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What is MACIMISE?

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Abstract. Mathematics and Culture in Micronesia: Integrating Societal Experiences (MACIMISE) was a collaborative research and development project led by Pacific Resources for Education and Learning (PREL) and the University of Hawai'i at Mānoa. It was funded by the U.S. National Science Foundation (Grant No. 0918309). Founded on ethnomathematics research, the project aimed to improve mathematics teaching and learning for first-, fourth-, and seventh-grade elementary school students in ten Pacific island groups. The project team included 21 master's and doctoral students from the region who developed and field-tested culturally and linguistically sustaining grade-level curriculum units in mathematics topics such as numbers and counting, division of whole numbers and fractions, and geometry. Project leaders and advisors provided feedback as graduate students developed and piloted lessons. Associated research focused on the indigenous mathematics learning experiences embedded within the respective island communities. The late Dr. Sandy Dawson (PREL, University of Hawai'i) and Dr. Thomas Craven (University of Hawai'i) were the original Principal Investigators of MACIMISE. Dr. Donald Rubinstein (PREL; University of Guam) took over for Sandy Dawson in November 2014. This article, taken from reporting on the project by Sandy Dawson, gives background and framing for the articles in this special issue.

1. Introduction

Pacific Resources for Education and Learning (PREL) received funding from the U.S. National Science Foundation (NSF) in 2009 to implement Project MACIMISE – Mathematics and Culture in Micronesia: Integrating Societal Experiences (pronounced as "maximize"). The project was a collaborative effort between PREL and the College of Education, University of Hawai'i at Mānoa (UHM). The author, Dr. A. J. (Sandy) Dawson was Director of the Project for PREL, with Dr. Tom Craven and Dr. Donald Rubinstein as Associate Directors. During the project, Drs. Dawson and Craven were professors (in Mathematics Education and Mathematics, respectively) at the University of Hawai'i; Dr. Rubinstein was a professor (Anthropology) at the University of Guam.

The 21 graduate program participants in Project MACIMISE were from ten island groups in the United States Affiliated Pacific Islands (USAPI) in the northern Pacific from Hawai'i west to the Republic of the Marshall Islands (RMI) and across the Federated States of Micronesia (FSM)—which includes the states of Kosrae, Pohnpei, Chuuk and Yap—to the territory of Guam, the Commonwealth of the Northern Mariana Islands (CNMI), farther west to the Republic of Palau, and south of the equator to American Samoa. The region encompasses a population of approximately 1.7 million people living on 110 islands spread across 4.9 million square miles of the Pacific Ocean yet having a total landmass of less than 1000 square miles (see

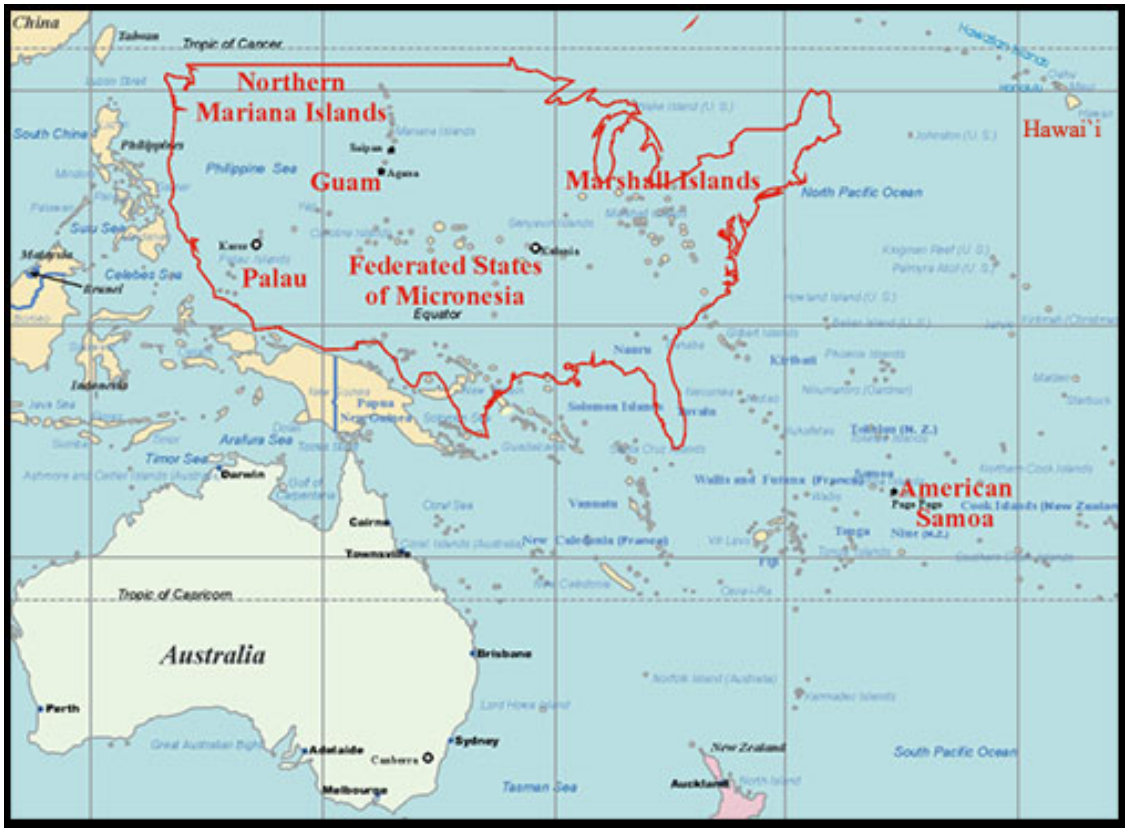

Figure 1. Map of the Pacific Region for the MACIMISE project.

Figure 1 for a sense of the size and distribution of islands of the area). In addition to being geographically isolated, the region is characterized by: high cultural and linguistic diversity, varying sociopolitical, class, and cultural structures, and generally limited economic resources.

Twelve of the participants worked in their local departments/ministries of education, eight worked for local colleges, one worked for the State's Justice department, and one was also a State legislator. The latter two were with the local education authority when selected for the project. All participants were enrolled in doctoral (10 participants) or masters (11 participants) programs in the Department of Curriculum Studies at UHM. They call themselves the Macimisers.

Building on the work accomplished in two previous NSF-funded projects, Project DELTA (Developing Effective Leadership Team Activities) and Project MENTOR (Mathematical Experiences for New Teachers: Opportunity for Reflection), the MACIMISE Project's primary goal was the development of elementary school mathematics curricula sensitive to and sustaining of local mathematical thought and experience. A necessary prerequisite for the achievement of this goal was to recapture and honor the mathematics developed and practiced in Pacific Island communities. The recapture of local mathematical thought and its transformation into school curricula requires local experts in the teaching and learning of mathematics who are familiar with the mathematical practices in their own cultures and who, in the years ahead, will provide leadership in the development of culturally sustaining curricula.

In particular, the goals of the project were:

- Develop and assess local mathematics curriculum units for grades 1, 4, and 7.
- Rediscover/uncover the indigenous mathematics of participants' Pacific Island language communities (Palauan, Yapese, Chamorro, Chuukese, Pohnpeian, Kosraean, Marshallese, Hawaiian, and Samoan).
- Build local capacity by offering advanced degree opportunities to local mathematics educators.

The dynamics of how these goals were to be achieved consisted of three phases:

- Educate the local mathematics educators to be trained collectors of the mathematical practices found in their language and culture.
- Support the local mathematics educators to be trained documenters of the mathematical practices found in their language and culture.
- Develop the local mathematical practices into curriculum units that were implemented and assessed in schools on the respective island communities.

2. Scaling Across

Scaling across means "releasing knowledge, practices, and resources, and allowing them to circulate freely so that others may adapt them to their local community" (Wheatley & Frieze, 2011, p. 32). This concept seems particularly appropriate to describe what took place in Project MACIMISE. Scaling across is distinct from the idea of "scaling up" that dominates many western educational reforms. According to Wheatley and Frieze scaling up "creates a monoculture that relies on replication, standardization, promotion, and compliance" (p. 35). Scaling up is the opposite of what the Macimisers wished to accomplish. They were interested in preserving and promoting cultural practices and knowledge that were in danger of being lost. The aim of Macimisers' work was not at all that of designing one approach, or one interpretation, or one body of knowledge to encompass the vibrant cultures found in each of their ten jurisdictions.

> But respect for the invisible forces of place—to which we could add its social and cultural heritage—is hardly conventional wisdom when it comes to taking things to scale (p. 35)

Scaling up does not fit well with the ways of working, respect for the wisdom of their elders, and the power found in their cultural practices that enabled Macimisers to thrive on their remote Pacific islands. The conventional wisdom of Micronesian cultures is not the conventional wisdom of western education systems. This is not to imply that the practices found on one island are not similar to those found on other islands. There are some at least superficial similarities in language, in methods of building canoes and houses, forms of dance, and other indigenous activities. But there is not the standardization and replication that western educational reform movements seek. Attempting to identify "best practices" is not the Holy Grail for these Pacific island nation/states that it is for many western educators. As Wheatley and Frieze note:

> Exchanging best practices often doesn't work. What does work is when teams from one organization travel to another and, through that experience, see

> themselves more clearly, strengthen their relationships, and renew their creativity. (p. 35)

In the case of Project MACIMISE, the "organizations" that traveled were the Macimisers themselves. As indicated previously, the Macimisers were from a variety of professional and home groups. During the project, Macimisers came together at least once per year, rotating the meetings among the islands (July 2010 on Saipan in the CNMI, July 2011 on Pohnpei, July 2012 on Palau, July 2013 on Saipan, May 2014 in Hawai'i, and July 2015 in the Marshall Islands). A significant aspect of each meeting was the time given over to cultural sharing. This gave participants an opportunity to experience and learn about other cultural practices, to build strong inter-personal relationships bound together by a common interest in mathematics education, and to devote their considerable expertise and creativity to the development of teaching and learning situations based on their local children's experiences and practices.

Macimisers took the ideas they encountered during regional meetings and learnt from them. They carried these learnings back to their home islands and developed them in their own unique ways. Unlike scaling up, scaling across "invites communities to learn from one another and solve their own problems in their own particular way" (Wheatly & Frieze, 2011, p. 36). Moreover, Wheatly and Frieze's term "trans-local" describes what happened when Macimisers carried an idea from one place back to let it loose in their home environment, often fostering its growth into something quite different.

3. Where to Begin

Working with peoples from ten different language groups, and ten unique cultural settings spread over 1.5 million square miles of the Pacific Ocean, presents many challenges. Where to begin was certainly a question that faced the project staff. Because of the Macimisers' varied backgrounds, their first university course would deal with anthropological research strategies, preferably taught by an anthropologist who knew the Pacific region, and who had experienced some of the island cultures that were part of the project. A professor at the University of Guam filled that requirement, and was recruited to offer the first course. This was the start, and the professor followed that everywhere by sharing with the Macimisers materials and experiences he had from his work on Yap and Chuuk. Based on his own experiences, he was well aware of the fact that "each place is an interdependent web of relationships, which is why you can start anywhere ... and follow it everywhere" (Wheatley & Frieze, pp. 91–93). So, he started with the weaving patterns found in materials produced by the peoples on the island of Fais in the state of Yap.

The course was taught via an internet-based, synchronous interactive digital conference environment (Blackboard Collaborate). The software included tools for breakout rooms for smaller group conversation, whiteboard, graphical annotation, application sharing, and screen sharing. The moderator could record a synchronous class session for others to watch later. The whiteboard supported the uploading of presentations for viewing during the classes and consultation meetings. During the first summer institute (July 2010) each Macimiser was given a computer. The decision to equip the computers with an open source computer operating system was with a view that the computers should not be too expensive to keep up-to-date since many of the Macimisers live in subsistence cultures. Wheatley and Frieze (2011) shared what Desmond Tutu said about *Ubuntu*:

> [It] means [peoples who are] generous, hospitable, friendly, caring, and compassionate. They share what they have. It also means my humanity is caught up, is inextricably bound up, in theirs. We belong in a bundle of life. We say, "A person is a person through other people." It is not "I think therefore I am." It says rather "I am human because I belong." I participate, I share (p. 82)

In fact, the Linux operating system on the computers provided to the Macimisers was named Ubuntu. During the first summer institute (July 2010) the Macimisers bonded together and quickly displayed that generous, hospitable, friendly, caring and compassionate spirit so characteristic of Pacific island peoples, the Ubuntu of "an invitation to each other and every one of us to recognize that we are inextricably bound up together in a bundle of life" (Wheatley & Frieze, 2011, p. 95).

Part of each day during every one of the summer institutes was given over to cultural sharing, a time when the group of Macimisers from a particular language group presented an aspect of their culture to their colleagues. This sharing sometimes took the form of a chant, a song, or a dance that was taught and usually enthusiastically engaged in by fellow Macimisers; or the sharing described certain cultural ceremonies performed at, for example, weddings, funerals, or first birthday celebrations. Often gifts were presented: lava-lavas from the American Samoans, latte stones from the Chamorro group, leis from Yap, black pepper from Pohnpei, and so on. Prior to the launch of the project, many of the Macimisers had never had the opportunity to interact or visit with other Pacific islanders. Knowledge of each other's practices and beliefs was minimal so it was with the Ubuntu spirit that the cultural sharing aspect of regional meetings was initiated.

Through ten days of intense work together in the summer of 2010, the Macimisers bonded and began to provide support for each other academically, physically, and spiritually. Macimisers were given the technology for unlimited internet access through their local telecommunications providers. Facebook became a daily venue for the sharing of successes, challenges, and frustrations experienced by group members.

During the fall and spring terms of UHM, all Macimisers were enrolled in graduate courses that met synchronously online once per week. This was a challenge logistically, since Macimisers resided in six different time zones spread across the Pacific Ocean west of Hawai'i. Moreover, four of those time zones were on the opposite side of the International Date Line. To accommodate all the time differences a timetable was developed that allowed the class sessions to be synchronous (e.g., see Table 1).

Table 1. Timetable for all Macimisers and instructors to be in simultaneous communication.

Countries:	*Hawai'i*	*American Samoa*	*Marshall Islands*	*Kosrae, Pohnpei*	*Chuuk, Guam, CMNI, Yap*	*Palau*
Day	Wednesday	Wednesday	Thursday	Thursday	Thursday	Thursday
Time	10:00 PM	9:00 PM	8:00 PM	7:00 PM	6:00 PM	5:00 PM

After the first few meetings of the very first class the schedule worked smoothly. It did mean, of course, that for Macimisers on Hawai'i, the two and half hour meeting took place from 10:00 pm Wednesday to 12:30 am Thursday! Since all the Macimisers were fully employed and could only

attend class after their working day was over, the earliest a class could begin was 5:00 PM Palau time. All the Macimisers adjusted to this in order to accommodate their MACIMISE colleagues. This too was the Ubuntu spirit expressing itself in the workings of the project. So the Project started somewhere, and in the intervening five years the Macimisers lead it everywhere.

Along with the Macimisers, the Project's Advisory Board as well as UHM course instructors and a few accompanying persons participated in each institute. The Project's Advisory Board was composed of eight members, seven of whom were present in Palau: Beatriz D'Ambrosio, Bill Barton, Betsy Brenner, Shandy Hauk, Jerry Lipka, Arthur Powell, and Katherine Ratliffe; Ubi D'Ambrosio was unable to make the long trip to Palau. The picture in Figure 2 shows the assembled MACIMISE group at the summer institute on Palau, July 2012.

Figure 2. Macimisers, advisory board members, instructors and friends, Palau, July 2012

4. From Intervention to Friendship

The history of Micronesia is replete with examples of programs and projects being introduced by outside people who claim to be able to contribute to providing a solution for whatever challenge brought them to the islands. No longer do Pacific islanders necessarily welcome such intrusions.

When visiting the islands for the first time many years ago, one educational leader said to me, "you have a new program, and three years from now you will pack up and head back to the States, and what will be left to show from your program?" He was clearly skeptical, no doubt based on previous experiences, of the long-term benefits of the program being proposed. Such interventions are short-term strategies for current challenges, but it is clear that Pacific islanders realize that any longer-term impact requires the active engagement over time of significant people. Wheatley and Frieze (2011) describe the relationship between the short-term interventionist programs, and the philosophical underpinnings of an outside educator's vision:

> This empty-vessel paradigm of learning is one of the foundations of interventionist mind-set. It posits that the trainer is full, the trainee is empty, and it is only a matter . . . of pouring knowledge from one into the other. (p. 172)

They go on to argue:

> The empty-vessel paradigm of learning is fundamentally founded on the inequality between the professional and the amateur, the expert and the ignoramus, the so-called developed and underdeveloped. (p. 177)

The genesis of the MACIMISE Project came from the Pacific islanders themselves, and arose because of the intimate connections that project staff had developed with the islanders over the previous ten years of working across the Pacific region. One of the Macimisers became part of a previous NSF-funded project, DELTA (Grant No. 9819630), almost by accident. He happened to be standing in the College of Micronesia: Yap campus offices one day when I was there seeking a college mathematics person to be part of the year-old DELTA Project. Eight years later he had taken part in both the DELTA Project and Project MENTOR (NSF Grant No. 0138916). Over a meal on Yap when I was making one final trip across the region as Project MENTOR was wrapping up, his response to a question about what should we do next if money could be found, elicited this thoughtful and heartfelt reply:

> For eight years we've studied western mathematics, mainland mathematics, and teaching approaches that are suited to mainland children. Why don't we ever look at Yapese cultural practices and languages, examine them for the embedded mathematical knowledge, and then create lessons and units of work for our children that are based on things they've experienced? Not many Micronesian children have ever experienced snow, but they sure know about fishing in lagoons. (J. Fagolimul, personal communication).

In hindsight, it is clear that Project DELTA was interventionist. It met and fulfilled a short-term need that was to assist Pacific islanders in developing their capabilities to provide in-service education to their local teachers. Project MENTOR worked with these newly empowered in-service providers as they moved into the schools to teach colleagues who were new to the teaching of mathematics. The suggestion noted above offered by the Yapese mentor arose because of the relationship that had developed between that one mentor and me. "Perfect friendship is a relationship between equals who offer good will to one another" (Wheatley & Frieze, 2011, p. 182). Because such a relationship existed between the mentor and myself, he pointed out the weakness with Projects DELTA and MENTOR and offered an alternate goal for the fledgling project MACIMISE.

The Yapese mentor's response to my query was the conversation opener for the remainder of that trip across the region. On each of the islands visited (Palau, CNMI, Guam, the FSM, and the RMI), the reaction was the same: yes, why don't we look at our own cultural practices, our own languages (some of the islands use as many as four or five different dialects)? They said that not only would their children relate more easily to examples and illustrations from things they knew, but also such an approach would help to preserve aspects of their cultures and languages that were being lost. One gentleman on Chuuk lamented the fact that at one time there were more than 50 ways of counting, and now there were only 3 and even those were in danger of being lost.

Conversations with community elders (persons of knowledge who may or may not be old in terms of age), reinforced the desire that traditional practices not be lost, that the younger generations be introduced to and educated in the ways of living on isolated Pacific islands which enable

survival, protect the land and waters surrounding their islands, and keep the people locally smart as well as world smart. MACIMISE was not an interventionist project. It was a project conceived of by Pacific islanders to serve the perceived needs of Pacific islanders. It supported Pacific islanders to engage in examination of their own practices, to recover indigenous knowledge on the verge of being lost, and to re-frame the mathematical attributes of that knowledge into locally developed classroom experiences and investigations. MACIMISE was an exemplar of "what becomes possible [when] we work together on what we care most about, freed from overbearing control, curious about one another's talents and knowledge, discovering the wisdom and wealth revealed when we turn to one another" (Wheatley & Frieze, 2011, p. 219). The Macimisers were fully engaged in bringing to life the possibility of locally developed curriculum units for mathematics that were based on local cultural practices.

During the MACIMISE summer institutes, each day concluded with circle where Macimisers would share stories about the events of the day, or respond to some questions brought forward from the participants. Circling facilitates the transference of responsibility from a leader to the participants. Leaders are supposed to have the answers. Wheatley and Frieze state, "When we believe this, we willingly give away our power. We wait for leaders to direct us, assuming they know what they are doing." But in circle, as the talking piece travels around, every voice is heard, "even those that for reasons of age or gender or politics have been silenced" (p. 103) The talking stick is a powerful tool. Initially, a sacred eagle feather (presented to the author by an indigenous band in northern Canada) was used but it deteriorated over time and was replaced by a hand-carved Haida Gwaii talking stick. The use of the stick changed the conversation, changed the participant's focus, and though resisted initially by some who were not used to its use, had a powerful impact on the group.

The project presented the Macimisers with multiple opportunities: opportunities to interact with other Pacific islanders, opportunities to interact with international experts from the field of ethno-mathematics (e.g., Ubi D'Ambrosio and other members of the Project's Advisory Board), opportunities to share with colleagues on their home islands, and opportunities to learn from a broad range of people in a variety of environments including but not limited to community elders. Furthermore, as one Macimiser said, "there is a giving of respect to those who went before—elders, researchers, and scholars—and gaining respect for and confidence in the work we are doing."

The vision of the Project to maximize the potential of Pacific islanders to become educational leaders on their home islands, and to further the growth and understanding of indigenous based mathematics curriculum as found in the cultural practices of their island nations has been realized. The papers in this volume are a sampling from the larger collection of Macimise lessons, papers, and dissertations available at `https://macimise.prel.org` (see Figure 3, next page, for a snapshot of the page as of July 2018).

As this paper is prepared, the use of the new materials across the ten island language groups is well underway, sustained by the Macimisers who continue identifying starting points and follow them everywhere. Macimisers forged friendships that grow in depth and richness with each interchange that occurs, whether face-to-face or via the internet, and when they come to sit together in a hospitable space for a circle when next they meet, they will ask each other powerful questions, allow their collective intelligence to emerge, harvest the learning that occurs, and move forward to wise action.

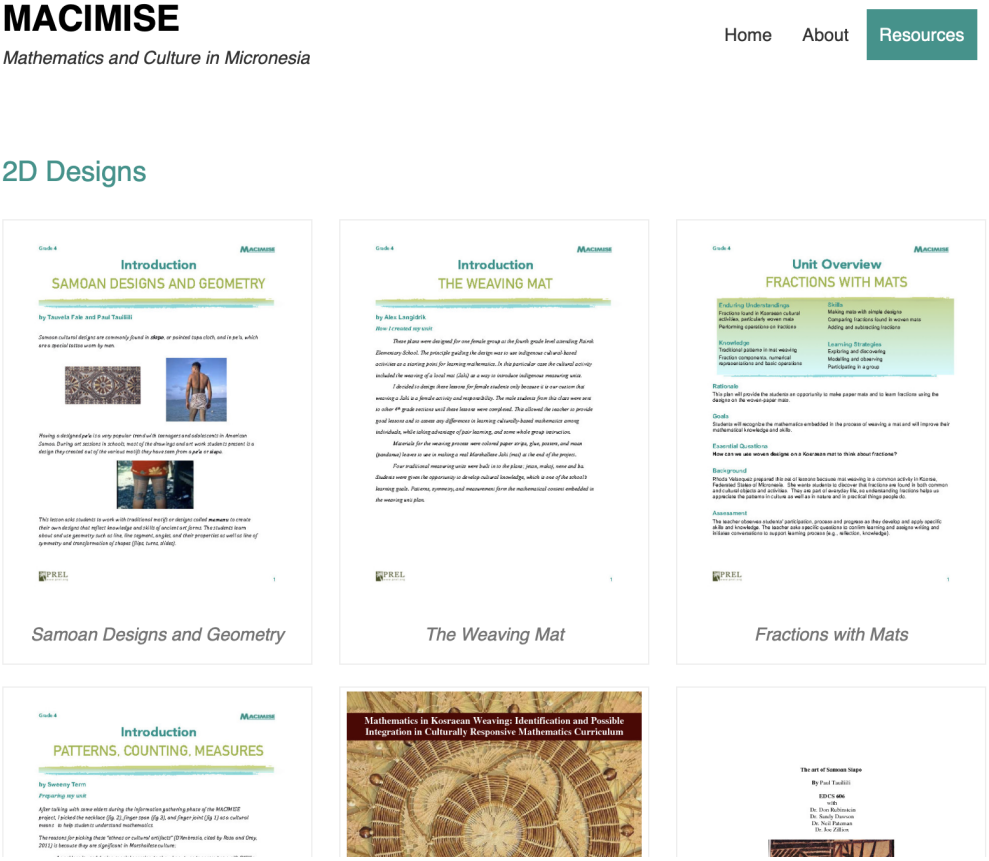

Figure 3. Snapshot of the MACIMISE lessons and research products website.

5. Coda

The author of this note, Sandy Dawson, became ill and died in 2015, in the last year of the MACIMISE project. Sandy began his career in education in 1963. He taught at elementary and secondary schools in Canada, was active in the Canadian Mathematics Education Study Group as well as both the international and North American organizations for the Psychology of Mathematics Education (PME). Over the years, he worked at the university level in Canada, Portugal, Sri Lanka, and Hawai‘i. He shared this life with his wife, Sandra, his co-traveler to mathematics education conferences world-wide and mother to their three children, and found joy with their many grandchildren.

A dedicated communicator across professional contexts, Sandy authored more than 50 papers, edited dozens more, co-wrote two books, edited a set of conference proceedings, and was the guest editor for two publications. He made over 70 presentations around the world, including conferences in Israel, South Africa, Spain, Portugal, France, the United Kingdom and North America. He produced two film series, one on mathematics education, and one on Logo. He led over $6.8 million in research and implementation grants, primarily from the U.S. National Science Foundation, for Project DELTA, Project MENTOR, and the MACIMISE project.

The PME book he co-authored with Jaworski and Wood looked at teacher education in mathematics from an international perspective (Dawson, Jaworski, & Wood, 1999). That work was informed by, and informed, the ways Sandy was instrumental in the development and delivery of post-baccalaureate diploma programs in mathematics education. Ultimately, Sandy's work in teacher education focused on "the subordination of teaching to learning" (Kieren, 2015, p. 14). Finally, in reflecting on what he had learned from Sandy, Ubi D'Ambrosio voiced many of the ideas shared by Macimisers, advisors, and project faculty during the last circle of the project:

> History tells us that the evolution of basic mathematics, which is the basis for school mathematics, reflects changes of culture, including language, and social, political, economic, ideological and religious factors. The same is true for the evolution of ethnomathematics. The complexity of situations and problems, which determine the generation of traditional ethnomathematics, changes and, as a consequence, the solutions proposed must also change. Ethnomathematics is as dynamic as much as academic math- ematics and every other system of knowledge. We have to recognize that new methods and new facts will be absorbed and incorporated by ethnomathematics. As long as an abundance of new facts, phenomena, situations and problems require ethnomathematical solutions, ethnomathematics will be alive. A lack of evolution of ethnomathematics foreshadows the extinction or the cessation of its development. The cultural dynamics of encounters show that ethnomathematics, which is holistic, transdisciplinarian and transcultural, benefits from academic mathematics. We need to modernize the rich resource and cultural heritage of both ethnomathematics and academic mathematics and to put them in their proper places in today's world. (D'Ambrosio, 2015, p 16)

Acknowledgments

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