International Collaboration in Science and Mathematics Education

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The *Electronic Journal for Research in Science & Mathematics Education* is the flagship journal of the International Consortium for Research in Science & Mathematics Education (ICRSME). ICRSME was conceived by Dr. Arthur L. White in 1983 as a result of working on various projects in Central America and the Caribbean under the auspices of The Ohio State University and the United States Information Agency (USIA). The USIA was in effect from 1953 through 1999 (National Archives, 2020). The two-pronged mission of the USIA guided its activities:

> To seek to inform others about American life and values, policies, and interests as a nation; and, if possible, to eliminate misperception and move others to action in ways that serve the national interest; and second that mutual understanding borne of people-to-people communication matters, and that USIA should serve as a facilitator to bring Americans and their academic and other nongovernmental sector institutions into substantive contact with influential counterparts abroad through exchanges and other programs. (United States, p. 718)

By 1985, a variety of cooperative and collaborative projects were underway across institutions and countries, leading to ICRSME's first consultation in 1986 hosted in Port of Spain, Trinidad and Tobago. Subsequently, Dr. White and Dr. Donna F. Berlin organized 14 consultations across Central and South America and the Caribbean over three decades.

The mission of ICRSME is the advancement of science and mathematics education in the participating countries. This mission is based on the premise that all peoples can benefit from the knowledge and experiences of their local, national, and international colleagues. To serve the mission, the consortium model includes five interrelated goals:

1. Designing, facilitating, and conducting research and development toward the improvement of science and mathematics teaching and learning
2. Developing academic exchange programs between universities in order to broaden the educational experiences of students and faculty
3. Acting as an impetus in establishing ties between the local, state, and national educational associations in the participating countries
4. Identifying the particular science and mathematics education needs and issues facing current and emerging under-represented populations in the participating countries and directing research and development to address those needs and issues
5. Promoting collaborative efforts among scholars in the participating countries

As ICRSME continues to evolve, the organization plans to consider its mission and these goals and how they can be met. This editorial serves as an introduction to a series of editorials about fostering effective and genuine international collaboration in science and mathematics education.

Genuine Collaboration

In the process of developing genuine and productive collaboration, partners may encounter challenges. Such issues include differences in cultures and norms of diverse settings, variation in points of view and body-of-knowledge of persons involved, power structures, disparate motivations for involvement, weak communication about the goals of the work, and a lack of trust between partners (Adamson & Walker, 2011; Barnett et al., 2006; Buysse et al., 2003; Sim, 2010). One way to counter these challenges is to be purposeful in identifying the type of collaboration desired and the approach to building this collaboration, ensuring critical components are present at the outset.

The construct of *communities of practice* can serve as a framework to guide collaborative work. Communities of practice are "groups of people who share a concern, set of problems, or passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" (Wenger et al., 2002, p. 4). Wenger et al. (2002) describe three core characteristics of communities of practice: "a domain of knowledge, which defines a set of issues; a community of people who care about this domain; and the shared practice that they are developing to be effective in their domain" (p. 27). For instance, ICRSME is a community of people who care about the learning and teaching of science and mathematics. Moving forward, the organization plans to consider how to purposefully develop a shared practice.

Two critical premises ground the formation of communities of practice: a shared goal (Clausen et al., 2009) and the co-construction of knowledge (Palinscar et al., 1998; Sim, 2010). The establishment of both of these conditions has been found to result in genuine collaboration with opportunities to learn for all parties involved (Quebec Fuentes & Spice, 2017). Quebec Fuentes and Spice differentiate between *shared but given goals* and *shared beyond given goals*. For example, with ICRSME, a shared but given goal is the advancement of science and mathematics education. A shared beyond given goal would focus on an aspect of the learning and teaching of science and mathematics in a particular setting and relevant to the parties involved. In other words, a shared beyond given goal is a mutually established endeavor centered on a specific area of need (Buysee et al., 2001).

Effective collaborations also move away from an authoritarian, hierarchical, or colonialist model of knowledge dissemination. A foundational aspect of communities of practice is a shift from attention to individual ideas to group interactions (Buysee et al. 2003). In other words, "learning is viewed as distributed among many participants within the community in which people with diverse expertise (i.e., experts, novices, and those in between) are transformed through their own actions and those of other participants" (Buysee et al., 2003, p. 266). This concept of distributed expertise (Pugach, 1999) emphasizes the co-construction of knowledge with various stakeholders sharing ideas and perspectives (Palinscar et al., 1998; Sim, 2010).

Factors that enable the development of a shared goal and an environment for the co-construction of knowledge include conflict, communication, trust, and reflection. Conflict can be viewed as an undesirable *situation* or as an *ongoing process* that has the potential to lead to learning (Achinstein, 2002, p. 425). If conflict is perceived as a problem, participants avoid examining their beliefs and assumptions and instead establish a *culture of nice* (MacDonald, 2011, p. 46) through *feigned politeness* (Hargreaves, 2001), *superficial effort* (Barnett et al., 2006), and *contrived collegiality* (Hargreaves, 1994). On the other hand, if conflict is embraced, participants "acknowledge, solicit, and own conflict by critically reflecting upon differences of belief and practice," opening up space for "active dissent and opportunities for alternative views," the transformation of the status quo, and organizational learning (Achinstein, 2002, p. 441).

To support growth through the process of conflict, norms of communication must be established. The particular means of communication within a community are unique (Sim, 2010) since the community builds a shared language through their open and critical dialogue (Wenger et

al., 2002). Additionally, trust amongst participants is essential for communication (Barnett et al., 2006; Palinscar et al., 1998). "Trust can be established if the community assumes that responsibility for understanding is shared, and authority for knowing is internal and collective" (Palinscar et al., 1998, p. 9). Trust and respect within a community allows for critical reflection centered on the collaborative sharing, listening, challenging, and reconstructing of ideas (Wenger et al., 2002). Reflection can be integrated into the discourse through informal or purposefully structured processes (Adamson & Walker, 2011; Quebec Fuentes & Spice, 2017). The purpose of the reflection is twofold; members of the community consider their progress toward their joint learning endeavor as well as monitor the collaborative process itself (Buysee et al., 2001; Quebec Fuentes & Spice, 2017).

International Collaboration: Challenges and Opportunities

International collaboration faces the same aforementioned challenges as well as some additional considerations and obstacles. Some issues are logistical, such as working around time differences and different academic calendars (Peled & Rozansky, 2014). Other deeper considerations address who is included and how they are involved. The concept of *border politics* is the process of "negotiating the bounds of membership and beliefs of a given community" (Achinstein, 2002, p. 426), and Atweh and Keitel (2007) examine border politics from a social justice lens.

In particular, Atweh and Keitel (2007) examine five signs of social injustice in international collaboration (exploitation, marginalization, powerlessness, cultural imperialism, and violence). Exploitation in research endeavors occurs when the accomplishments and perspectives of one group is furthered to the detriment of others. Additionally, research foci and methods of some countries are valued more in the international community, pushing the problems of practice (and ways of addressing them) in other countries to the margins. Further marginalization stems from language and economics. For instance, the primary language(s) used to communicate within a community could force members to the periphery of or completely exclude them from involvement (Adamson & Walker, 2011). Some academics may not be able to participate in international scholarly activities, such as conferences, due to their cost. This lack of involvement results in powerlessness. Cultural imperialism is then evidenced in "the non-critical transfer of curricula and research results from one country with a certain perceived higher status to another" (Atweh & Keitel, 2007, p. 14). Lastly, linking economic support from more affluent countries to cultural imperialism is viewed as symbolic violence.

International collaboration has the potential to counter these injustices if grounded in the premise that people learn from each other through such collaboration (Atweh & Keitel, 2007). First, the borders of the community need to be expanded to include members from different cultures and contexts. Communication and conflict allows for the negotiation, rather than the imposition, of the border politics by members of the community (Achinstein, 2002). Second, policies and practices at all levels (local, state/provincial, national, and international) are influenced by historical, political, economic, and social circumstances of a setting. When international peers share their funds of knowledge and compare these influences across locations through dialogue, a greater understanding of each context develops (e.g., Winton & Pollack, 2014).

Lastly, international groups must regularly reflect on their collaboration to ensure that it maintains socially just actions.

> International contacts and exchanges in mathematics and mathematics education have … increased in the new age of globalization and will continue to exponentially increase in the future with further developments in technology, ease of travel and population movements. While we do not construct such contacts as necessarily either good or bad, the outcomes of these processes should be carefully scrutinized world wide as to the benefits and losses that

might arise from them. This can only be achieved through deliberate and targeted reflection and debate. (Atweh et al., 2003, p. 224).

The following questions can guide such deliberation (Atweh & Keitel, 2007):

1. Who is included in the international collaboration?
2. How are the various members' included in the activity?
3. Are decisions being made in a just and fair way?
4. Are the means to work together effectively and with equal rights collaboratively considered?
5. Who benefits from the international collaboration?
6. Whose views are expressed in the products of the international collaboration?
7. Whose knowledge is being represented in the international collaboration?

As indicated by the fourth question, such inquiries should be consistently interrogated by all partners.

Conclusion

ICRSME and EJRSME are committed to promoting genuine international collaboration to advance science and mathematics education. This EJRSME editorial begins a series that will examine international collaborations and reflect on the opportunities and potential pitfalls that such relationships can present. As the flagship journal of ICRSME, we hope these editorials will inspire you to consider ways in which you can engage with colleagues in genuine collaboration through future international consultations and virtual conferences.

The theme of our upcoming virtual conference, taking place on March 12, 2022, is *International Collaboration in Science and Mathematics Education.* We will feature Dr. Grace Bascope, from the Botanical Research Institute of Texas (BRIT), sharing *Lessons Learned from Collaborative Place-Based Learning Programs in Yucatan, Mexico and Belize* as well as Dr. Ricardo Lleonart, del Instituto de Investigaciones Científicas y Servicios de Alta Tecnología de Panamá, sharing *INDICASAT AIP - A Model Institute for Innovation in Research and Education.* We look forward to learning from these international collaborators as well as the many ICRSME friends who will be presenting both virtually (asynchronously) and in round table discussion rooms.

At the virtual conference, we will be announcing a newly formed ICRSME ad hoc committee that will be focused on answering some of the questions posed in this editorial. This diverse and international committee will examine the ICRSME mission statement and goals as well as other ICRSME activities and opportunities to determine if we are doing all we can to foster the *genuine collaboration* between participating countries that we desire.

As we strive to deepen our collective understanding of genuine international collaboration in science and mathematics education, we hope to learn from those who have engaged in such work already. We encourage you to share your experiences through multiple venues hosted by ICRSME (*ICRSME Newsletter*, EJRSME, virtual conferences, and biennial consultations).

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