Cambodia STEM Mentoring Programme Forum
4 and 5 April 2023
ASEAN CENTRE for DIGITAL EDUCATION

Content

Executive Summary

STEM is widely recognised as a strong driver of economic and national development. It can provide solutions to many challenging societal problems, while preparing students to be future-ready.

Cambodia aims to be a middle-income country by 2030 and a high-income country by 2050. STEM is a strong driver of economic growth and there is a need to develop STEM education capacity in Cambodia in the next few years.

Currently, there is neither an official definition of STEM nor a STEM syllabus in Cambodia. Cambodian school leaders and teachers have identified limited availability and quality of trained educators, limited provision of infrastructure and equipment, and funding constraints as the key challenges of STEM delivery.

On 4th and 5th April 2023, 45 participants from **The HEAD Foundation, the Ministry of Education, Youth and Sport (MoEYS) Cambodia, Kampuchea Action to Promote Education (KAPE), SEAMEO STEM-ED Centre**, school leaders in STEM, teacher educators, mentors and other specialists conveyed in Phnom Penh to exchange experiences in STEM education and mentoring STEM teachers in South-East Asia.

By learning about similar initiatives in neighbouring countries and the specific context of Cambodia, the primary outcome of the forum was to identify effective practices for a successful STEM Mentoring Programme in Cambodia.

The main consensus among participants were; STEM needs to be focused on real-world problem solving, and STEM teacher training and STEM delivery in classroom must be country appropriate. Cambodia will need to develop her own model of STEM education and mentoring. Educational goals must be aligned with human resource development to support Cambodia's economic growth.

To effectively do so, Cambodia must provide coherent structural resources to support the envisioned changes. Teachers and schools need to be equipped with the necessary resources. Besides providing hardware (infrastructure and equipment), teachers need the corresponding knowledge and skills to use them effectively. Instead of designing new STEM resources from scratch, it is feasible to source and customise existing open-source STEM resources and learning activities.

Critical enabling factors to develop and sustain STEM teaching and learning include: -

1. People – Establish a shared vision and secure the commitment of teachers, teacher mentors, school leaders, community stakeholders and education policy makers
2. Resources – Increase availability and quality of resources (infrastructure, equipment, financial, human resources)
3. Assessment – Enable an assessment culture and attitude that is more aligned with the purpose and modality of STEM
4. Policy – Introduce policies and strategies supporting continuous professional development for educators

The learning points from this Forum will be used to shape the design and delivery of future STEM centric initiatives in Cambodia.

The organisers would like to acknowledge and appreciate all presenters, guests and working committee members for our inaugural STEM Mentoring Programme Forum 2023 (Please refer to Section 8 for Acknowledgements).

1. Forward Plans

The 2-day forum brought STEM and teacher mentoring experts together to share their knowledge and experience on challenges, opportunities, and factors influencing a successful STEM and mentoring programme.

Presenters and participants provided the following actionable suggestions;

1. Enhance design of capacity building programmes for educators
    a. Focus on core practices that are proven effective at improving learning outcomes
    b. Establish stronger links between coursework and classroom experience to increase transferability
    c. Identify and hire experienced teachers as 'Professors of Practice'

2. Provide support to educators
    a. Provide an online learning platform with adequate and appropriate STEM resources
    b. Develop a STEM toolkit
    c. Engage fellow teachers to support each other (e.g., action research groups, STEM Mentor Network)
    d. Provide continuous professional development opportunities for teachers in STEM
    e. Ensure equitable access to STEM resources, especially for schools with limited budget
    f. Address availability and quality of resources provided (e.g., infrastructure, equipment)

3. Foster collaboration and partnerships
    a. Encourage collaboration among stakeholders
    b. Establish partnerships with organisations that have successfully implemented STEM mentoring programmes and adapt their models to the Cambodian context

4. Ensure accountability and sustained commitment to STEM development efforts
    a. Establish a STEM committee to oversee STEM efforts in school
    b. Assess outcomes of STEM programmes (evaluation)
    c. Offer adequate recognition and incentives to STEM mentors and schools that take on additional roles and responsibilities in STEM development efforts

The learning points from this Forum will be used to shape the design and delivery of future STEM centric initiatives in Cambodia. This will be aligned to Cambodia's national plans and opportunities, complement other concurrent STEM initiatives in Cambodia, and serve as key inputs to the development of relevant frameworks, syllabus and/or definition of STEM in Cambodia.

2. Forum Objectives and Agenda

The objectives were: -

1. Share learning outcomes and exchange experiences about STEM and Mentoring programmes (case studies from Cambodia, Thailand, Korea, US)
2. Share Cambodia's national plans related to STEM and Continuous Professional Development (CPD)

The activities during the 2-days included: -

1. Discussion sessions
    a. Experts in STEM education teacher training from Thailand shared on capacity building, and effective models of mentoring and training programmes
    b. Partners who designed and delivered STEM Education in Cambodia shared their design, process, and outcomes
    c. Partners involved in mentoring teachers in Cambodia shared their experience on teacher mentoring
    d. MoEYS representatives shared on Cambodia STEM education policy and professional development initiatives for teachers
2. Site visits to High Schools
    a. Meet key contributors to STEM education in schools to hear their achievements, challenges and hopes for the future

Forum Agenda

Date	Activities	Refer to Section in Report
4 April AM	Greetings and Registration	
	National Anthem	
	Welcome Speech by Mr Ul Run / KAPE	Section 3
	Remark Speech by Mr Vignesh Naidu / THF	
	Remark Speech by Dr Kritsachai Somsaman / SEAMEO STEM-ED	
	Opening Speech by HE. Dr Um Romny, Secretary of State for MoEYS	
	Break	
	Learning About STEM Education from Thailand / SEAMEO STEM-ED • Dr Kessara Amornvuthivornm, Programme Director • Asst Prof Dr Burin Asavapibhop, Programme Manager • Ms Yaowalak Jittakoat, Research and Evaluation Manager	Section 4.1
	Lunch	
4 April PM	STEM Education – Competency for Tomorrow (Competency-Based Curriculum) • Ms Serena, Senior Manager, EMCAST • Ms Hunshin Cho	Section 4.2

	Learning About Mentoring and STEM In Cambodia from Voluntary Service Overseas (VSO) • Mr Chin Sam Oeurn, Education Project Manager	Section 4.4
	Mentoring teachers at New Generation Pedagogical Research Centre (NGPRC) • Mr Stanislas Kowalski, Mentor	Section 4.6
	Site visit to New Generation School – Preah Sisowath High School • Opportunities and challenges of teaching STEM in school – Sharing by Mrs Im Leongsim • School tour	Section 4.5 Section 4.7
APRIL 5	Second Day	
5 April AM	Site visit to Network School – Boeung Trabek High School • Opportunities and challenges of teaching STEM in school - Sharing by Mr Sophal Chan • School tour	Section 4.7
	The STEM Excellence Pathway as a potential framework • Dr Katherine Prammer, International Adviser on STEM-ED	Section 4.3
	Lunch	
5 April PM	Cambodia's National plan for Continuous Professional Development (CPD) • Mr Ren Kun, Deputy Director of Personal Department, MoEYS	Section 5.1
	STEM Education in Cambodia • Mr Chea Vuth, Deputy Director of General Education Department, MoEYS	Section 5.2
	Break	
	Mentoring in STEM in Cambodia: Moving forward • Mr Kurt Bredengbert • Mr Vignesh Naidu • Dr Kritsachai Somsaman • Prof Jean Francois • Dr Katherine Prammer Moderator: Ms Michelle Leong	Section 6
	Closing Speech by HE. Mr Put Samit, General Director of Directorate Education	Section 7

3. Opening Remarks

The programme was opened by representatives from the four organising partners: -

- *Mr Ul Run, Director of NGS Programme and National Adviser on Education /KAPE*
- *Mr Vignesh Naidu, Director, Operations / The HEAD Foundation*
- *Dr Kritsachai Somsaman, Centre Director / SEAMEO STEM-ED*
- *HE. Dr Om Romny, Secretary of State / MoEYS*

The key points highlighted by the presenters included: -

1. Latest development of STEM education in Cambodia (a video produced by MoEYS)

2. SEAMEO STEM-ED's mission in collaborating with 11 SEAMEO countries on STEM. This includes STEM education and knowledge sharing (including for educators), resource utilisation and professional (learning) community.

3. Having indigenous educators who can best support and collectively uplift each other in the community. One proposed model is to develop and support STEM educators - to train, mentor and develop their peers.

4. Importance of aligning education and human capacity development to support Cambodia's economic growth and development through STEM and Digital Education

4. Sharing Sessions on STEM and Mentoring

There was a total of six sharing sessions on STEM and Mentoring and two school visits. Presenters covered the following in their presentation, followed by Question and Answer.

1. General overview of the programmes and contexts
2. Objectives and desired outcomes
3. Current situation (status/evaluation of outcomes, etc.)
4. Factors supporting progress and overcoming challenges
5. The way forward (projects, next phases, challenges, etc.)

At the school visits, school teachers and principals shared on the opportunities and challenges of teaching STEM in their schools, followed by school tours.

4.1 (Day 1 AM) Learning about STEM Education from Thailand by SEAMEO STEM-ED

Synopsis

Dr Kessara Amornvuthivorn, Asst Prof Dr Burin Asavapibhop and Ms Yaowalak Jittakoat from SEAMEO STEM-ED shared on the following:

1. SEAMEO STEM-ED adopts the following definition of STEM, which focuses on the purpose.
   "STEM education is a teaching and learning approach that emphasizes the connections among–or the integration of–knowledge and skills in science, technology, engineering, and mathematics. STEM education addresses problems faced by communities, as well as larger global issues that require a skilled workforce and knowledgeable citizens (who can apply these skills and knowledge) to develop solutions."

2. Chevron Enjoy Science Programme
   This 8-year Thailand Partnership Initiative (2015 to 2023) aims to: -
   a. Develop K-12 learners to graduate with competencies in STEM and related areas
   b. Build inspiration and aspiration for learners in STEM-related careers and develop their competencies for such careers

   The programme included Capacity Building of Educators, Learning Modules and Career Academies.

3. A research study was conducted to measure the impact of teacher professional development on STEM teacher practices to promote student learning and STEM skills. The monitoring and evaluation findings from Phase 1 (2015 to 2019) showed positive outcomes.

Discussion

The discussion revolved around: -

1. Definition, objectives, and student learning outcomes of STEM
   a. Thailand focuses on understanding the scientific phenomena and application to basic problems to make it applicable to everyday life
   b. US takes a low-floor high-ceiling approach to STEM learning by identifying minimum level of knowledge and skills that needs to be taught and matched with appropriate resources, and more advanced levels at subsequent levels

2. Ways to support STEM learning in schools with limited budget and/or technical equipment
   a. Focus on minimum level of equipment to facilitate learning basic (core) concepts
   b. Offer shared resources to facilitate STEM learning (e.g., STEM kits at library)

3. Commitment required from stakeholders to ensure sustainability of STEM programmes in Thailand

Key learning points

1. Factors influencing the success and sustainability of STEM programmes include: -
   a. Identify the correct people - Target participants, implementers, and policy makers
   b. Use evidence to design, improve and evaluate programme aligned with national agenda
   c. Engage policy and implementing partners with shared vision, mission, and expertise
   d. Mobilise and optimise resources from committed partners
   e. Manage change and incentivise educators to sustain change

4.2 (Day 1 PM) STEM Education – Competency for Tomorrow (Competency – Based Curriculum) Korea – STEM School Model

Synopsis

Ms Serena and Ms Hunshin Cho shared on the following:

1. Comparison of Education Conceptual Framework and competencies across OECD, Cambodia, and Korea

2. Korean STEM model
   a. Focus on competency-based education, and testing across disciplines
   b. Place more value on general educational goals (e.g., interpersonal competencies)
   c. Pair coherent curriculum choices with assessment framework, practices, and testing
   d. STEM activities can be student-centric and involve all STEM disciplines with precise learning outcomes and ongoing evaluation. Examples include flipped classroom and product development.
   e. STEM education is offered in selected schools as it is not a mandatory offering in Korea. Schools indicate their interest and receive special (STEM) government budget, with flexibility to decide on the frequency and duration of the STEM projects/ activities.

3. Korea also covers STEAM – addition of Arts to STEM. Concepts of friction (S), product conception (TE), centre of gravity (M), design/creation (A) were illustrated in the design of a tablet stand.

Discussion

The discussion revolved around: -

1. Availability of STEM resources
   a. There are no fixed STEM modules defined by the government
   b. Teachers are willing to share STEM resources with other teachers
   c. Resources (e.g., assessment grid) and national STEM activities database would enable school teachers to utilise the materials better

2. Teachers have the autonomy to collaborate and design, develop, and implement STEM curriculum and activities with their peers. This is typically an annual activity. By doing so, they align with the perceived needs of the government.

3. Assessment
   Besides national exams, teachers provide continuous evaluation of students (Grades 10 to 12) on their attitudes. There are social and institutional systems to ensure teacher evaluations remain transparent and fair.

Key learning points

1. Provision of support (e.g., financial and autonomy) for developing teacher-led STEM activities and the exchange of learning resources between teachers
2. The way assessment is conducted affects the interest of students/teachers/schools and the resources channelled to development of STEM activities in Korea

4.3 (Day 2 AM) STEM Excellence Pathway as a Potential Framework for Cambodia

Synopsis

Dr Katherine Prammer shared a draft Cambodia STEM Education Framework and conducted a demonstration on Raspberry Pi.

The framework aims to foster thinking about long-term strategic goals while focusing on continuous growth with SMART action plans to address identified priorities. It serves as a strategic tool for Cambodia schools to systematically and strategically define a pathway in STEM. For full details on draft Cambodia STEM Education Framework (including the development history), please refer to Annex A.

The key elements in the framework include: -

1. Description of 20 priority areas across the Cambodia STEM Model progression of performance
    a. Have four classifications - STEM Exploratory, STEM-Enabled, STEM-Proficient, Full-Immersion
    b. Consists of 20 high-impact STEM Priority Areas under 3 levels of responsibility and 6 focus areas
        i. School- 1. Teacher Qualifications, 2. Curriculum
        ii. Classroom- 3. Instructional Practice, 4. Assessment and Demonstration of skills
        iii. Community- 5. Family and Community Engagement, 6. Real-world connections
    c. Function: A Tool to create a practical plan with SMART goals, a Process for assessment, a Guide for developing specific steps in the process, and a Support for professional development, mentoring, and engagement with the community.
    d. There is a high level of granularity provided in the 20 high-impact priority areas. This can better accommodate the significant level of inter-dependences between the priority areas and the variability between Cambodian schools.

2. Application by schools
    a. Each school will self-evaluate 20 priority areas and identify 3 targeted priority areas
    b. Schools will create SMART goals, timeline, and action plan
    c. Process is repeated as the school progresses to higher level of STEM Education.
    d. Any school can use it, regardless of school size, budget, population, geographic location, organizational structure, and curriculum.

Dr Katherine Prammer also shared on her creation – Cambodia STEM In a Box on the Raspberry Pi OS. It offers numerous resources for science, math, and STEM education (with Khmer translations). For more details on Raspberry Pi (including the development history), please refer to Annex A.

Discussion

1. For teachers/schools interested in the Raspberry Pi and its resources, they could explore applying to the Raspberry Pi foundation for support and/or approach Dr Prammer directly.

Key learning points

1. Schools need scaffolding to improve. One way is to provide a highly customisable framework, based on the school's context, resource availability and needs (see point 2 above)
2. The more urgent tasks include: -

a. Develop an understanding of "What is STEM?" and "How do we want to do it?" at the school level
b. Provide a good curriculum map of all the STEM subjects (tap on existing available resources worldwide), identify the most relevant ones, and translate some STEM materials into Khmer

3. Offer more support for teachers
    a. Share resources
    b. Offer ongoing professional development opportunities
    c. Create / curate a Ministry-level online repository (in Khmer) containing STEM projects and professional development resources to support school PLCs, and district and national mentoring
        i. Indexed to MoEYS grades 3-12 curriculum map
        ii. Should include a set of low-floor, high-ceiling, wide-wall project themes, and share exemplar implementations of Cambodian STEM projects and the teacher facilitation guide
        iii. Include an open submission process for project review prior to posting

4.4 (Day 1 PM) Cambodia – Learning about STEM and Mentoring by Voluntary Service Overseas (VSO)

Synopsis

Mr Chin Sam Oeurn from Voluntary Service Overseas (VSO) shared on the following:

1. Key activities in Professional Development in Upper Secondary School (PDUSS) targeted at NIE teacher educators and 50 teachers at Secondary Resource Schools (SRS) included: -
    a. STEM Training Manual
    b. Training of Trainers (ToT) for NIE core trainers
    c. Mentoring of teachers (onsite), guided by STEM Mentoring Framework

2. VSO trainers had to visit schools regularly (5 visits, once per month) to support implementation through: 1-Demonstrations; 2-Observations and training (e.g., co-teaching, lesson planning); 3-Initiation of lesson study and action research; 4-Follow up and creation of a STEM committee in the school to continue the work. They also provided recommendations after each visit.

3. VSO recognised the importance of conducting the post-programme evaluation /implementation follow-up.

Discussion / Key learning points

1. Factors supporting progress include:
    a. People
        i. Need to establish relationships and trust with external trainers/mentors
        ii. Need to provide support for school-based STEM committee
        iii. Build and maintain a community inside and outside the school to learn and share about STEM
        iv. Depends on teachers' willingness to learn and experiment (correlation with age)

    b. Utilisation of ICT and support required

i. Provide demonstrations and opportunities to use new equipment
ii. Schools need to consider providing support in lab management and scheduling for effective utilisation of lab resources

2. Resource Development
   a. Develop a "STEM toolkit" to help teachers doing STEM more systematically and connect with the expected learning outcomes
   b. Explore the development of a Moodle dedicated to PD (sharing of best practices and resources, etc.) with contribution and curation by the community

4.5 (Day 1 PM) Cambodia – STEM in New Generation School (NGS) Preah Sisowath School

Synopsis

Mrs Im Leangsim from Preah Sisowath School shared on the following: -

1. STEM activities in Preah Sisowath School
   a. Involves around 400 students (from Grade 7 onwards) and 50 teachers
   b. Students apply their learning to a project with a monthly lab visit and receive support from their teachers. Students present their project upon completion and get feedback from other teachers who will draw connection to their own discipline.
   c. STEM projects are realized in part during normal class schedule and after school
   d. STEM projects are not marked
2. Challenges faced by teachers and students for STEM projects
3. Professional Learning Circle (among teachers)
4. 4 "levels" of STEM proficiency

Discussion

Fellow teachers shared their perceptions and expectations of teacher mentors, followed by teacher mentors responding on their roles and takeaways.

Key learning points

1. There is a high level of commitment required from teachers as consultations with students can be time-consuming and spill over to weekends.
2. Teacher mentors tend to perceive themselves as supporting fellow teachers and enabling growth of teachers (with teacher mentors as equals). In contrast, teachers tend to view teacher mentors as having more expertise, such as giving feedback.
3. There is additional technical expert / manpower support (engineer) to support the development of STEM projects in school.

4.6 (Day 1 PM) Cambodia – Teacher Mentoring at New Generation Pedagogical Research Centre (NGPRC)

Synopsis

Mr Stanislas Kowalski from NGPRC shared on the Master's Degree of Education in Mentoring and key mentoring elements in the one-year programme.

The programme includes lectures, student-centred activities, and role-play etc. Teacher mentors also must undergo practicum, action research and submit a mini-thesis.

Key learning points

1. NGPRC is currently offering her 4th cohort (25 teachers per cohort) in 2023. This programme is not limited to Maths and Science teachers and requires teachers to be proficient in English.

4.7 (Day 1 and Day 2) Site visits to Schools

2 school visits were conducted with sharing by the principal and a school teacher.

- *Preah Sisowath High School – Mr Sam Kamsam and Mrs Im Leangsim*
- *Boeung Trabek High School – Mr Sovanara Pheng and Mr Sophal Chan*

They identified challenges as lack of infrastructure, lack of skilled personnel, lack of funds, and weak link between STEM teaching in high school to university. They also shared their experience and progress in mentoring and STEM teaching.

5. Cambodia Education Policy

There were two sharing sessions on Cambodia's National Plan for Continuous Professional Development and STEM Education in Cambodia. Presenters shared on the existing systems, policies, structures in place, followed by Question and Answer.

5.1 (Day 2 PM) Cambodia's National Plan for Continuous Professional Development (CPD)

Synopsis

Mr Ren Kun and Ms Yuos Sokunvary presented on the Cambodia's CPD system which included:

1. Desired outcomes and attributes
2. Types of CPD
    a. Structured (formal courses or offered by accredited CPD provider)
    b. Self-directed (within scope of CPD framework, no accredited provider)
3. Duration of 100 CPD hours per year (40 hours of non-teaching days and 60 hours of own activities)
4. Types of CPD activities and corresponding assessment methodology and criteria
5. CPD should include assessment and professional learning plan
6. Accreditation process for CPD providers

5.2 (Day 2 PM) STEM Education in Cambodia

Synopsis

Mr Chea Vuth shared on the following: -

1. Implementation of STEM, best practices and support provided at New Generation Schools and Resource Schools
2. Reforms
    a. Curriculum reforms
    b. Reform of teaching and learning methods
    c. Structural reforms
    d. Support and mechanism reforms
3. Challenges faced
    a. STEM integration and implementation
    b. Digital integration
    c. Teachers and materials
    d. Trends and student population
4. Strategies targeted at STEM in Cambodia

Discussion

1. Indicators used to rank schools such as good direction, environment, and teachers
2. Importance of changing assessment methods to meet current needs
3. Support for under-performing students
4. Ways to increase enrolment and retain students in science stream

Key learning points

1. There are many existing strategies and reforms to enable development of STEM in Cambodia.

6. (Day 2 PM) Sharing by Forum Partners

Synopsis

Five representatives from KAPE, NGPRC, THF and SEAMEO STEM-ED shared their key learning points and/or observations on STEM Education in Cambodia. The audience were also polled on key areas to focus on with regards to STEM development efforts in Cambodia.

Key learning points

1. What is STEM?
    a. STEM needs to be an integrated approach to solve real world issues, which requires
        i. Problem Based Learning (PBL)
        ii. Contextualisation (variation and local solutions)
        iii. Needs analysis, research and evaluation culture and assessment review
    b. STEM builds up both hard (technical) and soft skills, which affects employment and multiple aspects in life (e.g., people interaction) respectively

2. Enabling environment for STEM in Cambodia
    a. Infrastructure – Functioning and well-equipped school facilities

b. People – Competent, committed, and collaborative teachers and school leaders amidst challenges faced
c. Reform in assessment at national and school level (in turn affecting teaching instructions and exam culture)

3. Assessment
   There are growing calls and recognition on the importance to reform assessment and shift away from the current national exam-oriented culture in Cambodia. However, the forward moves need to be contextualised to Cambodia's social and cultural issues.

4. Audience polling – There were more participants who voted: -
   a. Continue to develop capacity of educators in STEM (i.e., continue to increase exposure to various STEM models) in the next 6 months over creating a definition of STEM
   b. People and assessment factors were more critical than developing infrastructure in creating the enabling environment for STEM teaching and learning in Cambodia

There was no clear conclusion whether STEM should focus more on hard skills or soft skills (as there are too many factors).

7. Closing Remarks

HE. Put Samit from MoEYS closed the Forum.

The direction and momentum to drive changes in Cambodia's education include: -

1. Collect and analyse evidence / data to inform on forward plans (e.g., PISA data to inform on school reform)
2. Continuously explore, share, and learn from each other on new trends and concepts (e.g., STEM)
3. Establish a strong link between education and Cambodia's economic development

8. Acknowledgements

Organising Committee

	Designation	Organisation
Mr Vignesh Naidu	Director, Operations	The HEAD Foundation
Ms Michelle Leong	Senior Manager	The HEAD Foundation
Mr Ul Run	Director of NGS Programme National Adviser on Education of KAPE Organization	KAPE
Prof Chan Roath	NGPRC Manager	NGPRC

Name	Role	Organisation
Dr Sun Somara	Translator / Interpreter	NGPRC
Mr Kong Maneth	Translator / Interpreter	NGPRC
Mr Phe Saorith	Translator / Interpreter	NGPRC
Mr Banh Hornmann	Translator / Interpreter	NGPRC
Mr Kosal Loeung	General Assistant	Student / NGPRC
Mr KEA Sophanha	General Assistant	Student / NGPRC
Ms Kang Sopharamy	Emcee	Student /NGPRC
Mr Teth Sophany	Emcee	Student / NGPRC

Presenters / Remarks / School Visits

Name	Designation	Organisation
HE. Dr Om Romny	Secretary of State for the MoEYS	MoEYS
HE. Mr Put Samit	General Director of Directorate Education	
Mr Kurt Bredenberg	Senior Technical Advisor	KAPE
Dr Kritsachai Somsaman	Centre Director	SEAMEO STEM-ED
Dr Kessara Amornvuthivorn	Programme Director	
Ms Yaowalak Jittakoat	Research and Evaluation Manager	
Asst Prof Dr Burin Asavapibhop	Programme Manager - STEM Resources and Capacity Building	
Ms Serena Sungae Son	Senior Manager	STEM Teaching Training Centre (STTC), EMCAST Inc.
Ms Hunshin Cho	Teacher	
Mr Chin Sam Oeurn	Project Manager	VSO
Pr Jean-François Maheux	Professor	Université du Québec à Montréal – Research group on mathematics teacher training (GREFEM)
Dr Katherine Prammer	International Adviser on STEM Ed.	NGPRC (Visiting Professor)
Mr Chea Vuth	Deputy Director of DGE	MoEYS

Mr Ren Kun	Deputy Director of Personal Department	
Ms Yuos Sokunvary	Technical specialist, Personnel Department	
Mr Stanislas Kowalski	Lecturer	NGPRC
Mr Sam Kamsan	Principal	Preah Sisowath High School
Mrs Im LeangSim	Teacher	
Mr Sovanara Pheng	Principal	Boeung Trabek School
Mr Sophal Chan	Teacher	

9. Annex A – Draft Cambodia STEM Education Framework and Raspberry Pi

Development of Draft Cambodia STEM Education Framework

The framework was developed under the leadership of HE. Professor Chan Roath, Manager at NGPRC, Sam Kamsan, Director at NGS Preah Sisowath, and Dr. Katherine Prammer, authorized provider of the Carnegie STEM Excellence Pathway, at a month-long *2019 Cambodia STEM Excellence Pathway Workshop*. Participants included master educators from private and public Cambodian schools and Ministry officials (CICME 2021 presentation).

Afterwards, the Cambodia STEM Framework was piloted for after-school projects in 2019 in the community through a STEM Lending library, at Kids City and at the Cambodia Scout Jamboree, and in 2019-2020 at a private school in Phnom Penh, where it was found to be effective at scaffolding improvements in integrated STEM education.

The updates in a 2023 proposed framework further incorporate the Cambodian context, based on a 2020 STEM Workshop at NIE, input from Cambodian educators in Blended and Online Workshops during COVID, and 2023 meetings with a master STEM educator Cham Sophal at Boeung Trabek High School.

Additional information about Raspberry Pi

The Raspberry Pi demonstration at Boeung Trabek High School was presented in part at the ITEEA Conference in 2021 (https://vimeo.com/677082634?share=copy).

Some contents on the Raspberry Pi include

1. "Internet in a Box" server software for schools without stable internet access, including supporting offline Moodle use on phones without SIM cards, which sync with the Raspberry Pi server when nearby. Also includes Calibre, Kolibri, Kiwix, OpenStreetMap, NextCloud, Sugarizer, WordPress, Internet Archive, Media Wiki, Lokole.
2. IOT and electronics project software Mosquito and Node-Red
3. Mathematica software to use the Vernier quantitative lab probes with the Raspberru Pi, adapted Vernier teacher lesson plans and student documents for inquiry labs, STEM projects, and demonstration labs.
4. Khmer resources, including
    a. All MoEYS 2019 open resources in Khmer from the website krou.moeys.gov and all COVID-era created instructional science and math instructional videos.
    b. Grades 9-12 science resources in Khmer donated by Cambodian teachers
    c. Phet simulation