow them to make a more holistic assessment of the breadth and depth of each student's learning for the duration of the course or class. These include authentic assessment strategies or the direct/real-world application of students' knowledge and skills, such as community projects, performances, stories, presentations, and audio-visual work. They also include the use of non-traditional techniques, such as the student portfolio (which typically includes student journals, reflection pieces, and samples of best work), use of rubrics to assess student outputs, peer assessment, informal interviews, and class observations. Such diverse tools and strategies promote collaborative assessment, integrated learning and mastery, and help education authorities determine if curriculum objectives or standards are being met.

National education policies still place much importance on standardized tests to measure learning outcomes, however, schools and teachers committed to IBTL are advised to design an assessment system that balances national requirements with student-centered/student-inclusive and holistic assessment that is aligned with the inquiry-based approach.

The 5E Instructional Model and Other Instructional Approaches

The 5E Instructional Model is a useful tool for school administrators and teachers in their curriculum review and instructional planning of inquiry-based teaching and learning. Several schools in the study employ the 5E model or some elements of it, while other schools use other permutations of IBTL, such as problem-based learning. For the 5E model and other IBTL instructional approaches to be effective, schools should be able to recognize how these approaches can be contextualized to suit their realities taking into consideration the differences in culture, available resources, teacher preparation and national or school-level policies on IBTL.

Informants from the study note that these inquiry-based approaches encourage children's curiosity; stimulate thinking; foster imagination; and give children opportunities to explore new ways of learning, ask questions and seek knowledge. There is also consensus that through simple experiments, learners develop the habit of investigating and validating the new concepts (information) they come across. Moreover, informants attest to the socio-emotional benefits of IBTL; that is, it hones interpersonal skills; instills different mindset; builds initiative, independence and self-direction; improves self-confidence; and builds learning to learn skills among children. Still, while the school administrators, teachers, and parents gave favorable testimonials about IBTL, they remain anecdotal and episodic. Further studies and documentation are needed to be able to directly link better academic performance and positive behavior with the inquiry approach, and to determine the sustainability of its benefits.

Enabling Policies

A brief review of Southeast Asian countries' national education policies and plans in this study reveals that all are concerned about developing thinking skills and recognize IBTL as one of the approaches to cultivate the habit of reflective inquiry among children. However, while IBTL is being touted as a promising pedagogical approach, most of the participating countries have no comprehensive strategy for its systematic and large-scale (national-, provincial-, district- or school-wide) adoption. Unlike Brunei Darussalam, for example, which invested in the multi-year in-service training of its public school teachers in inquiry-based science education, most participating countries treat IBTL as optional for public schools and teachers.

There is also no corresponding shift in systems and procedures that would support or facilitate the acceptance and adoption of IBTL by schools. For example, the assessment system remains summative in nature, with learning outcomes valued over processes. Since guidelines are non-existent, schools and teachers are left to design their own inquiry-based assessment tools. In addition, there is no incentive and reward system for IBTL initiatives of schools or for innovative work or excellent performance of teachers practicing IBTL. There is likewise no incentive for developing local materials to guide the practice of IBTL. Since IBTL approaches originated overseas, resources such as sample lesson plans are not Asian-oriented and use the English language which, as this study showed, can hinder learning.

While the inquiry approach has been given policy space, support mechanisms are still sorely lacking. This may account for the slow adoption or implementation of IBTL in schools. Apart from national policies, schools should also develop their own policies on IBTL that are aligned with the national and/or regional/provincial/district policies, guidelines and standards. The critical role of the school head in instructional leadership, managerial leadership, strategic thinking and innovation, stakeholder engagement, and personal excellence should be underscored to support IBTL. Schools (and teachers) intending to introduce IBTL or expand its scope will need to craft a comprehensive plan, which identifies what IBTL model to follow based on the school's assessment and experience of what works and considering the school's philosophy and culture; in which grades/levels and learning areas (i.e., specific lessons or competencies) to integrate the inquiry approach; how the inquiry approach can be integrated into the existing curriculum; what resources are available to teachers and students; what capacity building do teachers require to practice IBTL; and how to assess student progress. In addition, schools should be able to commit to investing in the in-service training of teachers and other resources needed to support and sustain IBTL practice.

Monitoring and Evaluation

Although IBTL is being promoted as a pedagogical method in national education plans, there are no mechanisms to monitor its implementation and evaluate its impact. Education authorities should develop a monitoring and evaluation framework—one that can be used across schools—which includes indicators to track changes/progress, methods and frequency of data collection, and method of analyzing data. Initial data from different implementing schools, such as documentation of practices, can be utilized to design the framework.

Action research, at the national or school level, may also be undertaken not only to establish tangible impact, but also to identify gaps and weaknesses in improving learning outcomes. National education authorities are encouraged to partner with teacher education institutions, schools, teacher associations, parent associations, and other stakeholders to define research priorities and facilitate the conduct of research. One important area of research is to determine the factors affecting children's engagement with IBTL, such as the language with which to effectively deliver inquiry-based learning. The study reveals that the use of ESL (English as second language) in multilingual and multicultural classrooms can be a deterrent to learning and may negate the objectives of the inquiry approach. Other areas of research may include teacher preparation, actual day-to-day IBTL practices, assessment methods, and link between child-rearing practices and pre-disposition for inquiry, to name a few. These studies can become part of a national data network on IBTL, which can provide wider understanding of and lead to progress in the field.

Evaluation studies that provide evidence of positive impact are particularly critical if IBTL advocates and practitioners are to convince schools, both public and private, to integrate the inquiry practice in their system, to widen its scope to include all grades or learning areas (not just the sciences) or to strengthen IBTL implementation in both regular and multigrade schools. These impact studies can likewise counter the criticisms leveled against the inquiry approach (e.g., inquiry is not suited to all kinds of learners, does not lead to better performance in subject areas, leads to misconceptions and disjointed knowledge), and dispel concerns, skepticism, and any resistance to mainstreaming inquiry in education.



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VII. CONCLUSION

Developing higher order thinking skills as part of the 21st-century learning is one of the education goals in all countries where the study was conducted. All participating countries recognize IBTL as one of the promising approaches that can be used to enhance critical and creative thinking skills among children. Each country uses IBTL in different ways depending on their context, available resources, level of teacher readiness, and existing policies. The study also reveals that IBTL can be practiced not only in science but also in other learning areas such as mathematics, language, literacy and numeracy, arts and crafts, and life skills. IBTL promotes holistic development of children, imbued with critical thinking, creativity and other 21st century skills.

Acknowledging the benefits derived from the practice as shared by selected Southeast Asian schools that have embraced the inquiry approach, IBTL is an area that national education authorities are advised to systematically investigate to scale-up the reported encouraging results among children. It is beneficial to inculcate the inquiry practice among children at an early age to nurture their natural state of inquisitiveness. Ultimately, these fundamental skills will prepare them for future jobs that are needed to propel the society's growth in the wake of the Fourth Industrial Revolution and increasing regional and global integration.



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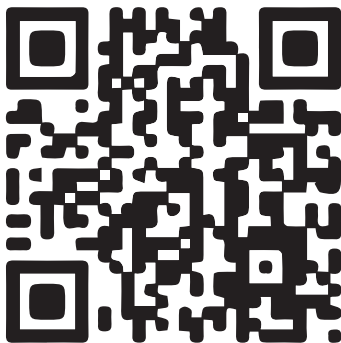
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