

Professional learning networks in mathematics education

Challenges to the quality of basic mathematics education, especially in under-resourced countries, are well documented. It is in response to these challenges that the International Commission of Mathematical Instruction (ICMI) launched its programme of Capacity and Networking Project (CANP). This programme aims to create and sustain effective regional networks in low-income and lower-middle-income countries and develop the educational capacity of those responsible for mathematics teachers. This paper reports on the deliberations among the representatives of CANP, ICMI and the International Mathematical Union in working towards the common goal of making high quality mathematics education available to all.

Introduction

The quality of mathematics teaching and of student achievement in mathematics is a significant and ongoing concern for the communities of mathematics educators, mathematicians, and policy makers in many countries. It is well recognized that the teacher is the most significant factor for quality in the education process. However, there are significant challenges in supplying adequately prepared teachers who are also well supported throughout their career.

In many low-income and lower-middle-income countries (LMIC), teacher education, especially in mathematics, remains weak, compounded by the absence of systemic availability of continuing teacher professional development. In such a context, there is need for viable ways to support mathematics teachers at scale, especially in the remote and hard to reach areas in the LMIC.

Professional Learning Networks offer new spaces in which '[T]eachers may learn and grow as professionals with support from a diverse network of people and resources. With recent advances in technology and widespread access to the Internet, teachers can expand their web of connections beyond their face-to-face networks, seek help and emotional support, and aggregate vast quantities of professional knowledge at any time and from anywhere' [1].

In this spirit the ICMI launched a network for mathematics educators which is described below.

Capacity and Networking Project

The Capacity and Networking Project (CANP) is a flagship programme of the International Commission of Mathematical Instruction (ICMI). It was launched in response to a report by UNESCO [2]. It has two major goals: (a) create and sustain effective regional networks in low-income and lower-middle-income countries of teachers, mathematics educators and mathematicians, also linking these networks to international support networks to enhance mathematics education at all levels; (b) develop the educational capacity of those responsible for mathematics teachers. To date, ICMI has supported five CANPs, each with the common purpose of advancing mathematics education but differing in its approach and methodology. Each CANP has a loosely structured governance mechanism supported by at least two 'representatives' and one member from the ICMI Executive Committee (EC), who serves as a liaison. The CANP representatives are nominated by the mathematics education community in the respective regions to lead and coordinate the activities on the ground and represent CANP in forums such as ICMI. Overall coordination of all the CANPs is provided by one of the two vice presidents of ICMI. Under the current ICMI EC, efforts have been underway to consolidate and enhance the impact of CANP.

On February 15th–16th this year a workshop was conducted with the participation of all five CANPs, along with members of ICMI EC and representatives of the International Mathematical Union (IMU). This meeting was important because all were meeting in-person for the first time since the outbreak of the COVID pandemic. Moreover, several new members had joined as CANP representatives, and it was important for them to meet with the larger group and with the ICMI EC.

Objectives of the workshop included: (i) meet collectively to share progress update and engage in reflection and analysis based on updates; (ii) identify barriers and challenges to sustainability of

CANPs; (iii) identify support within and externally to address the challenges; (iv) develop guidelines for a plan of action for a way forward.

The workshop was highly interactive. CANP representatives gave presentations and engaged in small and large group discussions. The language of the workshop was English. To enable participation of all, Núria Planas Raig offered facilitation in Spanish and Jean-Luc Dorier facilitated communication in French.

| No. | Region | CANP Representatives | EC Liaison |
|--------|-----------------------------------|---|------------------|
| CANP 1 | Francophone Sub-Saharan Africa | (i) Adolphe Cossi Adihou (Benin) (ii) Sounkharou Diarra (Dakar) | Jean-Luc Dorier |
| CANP 2 | Central America and the Caribbean | (i) Yuri Morales López (Costa Rica) (ii) Nelly Amatista León de Morales (Venezuela) | Marta Civil |
| CANP 3 | Southeast Asia | (i) Vu Nhu Thu Huong (Vietnam) (ii) Nisakorn Boonsena (Thailand) (iii) Chanika Senawongsa (Thailand) (iv) Pimpaka Intaros (Thailand) | Susanne Prediger |
| CANP 4 | East Africa | (i) Marjorie Sarah Kabuye Batiibwe (Uganda) (ii) Aline Dorimana (Rwanda) | Mercy Kazima |
| CANP 5 | Andean Region and Paraguay | (i) Jorge Daniel Mello Román (Paraguay) (ii) Fredy Yuniór Rivadeneira Loo (Ecuador) | Patricio Felmer |

The community of mathematics educators across the five CANPs is a significant resource because working at the grassroots level they provide insights into key issues and challenges in promoting mathematics education. The following section summarises some key issues, challenges, and possibilities.

State of mathematics education on the ground: Possibilities and challenges

As the five CANPs mapped out the current state of mathematics education in their respective regions, it was evident that there was considerable practical and research activity in mathematics

education at the local levels. These include doctoral programmes in education (mathematics), annual conferences and teacher development programmes. However, very little was known about the quality and impact of these programmes and activities. CANP could support the local efforts to become part of the wider international mathematics education community by helping local activity aspire to international standards of quality, and by supporting international dissemination of findings.

In the regions where CANPs are active, a significant challenge was limited availability and low quality of pre-service mathematics teacher education. In most cases, secondary school teachers were recruited based on their academic qualification, but they lacked pedagogical content knowledge (didactics). In the case of primary school teachers, content knowledge in mathematics was also found to be lacking. In-service and continuing mathematics teacher education was not available systemically. However, there were exceptions, such as in Thailand, when continuous professional development is essential for the promotion of teachers and is frequently conducted.

In the vast and often hard to reach geographical regions of CANP activity, it would be reasonable to create 'regional networks' linking other national bodies across the countries in the region. It was found easier to create regional networks when national mathematics associations or similar bodies were already in place. For example, the presence of the Association of Western and North African Didacticists of Mathematics (ADiMA) provided stability to CANP 1.

Future directions for CANPs

To address the issues noted above, participants of the workshop identified several areas where CANP would focus its efforts.

Mathematics education research

Members agreed that to provide empirical foundation for mathematics education, local research in this field should be strengthened. This could be achieved through enhancing the quality of existing PhD programmes and initiating PhD programmes in mathematics education where none exist.

CANPs could work with the local mathematics education stakeholders, especially the policy makers, to sensitize them to the importance of disciplinary research in mathematics education, as opposed to educational research that is generic. Similarly, CANP could help support specialized mathematics teacher education.

Establish and nurture networks: A three-dimensional strategy

During the deliberations, a three-dimensional framework was presented by Susanne Prediger, one of the participants, as an

approach for establishing and nurturing networks of mathematics teachers, mathematics teacher educators, and mathematics education researchers. The three dimensions were personnel, material and systemic. It was suggested that for networks to be sustainable, all three dimensions would need to be strengthened. For example: developing capacity of personnel through workshops, seminars, and conferences; developing materials and resources to sustain relevant activity; and systemic support through changes and intervention in educational policy. The framework was proposed as a guideline, and to raise awareness about the complexity of creating and nurturing professional learning networks.

International community and CANPs

It was noted that a variety of resources and support mechanisms are available to the CANPs from ICMI. Some of these resources can be highly relevant for addressing the apparent disconnect between local and/or regional mathematics education stakeholders and the international community. These include the following:

- ICMI EC members, in particular those in the role of CANP liaison, are available to provide support in the form of online webinars, talks, and other input as appropriate.
- An ICMI newsletter is published four times yearly and includes considerable information about ongoing and forthcoming activity in mathematics education. It could be subscribed at the IMU website.¹
- AMOR is a series of digital lectures about the work of the ICME awardees, which could be used as a resource for teaching in mathematics education courses.²
- The ICMI database project collects information about national curricula, standards, and the structure of education systems.³
- International conferences can provide opportunity for networking, for example:
 - ICME-15 in Sydney,⁴
 - upcoming ICMI study 26 on geometry education,⁵
 - ICMI online symposium on socio-ecological perspectives.

Concluding remarks

Participants deemed the workshop to be a highly successful event. Workshop objectives as described above were fulfilled and provided an opportunity for the more experienced members in CANP to meet with the new entrants. It also provided an opportunity to share and map out the significant work in mathematics education at the grassroots level. Participants of the workshop were able to bond as a team as they took part in cultural activities in Bangkok, alongside the academic work.

Most importantly, the members of ICMI EC and the CANP charted out the issues and challenges they face in supporting mathematics teachers on the ground and deliberated on pathways to support them.

The presence of ICMI President Fredrick Leung, IMU President Hiraku Nakajima, and the IMU Secretary General Christoph Sorger along with other members of the EC showed the great support of the community of mathematicians for the community of mathematics educators, both of whom are working towards the common goal of making high quality mathematics education available to all.

Acknowledgements. The workshop was fully supported by the *International Commission on Mathematical Instruction* (ICMI) and the IMU Commission for Developing Countries.

References

- [1] T. Trust, D. G. Krutka and J. P. Carpenter, “*Together we are better*”: Professional learning networks for teachers. *Computers & Education* **102**, 15–34 (2016)
- [2] UNESCO, *Challenges in basic mathematics education*. UNESCO, Paris (2011)

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¹ <https://www.mathunion.org/icmi/publications/icmi-newsletter>

² <https://www.mathunion.org/icmi/awards/amor>

³ <https://www.mathunion.org/icmi/activities/icmi-database-project>

⁴ <https://www.mathunion.org/icmi/icme/icme-15-2024>

⁵ <https://www.mathunion.org/icmi/activities/icmi-studies/ongoing-icmi-studies>