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STEM Teacher Capacity Building in Cambodia: Towards Future Policy Interventions

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Key messages

- Among many continuous professional development (CPD) pursuits, Science, Technology, Engineering, and Mathematics (STEM)-focused activities mainly involve workshops and in-school training. Nearly 80 percent of the teachers sampled (n=401) attended at least one workshop throughout their teaching career, yet only half of them participated in at least one STEM workshop.
- Evidence shows that there is no gender difference in access to STEM CPD. However, disparities are evident by school type: teachers at resource schools (RSs) attend more STEM workshops due to project-driven CPD supported by the StepUP project, which provided funding and resources to its target schools.
- STEM workshops cover relevant topics and include engaging activities, but scope and relevance to school and individual needs pose challenges. Follow-up and support remain ad hoc, depending on teachers' motivation to adapt to STEM education.

Introduction

In Cambodia, Science, Technology, Engineering, and Mathematics (STEM) education is viewed as a key driver of socio-economic development. In 2016, a STEM policy was implemented to motivate more students to enrol in science classes, introducing several guidelines on the matter. These included new regulations, mechanisms, curricula, and resources related to STEM, as well as investments for improving the school infrastructures, teacher training, and monitoring and evaluation procedures. The policy also aimed to provide incentives for STEM initiatives (MoEYS 2016). As a result, STEM manuals and project interventions have been developed. For instance, Cambodia initiated the Science and Technology Project in Upper Secondary Education (StepUP) from 2017 to 2025, which focuses on enhancing STEM education across 50 resource schools (RSs), 101 network schools (NWSs), 4 general technical high schools (GTSs), and 103 normal schools (NSs)[1] (ADB 2022).

However, despite recognising the importance of STEM education for reaching the government's 2050 development goals, Cambodia still faces major challenges in STEM education. Enrollment in the science track has significantly dropped from 90 percent in 2012–2013 to 34 percent in 2020–2021 (Kao, Chea, and Song 2022). Meanwhile, in higher education, many students from the science track switched to the social science track due to poor academic performance and little interest in STEM subjects (Kao, Chea, and Song 2024). In addition, Cambodia faces shortages of scientific materials (e.g., technological, experimental tools) and qualified STEM teachers, which impede the effective implementation of STEM education (MoEYS 2021). These challenges highlight that various factors contribute to this negative trend in STEM education. To reverse this, teachers play a crucial role in renovating and enhancing their STEM teaching practices by participating in capacity-building activities.

In light of these challenges, particularly the shortage of qualified STEM teachers, there is limited evidence on teachers participating in capacity-building activities to improve their skills and knowledge, further complicating efforts to enhance STEM teaching quality. This study examined current practices and the continuous professional development (CPD) of STEM teachers at upper secondary schools (USSs) in Cambodia. It used a mixed-methods approach, beginning with qualitative interviews conducted from December 2024 to January

[1] Upper secondary schools in Cambodia at the time of this study were divided into four types: resource schools, network schools, normal schools, and general technical high schools. The first two types, along with some normal schools and general technical high schools, participated in the StepUP project.

2025 with 89 stakeholders across five provinces and Phnom Penh, including officials, school principals and STEM teachers. Subsequently, the quantitative phase involved conducting survey spanning March to April 2025, sampling 401 teachers from 60 USSs. The findings of the present study suggest specific policy recommendations.

Key findings

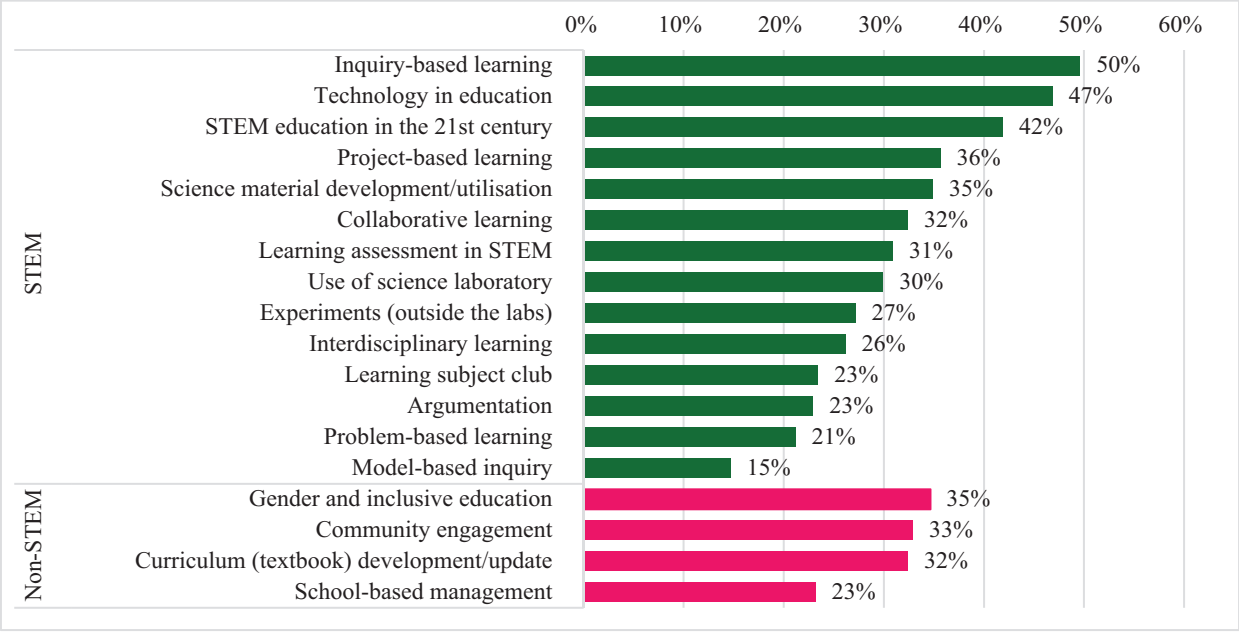
CPD opportunity and equity

Our research reveals a diverse range of CPD programmes available to Cambodian USS teachers. These programmes encompass national initiatives, such as project-driven workshops and school-based activities, including in-school training, technical meetings, class observations, and peer-to-peer teaching. Additionally, individual learning pursuits, such as online searches and formal degree programmes, also contribute to the CPD engagement landscape in Cambodia. In addition, it is noteworthy that workshops and in-school training sessions have emerged as the main CPD activities specifically designed to enhance teachers' STEM knowledge and skills.

However, despite various CPD pursuits, exposure to STEM workshops remains limited. While approximately 80 percent of teachers have participated in at least one workshop throughout their teaching careers, only about 50 percent of the teachers surveyed participated in workshops related to STEM topics such as Inquiry-Based Learning (IBL), technology integration, or STEM theory. Participation rates were lower in other areas, with approximately 20-30 percent involved in Project-Based Learning (PjBL), scientific material operations, assessments, experiments, and interdisciplinary learning in STEM (see Figure 1). Furthermore, access to STEM workshops is indiscriminate by gender yet remains uneven and largely influenced by school types. The data indicate that teachers in RSs, followed by NWSs, have significantly more opportunities to attend STEM workshops than their counterparts in other normal schools. This result suggests that the STEM CPD opportunity is driven primarily by project interventions, as those schools are part of the StepUP project, which provides infrastructure and a more supportive teaching environment to promote STEM education. Consequently, many teachers in such schools demonstrate greater awareness and engagement in STEM practices compared to those in the other ones. This evidence highlights that, although equitable access to CPD is prioritised in the national Teacher CPD framework (MoEYS 2019), concerns still emerge in the context of STEM education, which impacts its effectiveness.

School-cluster CPD activities appear to be scarce in Cambodia; only school-based activities, such as technical meetings, serve as a common platform for sharing, with over 53 percent of teachers attending 4-9 meetings annually. However, these sessions typically address general pedagogical issues rather than specific STEM content. Knowledge sharing among peer teachers about STEM topics remains virtually absent. For example, workshop participants are expected to share what they have learned with their fellow teachers, but uptake in this regard is often poor. This is due to a combination of factors, including teachers' limited capacity in disseminating the knowledge learnt, a lack of interest from colleagues, and insufficient support from school leadership to enforce or facilitate the process. Many teachers have noted that it is challenging to effectively convey two or three days' worth of learning in just one or two hours. This evidence highlights the importance of bottom-up initiatives in promoting STEM practices among peers.

Figure 1: Teachers' participation on STEM topics (n=401)



Source: Authors' working paper

Quality of STEM CPD and STEM adaptation

Content and activities

Besides accessibility, STEM CPD programmes have both strengths and limitations. STEM workshops (or CPD programmes) offer more engaging activities and relevant STEM content. For example, teachers have the opportunity to collaborate with other subject teachers to design lesson plans, present or implement them, and receive feedback from trainers. Some teachers have even applied the new activities in their classrooms. However, some concerns remain. For instance, training sessions often cover multiple topics at once, which can leave some participants overwhelmed and unsure of how to apply what they learnt. There is also a lack of interdisciplinary learning experiences, since training usually classifies teachers by subject, reducing opportunities for cross-disciplinary collaboration. Furthermore, most CPD workshops are one-time events, with few follow-up supports to reinforce learning or assist with implementation. Without ongoing support and practical guidance, many teachers revert to traditional methods (e.g., lecturing, writing lessons on the white board or administering exercise to students) because they lack the confidence and resources to apply new strategies effectively.

Coherence and adaptation

The content is not always properly tailored to the diverse backgrounds and experience levels of teachers; some find it too advanced, while others think it is too simple. As a result, while some teachers were able to apply new STEM activities, others returned to their old teaching routines. Some teachers of IT and Math subjects even saw a disconnection between their subjects and STEM education. Moreover, the alignment with the school context is also alarming, as some teachers report having no physical materials to implement what they have learned. Except for RSs, which showed to possess more resources, many others face constraints about materials and equipment, limiting teachers' ability to implement what they have learned through CPD programs. In addition, the exam-oriented culture also leads teachers to prioritise test preparation over developing engaged pedagogies. Social sciences' students, in particular, often neglect STEM subjects, believing them to be irrelevant to their exam performance, which further discourages teachers from adopting innovative pedagogies that are not exam-oriented. Lastly, large class sizes pose a significant challenge in managing hands-on STEM activities. Combined with a content-heavy curriculum, these factors leave little time or flexibility for PjBL and other interactive STEM practices.

Recommendations

This policy brief outlines key recommendations aimed at enhancing CPD, which in turn ultimately improves STEM education in Cambodia. These proposed ideas are directed towards relevant stakeholders to foster a more equitable, sustainable, and effective educational system.

To the Ministry of Education, Youth and Sport (MoEYS)

- **Operationalising equity provisions:** The CPD Framework 2019 envisions CPD for all teachers (MoEYS 2019), yet evidence shows rural schools and NSs remain underserved. A national strategy should prioritise equity by setting minimum STEM CPD access targets for disadvantaged schools. Although some teachers from certain NSs have some opportunities to attend training, they are not able to adopt STEM education in class due to resource limitations. Therefore, those schools should receive the necessary materials and equipment required for effective implementation of new STEM instructions upon the completion of each training.
- **Enhancing CPD relevance through contextualised and consecutive training:** The Ministry of Education, Youth and Sport (MoEYS) should ensure that CPD is tailored to teachers' backgrounds, interests, and school contexts by assessing teachers' competencies and motivations before training (also see King 2018). This allows differentiation – introductory STEM sessions for beginners and advanced pedagogical modules for experienced teachers – while valuing motivation and openness to innovation. CPD content must reflect the realities of Cambodian USSs, using practical examples relevant to large and diverse classrooms rather than idealised cases. New instructional activities should be tested locally before being promoted in training. MoEYS should also narrow training scope and adopt a consecutive, focused approach, emphasising depth and classroom application. Instead of many topics at once, each training cycle should focus on one area, such as inquiry- or project-based learning, followed by reflection and peer feedback in later sessions. These structured cycles, scheduled during semester breaks, would help teachers apply new methods gradually and strengthen confidence in STEM instruction.
- **Empowering school leaders to support teachers:** MoEYS should provide school leaders with clear guidelines and training to actively monitor and support teachers' implementation of new STEM pedagogical approaches. Our evidence shows that many school principals often blame their lack of knowledge of the training content as a barrier to supporting teachers; however, in fact, their role is centred around facilitating activities such as discussing with teachers how to incorporate new teaching methods into the classroom, how to support the implementation, and how it can be evaluated. This highlights the need for training for principals that focuses on teacher support and mentoring.
- **Implementing performance-based incentive systems:** Policy on CPD engagement and its incentive is available, yet it only recognises the track records of CPD participations, having an

irregular impact on educational changes, based on our evidence. To foster sustained engagement and tangible improvements, MoEYS should develop incentive systems that reward demonstrated enhancement in teaching-learning performance and positive educational outcomes in STEM, rather than solely recognising participation in CPD activities.

- **Addressing systemic structural barriers:** MoEYS should address systemic challenges such as large classes, resource constraints, teacher shortages, and exam-oriented culture, which hinder STEM education. The Grade 12 exam in Cambodia creates pressure on students and teachers, focusing on rote memorisation over mastery of STEM concepts, sidelining IBL, experimentation, or PjBL teaching approaches. MoEYS should align assessments with STEM goals, emphasising critical thinking and application. Additionally, upgrading facilities is essential for hands-on, student-centred STEM learning. Without these reforms, even strong CPD efforts may not result in classroom improvements. However, it should be noted that the implementation of STEM in schools also depends on teachers' competence.

To school principals and teachers

- **Championing STEM educational initiatives:** Principals play a pivotal role in shaping the culture and priorities of their schools and should act as visible advocates of STEM education, ensuring it is viewed as a core component of teaching and learning rather than an "add-on." This means actively raising the profile of STEM by communicating its importance to teachers, students, and parents, highlighting success stories, showcasing student projects, and embedding STEM into school events to build enthusiasm. Beyond visibility, principals can institutionalise STEM activities by integrating them into the regular rhythm of school life, such as establishing STEM clubs, encouraging cross-subject projects, and aligning school plans with MoEYS's national STEM priorities. They should also strategically allocate resources, prioritising limited budgets towards STEM-related activities like low-cost science experiments, ICT tools, or teacher participation in CPD, while leveraging school improvement budgets and partnerships with local communities, NGOs, and private actors to maximise impact. Equally important, principals should create a supportive environment for teachers by providing time for lesson planning, encouraging innovative teaching practices, recognising initiative in STEM pedagogy, and ensuring that professional development opportunities are fairly distributed among schools and teachers and directly connected to classroom practice.
- **Providing active teacher support and follow-up:** Principals are encouraged to consistently monitor teachers' progress in applying new STEM methodologies, offering constructive feedback, and facilitating an ongoing self-reflection (also see King 2018). Supporting the establishment of mentorship opportunities within the school is also crucial. In addition, principals should create regular spaces, such as post-lesson discussions or peer learning circles, especially during technical meetings where teachers can share challenges and successes in implementing STEM practices. By fostering a culture of continuous improvement and professional dialogue, principals help ensure that training translates into lasting changes in classroom practice.
- **Developing CPD plans:** Teachers should be encouraged to actively pursue their personal CPD goals through both formal activities, such as credited education, and informal methods, like peer-to-peer learning and self-study, as outlined in the CPD policy (MoEYS 2019). Additionally, schools should recognise and support these efforts as essential to improving teaching quality and student outcomes. Principals should take a proactive role in planning and resourcing school-based CPD initiatives, rather than relying solely on donor-funded projects. Teacher-based and school-led approaches to CPD would ensure more sustainability, relevance, and alignment with both the teacher and school context.

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