

Building Education Research Capacity: Collaboration between the United States and South Africa¹

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Abstract

This article describes a project that developed collaborative relationships between science and mathematics education researchers in South Africa and the USA. Significant features of the collaboration included a Liaison Committee with members drawn from both countries, exchange visits for pre- and post-doctoral researchers between the two countries, and the establishment of Research Schools in South Africa. An historical overview of the project focuses on both its functioning and its evolving structure. Summaries of assessments of two of its activities and their outcomes point to the project's influence on building research capacity at individual, structural, and community levels. Two aspects of sustaining the project-funding and structures-are discussed.

Introduction

Since 1997, a mutually beneficial collaboration between South African and U.S. researchers has been jointly funded by the National Science Foundation in the United States and the National Research Foundation in South Africa. The project was initiated under the umbrella of the U.S.-South Africa Binational Commission (USSABNC 1995). Its general purpose is to develop research capacity in South Africa and the U.S. through the development of academic linkages between researchers in science and mathematics education. The project has included activities at different levels. Systemically, it has developed academic networks, support systems and professional development programs, and individually it has provided professional development for individuals at different stages in their careers. Since its inception, the collaboration has evolved through different stages, each characterized by the focus and types of activities carried out, and the structures and personnel supporting these activities. This evolution has been, and continues to be, driven by an expanding awareness of the needs of the stakeholders of the project.

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This article provides an historical overview of the project, a summary of assessments of two of its activities and their outcomes, and discussions of significant features of the collaboration and of its future.

History and Structure of the Project

The collaboration has evolved through three distinct stages of activity: Stage I (1997-2000) involved the development of contacts between the U.S. and South Africa through short term reciprocal visits and strategic planning conferences, Stage II (2000-2002) involved planning of programs by a leadership committee and the implementation of these programs (focused on individual professional development), and Stage III (2003-present) involved continuation of existing structures and programs, and expansion into systemic capacity building by developing research networks and institutionalized professional development programs in South Africa. These stages, described in detail in Hewson and Damonse (2003), are diagrammed in Figure 1.

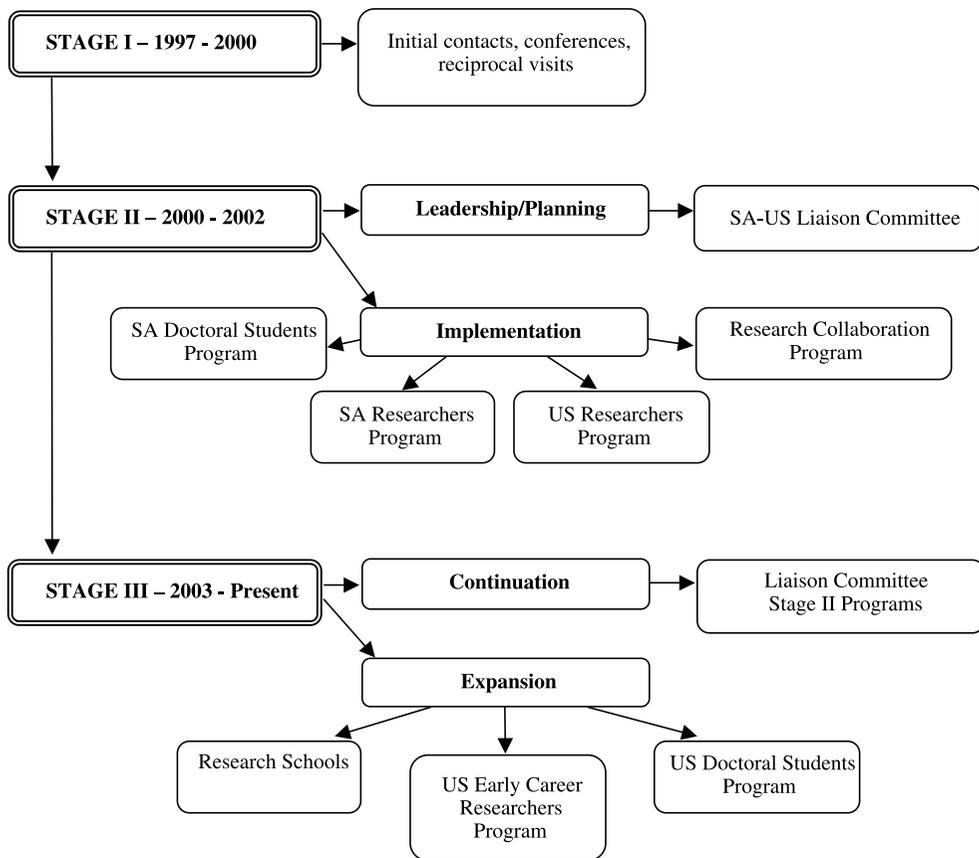


Figure 1. Project Stages

The National Science Foundation (NSF) (U.S.A.) and the National Research Foundation (NRF) (South Africa) funded the project. Grant and program administration differed: the NSF awarded grants to individuals who administered the grants and directed the programs², whereas at the NRF this function was the responsibility of the Education Focus Area. The project structure, unchanged across stages, is summarized in Figure 2.

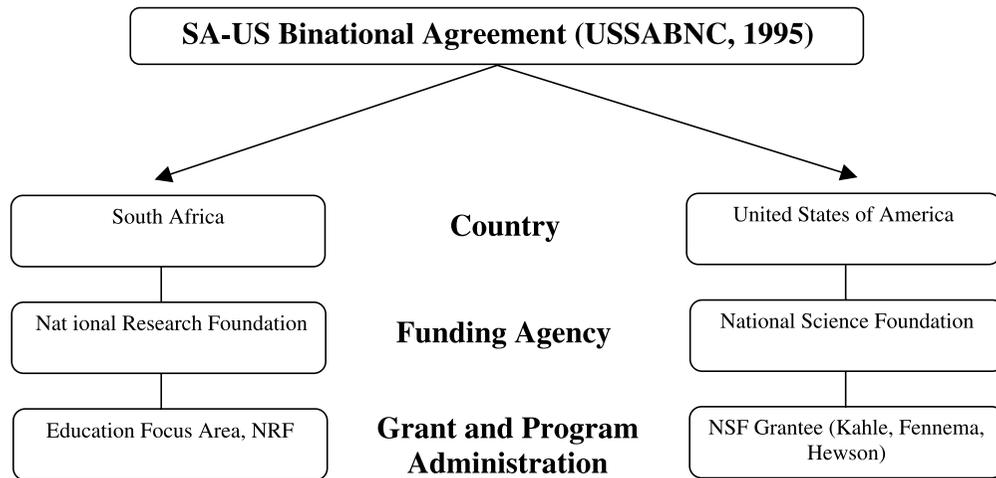


Figure 2. Project Structure

Stage I (1997-2000)

The first stage of the collaboration consisted of exploratory contacts between the NSF and the S.A. Foundation for Research and Development (FRD) (the predecessor of the NRF), visits of academics between South Africa and the U.S., and the holding of two small conferences in South Africa, entitled Forum I and Forum II.

The collaboration was initiated during a visit in 1997 to the NSF by Kopano Taole, a Program Manager at the FRD, under the umbrella of the U.S.-South Africa Binational Commission (USSABNC 1995). One focus of this visit was to find research issues that were common to the two countries. Systemic Reform was identified as a common theme between the two countries. In South Africa, a new curriculum (Curriculum 2005) had been drafted following South Africa’s first democratic elections in 1994. Curriculum 2005 represented a major departure from the existing curriculum, and its planners recognized that its successful implementation would make huge demands on teachers, teaching materials, instruction, and schools. In short, it would require extensive reforms of the whole educational system in South Africa. In the U.S., the NSF funded systemic initiatives throughout the 1990s at various levels: state, urban, rural, and local. A major purpose of these initiatives was to align

¹ NSF grants were made to Jane Butler Kahle (Miami University) (1998), Elizabeth Fennema (University of Wisconsin-Madison) (1999), and Peter Hewson (University of Wisconsin-Madison) (2000).

curriculum, instruction, and assessment with various state and local policies. A major proportion of the funding to systemic initiatives was spent on teacher professional development.

Following Taole's visit, a series of activities involving researchers from both countries occurred. First, a delegation from the U.S. visited South Africa in January 1998. The members of the delegation, chosen for their interest in and involvement with systemic reform initiatives, attended the annual meeting of the Southern African Association for Research in Mathematics, Science and Technology Education (SAARMSTE), held a small invited conference entitled Forum I in Pretoria at the FRD, and paid site visits to different places in South Africa where systemic reform projects had been funded by the FRD. The Forum I Proceedings were published in August 1998 (Chase & Taole 1998).

Next, a group of South African researchers involved in systemic research projects visited the U.S. in July 1998. They attended professional development workshops and held discussions with U.S. researchers about their research projects. Then, a second conference (Forum II) was convened in Pretoria at the NRF (the successor to the FRD) in October 1999. Speakers and participants came from both South Africa and the U.S. Forum II focused on three important components of systemic reform: professional development, materials development, and assessment. The proceedings were published in May 2000 (Fennema & Taole 2000).

Discussions following Forum II explored the possibility of including doctoral students in the collaboration, and the desirability of moving beyond the short term, *ad hoc* nature of the collaboration that characterized its initial stage.

Stage II (2000-2002)

The second stage of the collaboration began with a three year grant from the NSF that built on the previous activities of the collaboration (Hewson 2000). The proposed activities consisted of visits by researchers from both countries in both directions, and the holding of a conference in South Africa. The conference was envisaged as a follow up to Forums I and II, tentatively in the second year of the funding cycle. The proposed visits included:

Short-term visits by South African researchers to the U.S.;

Extended visits by doctoral students from South African universities to selected U.S. universities;

Longer visits by U.S. researchers to South Africa; and

Reciprocal visits between South African and U.S. researchers who were already collaborating on research projects.

To support these activities, a Liaison Committee was proposed. Consisting of members from both South Africa and the U.S., its purpose was to advise on the activities of the project and to plan new activities. Funding was approved, and the project started in September 2000. At about the same time, Beverley Damonse succeeded Taole at the NRF and assumed responsibility at the NRF for managing the South African side of the collaboration. This stage of the collaboration continued until the end of 2002 when, as a result of ongoing

discussion and evaluation of the project's activities, some continued, some were phased out and others were initiated. Stage II marked a shift in the focus of the project, moving from research on issues relating to systemic reform to a more active role in building research capacity. Participants in the project generally pursued research interests relating to systemic reform issues, but that was not a prerequisite for consideration or inclusion.

The two most significant aspects of this stage of the project were the Liaison Committee and the South African doctoral student program. Other programs involved fewer participants, and these programs are briefly described following fuller discussions of the Liaison Committee and the S.A. doctoral student program.

Liaison Committee

A critical component of Stage II of the collaboration was development of a Liaison Committee, with membership drawn from both countries. Hewson chaired the committee, and the membership included Damonse from the NRF, and three members from each of the two countries.³ Throughout Stage II, committee meetings were held on a quarterly basis, via conference call. The committee served several important functions. First, it was a vehicle for sharing information about the various activities and programs between people in both countries. While initially a significant proportion of the time was spent on these activities, this decreased as committee members became increasingly familiar with all aspects of the project. Second, it was a place for discussion of these activities and programs, leading to useful improvements in these initiatives. An illustration is the question of selection procedures for program participants. Early in Stage II, committee members expressed concern over a lack of transparency in the process. This led to the development of clearly articulated selection procedures and an opening up of access to the programs. Third, the committee, through extensive discussion of plans and program activities, moved in new directions. More specifically, discussion of the purposes of the proposed conference as a follow up to Forums I and II, and of the undersubscribed programs, led to the recognition that these seemed less relevant than the need to develop research capacity for early career researchers. This discussion in turn led to a consideration of other kinds of meetings and programs, discussed in Stage III.

S.A. Doctoral Student Program

The South African doctoral student program in science and mathematics education was conceptualized as serving one primary objective: to facilitate these students making significant progress towards the satisfactory completion of their doctoral research. To achieve this objective, doctoral students were to be matched with mentors who could facilitate their

³ From South Africa, these included Diane Grayson (University of South Africa), Jill Adler (University of the Witwatersrand) and Cyril Julie (University of the Western Cape). Due to other commitments, these were replaced by Vijay Reddy, (Human Science Research Council) and Marissa Rollnick (University of the Witwatersrand) in 2002, and Tulsi Morar (University of Port Elizabeth) in 2003. The U.S. members included Elizabeth Fennema (University of Wisconsin-Madison), Vinetta Jones (Howard University), Jim Gallagher (Michigan State University), and Jeremy Kilpatrick (University of Georgia). Kilpatrick replaced Fennema in 2003.

gaining access to appropriate human and material resources.

Between January, 2001, when the first visits occurred, and December 2004, 42 visits were made, 19 in Stage II, and 23 in Stage III. Of these, 5 were made by people who had completed their doctoral degrees. Visitors came from 9 South African universities. The visits ranged from 6 weeks to 5 months. Doctoral students were largely based on three different campuses, the universities of Wisconsin-Madison, Georgia, and Michigan State.⁴ Assigned to a faculty mentor, they attended doctoral level classes; interacted with their mentors, other faculty members, and graduate students; and made extensive use of the information resources on these campuses. Many visited American schools where they met students, educators and administrators. A majority attended national education conferences and meetings, such the American Educational Research Association and the National Association of Research in Science Teaching. More than half of them, depending on the timing of their visit, traveled to Washington D.C. to participate in joint seminars with graduate students from Howard University (a historically black university in Washington, DC), so that common ground could be explored between Howard's unique history in the U.S. and its research focus on oppression, and the research topics of the South African students.

Other Programs

Three other programs were instituted in Stage II. The intent of the first of these-the S.A. Researcher Program-was to provide opportunities for researchers in South Africa to visit colleagues in several institutions in the United States. In the second year a preference for early career researchers was expressed. Though extensively advertised by the NRF, only a few applications were received. Even though the program had funding to support six researchers each year, only 4 visits were made in this stage, and none in Stage III.⁵ Awardees visited several different institutions during periods of 2-3 weeks.

The other programs continued in Stage III. Details from both stages are discussed here for convenience. The intent of the second program-the U.S. Researcher Program-was that a senior researcher from the USA would make an extended visit to South Africa each academic year. The researcher, with expertise in an area of common interest to the USA and South Africa, would serve as a consultant to the science and mathematics education research community in his or her area of expertise, and develop collaborative links between the two countries. In total, three senior researchers, the number initially budgeted, visited South Africa in Stages II and III. These included Norman Webb (University of Wisconsin-Madison) in March 2001, Jane Butler Kahle (Miami University) in January-February 2003, and Thomas Romberg (University of Wisconsin-Madison) in February-March 2004. Webb and Kahle were based in Kimberley and Pretoria respectively, and also made brief visits to other parts of the country where they gave talks in their areas of expertise. In contrast, Romberg visited 11 universities in 6 different provinces, involving lectures, workshops, and discussions on

⁴ One doctoral student was placed at Tufts University because of his particular research interests.

⁵ In 2001, one award was made to Jill Adler (University of the Witwatersrand) and in 2002, three awards were made to Beverley Damonse (NRF), Dirk Wessels (University of South Africa), and Jan Smit (University of Potchefstroom).

research and practice in mathematics education.

The purpose of the third program—the Research Collaboration Program—was to facilitate the ongoing collaboration of S.A. and U.S. researchers who had an existing project, by providing funding to support reciprocal visits between the two countries. During these visits, it was envisaged that researchers could plan a program of research, gather research data, analyze their data, and/or prepare research reports, conference presentations or publications. Although there was funding to support reciprocal visits for one research collaboration per year, only two awards were made under this program.⁶

The goal was that these programs would facilitate greater collaboration between the two countries. There are various indicators of progress towards such a goal. These include ongoing communication between visitors and people who were visited; links to colleagues who were not previously known to one another; further visits between the two countries; and initiation of joint projects such as conference proposals, articles, or research projects. All of these represent progress towards greater collaboration, and there are examples of all of these indicators across the three programs. There was some disappointment that not all the funding allocated to visits such as these was utilized. Nevertheless the conversations that occurred during the visits and the reflections of the visitors themselves were invaluable in clarifying, confirming, and in some cases redirecting, the purposes of the project. In other words, the experiences of these programs were important input for the discussions that led to Stage III.

Stage III (2003-present)

Stage III of the collaboration is distinctly different from Stage II, in that it expanded its focus on individual capacity building to a systemic level by developing research networks, institutionalized professional development programs, and research culture in South Africa. This led to the initiation of new programs; these include a Research School, and the institution of visits by early career researchers from the U.S. to South Africa. In other respects, however, Stage III is a continuation of Stage II. The S.A. Doctoral Student program, the U.S. Researcher program, and the Liaison Committee, albeit with a changing membership, continued as before, and these were supported by the same funding sources in both countries. Because some programs in the project were not as heavily utilized as others, the NSF grant, originally planned for three years, was able to support the project's activities through December 2004.

The changed focus of Stage III emerged from Liaison Committee discussions. The committee realized that, while the doctoral exchange program was valuable for its participants, it could not be taken for granted that they would be able to capitalize on these experiences once they returned to their home institutions. This created a need to look beyond capacity

⁶ In 2002, Meshach Ogunniyi (University of the Western Cape) and Bill Kyle (University of Missouri-St. Louis) each spent several weeks visiting one another as they worked on their joint research project. In 2004, John Olive (University of Georgia) visited Dirk Wessels (University of South Africa), Hercules Niewoudt (Potchefstroom University), and Michael de Villiers (University of KwaZulu-Natal), partners in a research project on the teaching of geometry. Olive also participated in the second Research School as a presenter.

building in terms of the individuals involved, no matter how valuable that might be, to capacity building in terms of environments and structures that could support and nourish the ongoing professional development of young researchers. In particular, the committee recognized that the transition from a doctoral student supported by a supervisor and a doctoral program to an independent researcher needing to establish his or her own research program was critical. Finding ways to facilitate successful transitions of this kind was the logical next step. This came together with another issue in the committee's discussions. Since Hewson's NSF grant included funds to support a conference, envisaged as Forum III, the committee had spent time discussing the focus of such a conference, but without much enthusiasm or resolution. The suggestion that these funds could be used to support structural capacity building received a very different response, leading to the development of the concept of a Research School.

Research Schools

The first Research School was planned by an *ad hoc* committee in South Africa chaired by Damonse. It was held in July 2003 as a 5-day residential event in Gauteng, South Africa. More than 60 participants from South Africa and the U.S. attended the school, including doctoral students at various stages of study, post-doctoral researchers, supervisors, and presenters. The group reflected South Africa's diverse population. An evaluation showed that participants were overwhelmingly positive about their experience (Hewson & Schneckloth, 2004). The recognition of its success meant that, once it was clear that sufficient NSF funding was available to supplement NRF funding for a second school, a decision to repeat the school was a foregone conclusion. The Eastern Cape Educational Research Forum (ERF), under the leadership of Tulsi Morar (University of Port Elizabeth) offered to host the school. The second school, a 5-day residential event as before, was held in June 2004 at the Mpekweni Beach Resort in the Eastern Cape. A similar number of participants with a similar range of backgrounds and experience attended the school. The school modeled its predecessor's format, structure, and strongly positive reception.

The two schools shared the same overall theme: Rigor in Science, Technology and Mathematics Education Research. The sub-theme for the first school was Issues of Design, Theory, Analysis and Writing, and for the second, Data and Dissemination. The first school included plenary sessions each day,⁷ two theme group workshops that ran in parallel over several days, and group reflection sessions. The two concurrent theme group workshops focused on the analysis of data and writing for publication. The purpose was to develop skills in these areas, with participants attending one of the two workshop series. The theme groups followed a participatory, hands-on workshop model that allowed people to develop a project over several days of close interaction with facilitators. Reflection sessions were held after each plenary session and at the end of the school to encourage further discussion on

⁷ The areas covered in plenary sessions were: research process, research ethics, theoretical frameworks, data analysis, review of journal articles, research design, mentoring, developing a funding proposal, and rigour in research.

various issues. In addition to the structured sessions, participants had the opportunity to engage with colleagues during informal gatherings, meals and tea breaks.

The design of the second school in 2004 drew much from that of the first school in 2003, but with significant adaptations. These were in response to feedback from the first school in order to build on its strengths, address its highlighted weaknesses, and accommodate suggested changes. The program was structured around the same two themes of the first school, working with data and writing for publication, but on this occasion participants were able to attend both, with the two themes addressed in the mornings and afternoons respectively. A consequence of this design was that there was no time for the series of plenary sessions from the first school.

Other Programs

During Stage III, two programs continued from Stage II, as previously discussed, and two programs were initiated. The latter two programs, the U.S. Doctoral Student Program and the U.S. Early Career Researcher Program, were a response to two separate concerns. The first was the Liaison Committee's recognition that the project needed to support early career researchers, whether pre-doctoral or postdoctoral. The second was voiced by S.A. doctoral students who asked why reciprocal visits of U.S. doctoral students to South Africa were not a part of the program. Their reasons arose from equity considerations, a desire to reciprocate the hospitality they had experienced in the U.S., and a recognition that South Africa provided exciting opportunities to look at common educational issues in a different context. The equity concerns arose from the perception that existing programs constituted a one-way flow of expertise between the two countries, with South African novices going to the U.S. and U.S. experts going to South Africa. The two new programs gave concrete expression to the recognition that, despite the considerable differences in resources and history of educational research infrastructures, there is much that U.S. researchers can learn in South Africa.

The intent of these two programs was to support extended visits to South Africa by doctoral students registered at U.S. universities, and to researchers within seven years of their doctoral degree, respectively. While there, the hope was that participants would be able to share their research work with others for critical comment; learn about, through exposure to and participation in, the work of South African researchers; and to promote 'internationalization' through critical discussion of common problems of science and mathematics education in the different contexts of two countries. While the doctoral students were expected to focus on their own doctoral research, the hope was that postdoctoral participants would be able to explore ways of connecting their own research to that of South African researchers. The first awards were made in 2003. Even though the program had funding to support four doctoral students each year, only two applications were received in 2003, and two in 2004. The U.S. doctoral students were based at South African host universities but had opportunities to travel in the country and participate in conferences (e.g., Association of Mathematics Education in South Africa) and the Research School. The only award to a postdoctoral researcher was made in 2003. Even though the program had

funding to support several researchers, only one application was received.

Project Assessment

In this article we assess the project in two ways. The first is through an analysis of project activities, based primarily on various documents such as funding proposals, meeting summaries, conference presentations, and restructuring documents. The history and structure of the project as it developed through different stages, presented in the previous section, and its significant features and future, discussed in the final section, are grounded in this type of analysis. The second form of assessment of the project depends on the analysis of data explicitly gathered from participants in different programs. Two such focused assessments of the project have been carried out, of the S.A. Doctoral Student Program (Hewson & Curtis 2002) and the first Research School (Hewson & Schneckloth 2004).

S.A. Doctoral Student Program

At the conclusion of their visits to the U.S., all participants were asked to write a report regarding the nature and quality of their experiences and their perceptions on how this experience may impact their academic work. Analyses of the reports written by the 10 participants who visited in 2001 identified several factors perceived to be significant features of their experience (Hewson & Curtis 2002). Some of these factors concerned resources that they felt facilitated their academic progress, while others identified contributions that they felt they had made to their host institutions. Subsequent participants in the program reiterated the significance of these factors, all of which are positive aspects of the exchange visits. Several negative aspects were also mentioned. For a few participants, interaction with assigned mentors was unsatisfactory, due to misunderstandings, differences in communication styles, or lack of time. For several, there were logistical problems such as finding suitable accommodation, getting health insurance, and so on; some of these were exacerbated because participants were located on several campuses, and the project had only one program assistant responsible for logistics, located in Madison. Being aware of the negatives, however, meant that we were able to address and, at least in part, alleviate them. On balance, the negatives were far outweighed by the positives; these are now outlined.

Time for Intensive Study

Since South African students typically do their doctoral work part-time, their visits provided them with dedicated time to focus exclusively on their own research. Analysis of students' reports showed that students were able to use the opportunity to make progress on their dissertations in three ways. First, they were able to make significant progress towards completing important research tasks, such as transcribing and analyzing data, and writing up chapters of their dissertations. Second, the dedicated time allowed them to think about the implications of their research because they were able to develop an overview of their data and its analysis. Third, the opportunity to concentrate led to breakthroughs in significant problems they had previously been unable to resolve.

Access to Resources

Students reported that they had ready access to a wide variety of resources, both human and material, at their host institutions in the U.S. With a lengthy history and large programs in science and mathematics education, they were able to provide access to resources that were not as readily available at students' home institutions. First, human resources included their mentors, other faculty members and graduate students at the institutions where they were based, and other professional personnel, e.g., teachers, librarians. Second, particular structures that facilitated access included lectures and talks, courses, seminars, workshops, and conferences. Students attended courses on a variety of topics, such as seminars in science and mathematics education, discourse analysis, research methods in education, teaching for understanding, professional development, and the history of mathematics. They were also able to visit schools, colleges, and centers. Third, material resources that were available to students included articles, journals, books, and on-line resources that were available particularly through libraries.

Students reported various outcomes from their access to, and interactions with, these resources: progress in broadening the literature base of their research, improving approaches to, and ways of, analyzing their data, and helping them clarify issues in their own research.

Feedback Opportunities

Students reported that the experience provided them with different opportunities for receiving feedback. These included one-on-one meetings with their mentors and other faculty members (in most cases, prior to meetings they had submitted written material upon which they received feedback), and presentations they gave in courses or seminars: all students had opportunities to give presentations to different audiences. In these cases, students referred to the insightful comments, advice and guidance that they received, in part because of the different perspectives brought to the interaction by those providing the feedback.

The feedback served different purposes. First, the feedback helped them to clarify their thinking and to gain focus on their research. Some students reported that they had made conceptual breakthroughs as a result of feedback. Second, the feedback they received provided support, motivation, and encouragement that was important in helping them to keep moving forward with their research. Finally, students reported that feedback was very affirming when it indicated that what they were doing was of interest, importance and relevance to others in their fields of study.

Research focus on Oppression

Students reported that opportunities to meet graduate students from Howard University, Washington, DC, an historically black university, created common ground between the history of oppression in the two countries, and its role in the research topics of the students. In their reports, students affirmed the value of meeting Howard students and jointly presenting their dissertation work in a day-long seminar. They commented on the potential for academic stimulation arising from the commonality of educational issues addressed by both groups of students and the diversity of the approaches adopted in studying them. While students' presentations of their research topics at the seminar focused on issues of oppression to varying

degrees, students did not comment specifically on these issues in their written reports.

Developing Networks of Professional Contacts

Students reported that they were able to establish professional relationships that could continue beyond their visits. Many students said that they had been able to develop relationships with people that they expected to continue in the future. They envisaged that they would remain in contact through e-mail, through visits between South Africa and the U.S., and perhaps even through future collaborative projects. Some students anticipated that contacts would be at the institutional, as well as the individual, level.

Influence on Others

Students reported that the perspectives and experiences they brought from South Africa were able to enrich and broaden the dialog and perspectives of the faculty members and graduate students with whom they interacted in the academic life of their host institutions and departments. Their contributions created an awareness of the South African context, and led to a recognition of significant similarities and differences between research issues facing U.S. and South African science and mathematics education. In their reports, students indicated that conversations about their South African-based research had “given [U.S. graduate students and faculty members] a window into another perspective.” Students also commented on mutual enjoyment of these interactions in which they learned from one another. In several cases, mentors noted how interesting and stimulating their interactions had been for them and for others.

Follow up Evaluations

In September 2003, a questionnaire was sent to 34 South African doctoral students who had participated in the program in previous years. The questions asked after their professional progress since participating in the program, seeking information about degree completion, career advancement, publishing record and conference participation. Participants were also asked to describe the impact of the exchange experience on their work, to assess if they perceived their research as influencing education reform in South Africa, and to evaluate the strength of the collaborative nature of the project. The timing of the follow-up questionnaire allowed for a reflection of up to two years for some respondents who were in the first cohort of students, to a few months for the latter cohort. Sixteen completed questionnaires were received.

The majority of respondents indicated that the experience had been a critical factor in facilitating the completion of their degrees, citing time and resource availability as the most important aspects of the visit. For those who completed their degrees after their participation, most stated that the visit both expedited and strengthened the quality of their dissertation work. The three most frequently cited impacts of the experience on past participants included increased academic confidence, expanded networks of professional contacts, and a deepening or grounding of the substance of their research. All respondents indicated that they felt their research work has had a direct relationship to education reform in South Africa, ranging from improvements in teacher training to contributing to the national curriculum for mathematics and science education. On the question of collaboration, many expressed that

the exchange experience decreased the academic isolation they experienced in South Africa and expanded their sense of being part of an international community of scholars, but that collaboration on specific projects was not forthcoming as a result of the exchange visit. Most respondents felt that the exchange visits provided the opportunity for them to share insights and expertise with colleagues from the United States and that there were regular occasions for dialogue around issues of mutual interest.

Recommendations for improvements in the program included introducing more elements of formalized structure into the student/mentor relationship, providing opportunities for student teaching, organizing more occasions for sharing of research findings, and facilitating more reciprocal visits to South Africa by U.S. doctoral students.

The Research School

During the first Research School in 2003, participants offered oral feedback during a closing reflection session, and completed a 6-page written retrospective self-assessment questionnaire over the final day of the School.⁸ The written questionnaire asked participants to:

- 1) gauge the effectiveness of each of the types of sessions for their learning,
- 2) rate the effectiveness of each of the plenary sessions,
- 3) offer detailed feedback about the theme groups, the discussion groups and the reflection sessions,
- 4) self-evaluate their confidence in 15 different research skill areas before and after the school and
- 5) offer final comments about what they accomplished at the School and how they perceived the influence of the School on their research.

Thirty-two evaluations were collected and analyzed (Hewson & Schneckloth 2004).

The record of the oral feedback session and the written evaluations point to the overall success of the Research School, as well as offer on-point criticisms and recommendations for future Schools. The outcomes of the School for participants ranged from the very tangible, e.g., organizing a thesis, writing an article or analyzing data, to the intangible, e.g., coming away with greater self-confidence, inspiration and sense of community. Evaluations came from 14 people in the data analysis group and 18 people in the writing for publication group.

Overall Effectiveness

Participants were asked if they thought that their work at the Research School would impact their work in the year ahead; 31 of 32 responded positively. A sample of quotes illustrates the level of enthusiasm expressed by the majority of participants and the range of issues they addressed:

Without a doubt. This has been perhaps the most powerful experience I have had regarding my research study and my dissertation in the past year, and I am truly grateful. I was exposed to ideas about my theoretical framework, the ways I can

⁸ The questionnaire was based on an instrument developed by Hewson, M., Copeland, and Fishleder, 2001.

analyse my data, and the ways I can pull my dissertation together that I had never thought of.

I am 100% sure. I cannot believe I had to begin my research without knowing what I got here.

It was beyond my expectations. This school lifted me to a point where I have enough confidence to do research.

Definitely. I feel more confident about how I am to continue with my research and I am far more positive after having the opportunity to discuss the range of matters with very experienced people.

The School was very valuable for networking with others, becoming more aware of theory and method and ethics issues, learning about how I might do better research and learning how to be a better supervisor to my own students.

Participants expressed that the Research School was worthwhile on multiple levels of value, referring to both the hard outcomes of the sessions as well as the inspirational quality of the gathering in the context of building a community of mathematics and science education researchers.

Writing for Publication

Several tangible outcomes emerged from the workshop on writing for publication. In this workshop, participants submitted pieces of their writing for on-site review by, and immediate feedback from, experienced researchers. A few submitted articles for review in a leading southern African education research journal; one paper was accepted on-site for publication in the journal. The workshop structure allowed for immediate, constructive feedback on written material, and for participants to make concrete advances in their work in a very short period of time. Comments by participants from the evaluations speak to the range of experience:

I haven't published before. I am now motivated to write an article, and have been inspired by others as well.

During this week I have started writing a paper and have had the comments of many experts about this draft outline.

I have been empowered and motivated to write a proposal for NRF funding. I got clarity for research designs and theoretical frameworks that are the basis for writing articles and proposals.

I have conceptualized two papers and developed a framework for these. A third paper is in the development emanating from my PhD thesis.

Networking

The residential nature of the School contributed to the goals of building connections with colleagues and enabling people to engage with research issues in-depth, in a supportive environment. Students had the opportunity to present their work and interact with national and international peers and established researchers through formal and informal gatherings.

Several participants commented that they will build upon contacts and academic relationships that were formed at the school, and some researchers discussed working collaboratively on topics of mutual interest.

Follow-up Evaluations

In December 2003, six months after the completion of the first Research School, a follow-up questionnaire was sent to 32 participants, asking them to review their progress since their participation in the school. Nine completed evaluations were returned.

As in the initial evaluation, participants were asked to rate their own confidence levels in fifteen different research skill areas, this time comparing their self-assessed confidence in July to their confidence levels in December. The short-answer section of the questionnaire asked participants to reflect on aspects of the Research School that may have impacted their academic and professional development, and solicited feedback on collaborative projects and improvements for subsequent schools.

Six out of nine respondents stated that their confidence in their ability in the fifteen research skill areas had increased since their initial participation in the school. The written answers expanded on these ratings through discussion of research projects that had been completed or started in the intervening six months, citing the school as a motivating factor in terms of raising new ways to address issues related to writing, data analysis or networking.

One of the main points of feedback offered in the initial evaluations dealt with how the school functioned as an amplifier for research community and culture; that it provided an opportunity for participants to interact with national and international colleagues and develop connections around topics of mutual interest. The follow-up feedback underscored the value and sustainability of the networking that occurred at the school by highlighting two collaborative projects that had been initiated since the end of the school in July. Other comments reflected a sustained and enthused sense of being part of a larger community of mathematics and science education researchers in South Africa; all respondents stated they would recommend future participation in the school to their colleagues who were not able to attend.

Recommendations about improving the structure of the school offered in the follow-up evaluations were incorporated into the planning stages for the second Research School, namely the separation of the two main workshop tracks into non-parallel sessions, and maintaining the balance of South African and United States-based facilitators. The most frequently cited recommendation was that the school be sustained and expanded in years ahead as a way to meet the professional development needs of both doctoral students and their supervisors.

Discussion

The historical overview of the project and the focused assessments of exchange visits and research schools we present in this article provide the context for discussion of significant features of the collaboration and of its outcomes.

Significant Features of the Collaboration

Collaboration requires constant communication. In this project the primary vehicle for communication between the two countries was the Liaison Committee. The committee was essential to the smooth functioning and evolution of a project that encompassed many different human, cultural, and structural elements. Some of these elements were shared between the two countries, while others were significantly different, e.g., historical funding partnerships that placed one funding partner in a superior role. In this context, the committee provided a forum for resolving tensions, for planning activities, and for generating new directions. While the meetings were not always easy, because the committee was viewed as the “bargaining forum” for all concerned, the process of negotiation engendered very strong feelings of joint ownership. Above all, it facilitated the creation of a dynamic collaboration that was able to respond to the needs that arose, instead of following a rigid three-year plan. Without the Liaison Committee, the outcomes of the project would have been significantly diminished.

There is a significant disparity in the respective mathematics and science education research communities between the two countries. It is no surprise that in the U.S. doctoral programs in these fields are far more numerous and have been in existence much longer, the quantity of research produced is far greater, and the available resources to support the research are much larger. Thus it is also not surprising that, particularly in the early stages, senior U.S. researchers went to South Africa to talk about their expertise while early career South African researchers at the pre-and postdoctoral levels visited the United States for assistance in the progress of their research. Yet it is also the case that South Africans and the topics they are researching have had much to offer to U.S. researchers. The different educational, social, and political contexts in South Africa generate different approaches to common issues of education that have stimulated interest and debate in the U.S. research communities that South Africans have visited. Illustrations of topics in which project visitors from South Africa have made contributions include student learning in multilingual communities, access programs for students from disadvantaged backgrounds, and ethno-mathematics. In other words, the sharing of expertise in both directions is an important feature that has sustained the collaboration.

The most significant feature of the collaboration is the establishment of the Research School in South Africa. This is a structure that grew out of the deliberations of the Liaison Committee, was planned in detail and implemented in South Africa, has used South African and U.S. expertise in its teaching faculty, and benefits participants primarily from southern Africa but also from the U.S. It builds research capacity at different levels. It is obvious that it does so at the structural level, but it also does so at the personal level through the growth of individual participants, at the community level through the establishment of networks of researchers, and at the cultural level through its validation of the importance of science and mathematics education research in South Africa.

Project Outcomes

There have been a variety of outcomes from the project. These outcomes will be discussed in terms of immediate reactions of participants to project activities, subsequent achievements of these participants, informal and formal structures resulting from project activities, and future project activities.

The section on project assessment provided evidence, based on reactions, both immediate and after a period of time, that participants in the exchange programs and research schools were overwhelmingly positive about their experiences. This level of positive response indicates that these activities were effectively conceptualized, planned, and implemented, but beyond that it is not surprising considering that participants had been provided opportunities that they would not otherwise have had. While it was clearly the case that the experiences for some could have been improved upon, these negative reactions were more a comment about organizational details than the overall conceptualization of these activities. There is no evidence that any participants felt that they would have been better off had they not participated in these activities.

Identifying subsequent outcomes that can be traced back to participants' involvement in project activities is important but difficult. One can identify indicators of professional advancement: graduation with a doctoral degree; promotions; the submission and acceptance of conference proposals, research proposals, and journal articles, that are likely to have been influenced by participation. Yet this participation is not likely to be the only influence on the researchers' professional advancement. Pragmatically, there is also the difficulty of maintaining contact with participants over an extended period of time.

The outcomes discussed in the previous two paragraphs relate to individuals and their accomplishments. Another type of outcome focuses on the interactions between participants. Identifying individuals with similar interests, developing collegial relationships with them, and establishing networks to foster future contact and collaboration is as important as each individual's professional development. There is evidence that the establishment and development of at least two groups has been facilitated, among other things, by the project's activities. First, the second research school was organized by the Eastern Cape Educational Research Forum (ERF), following a visit by Kahle (a visiting U.S. researcher), attendance of the first research school by Morar, and a shortened version of the school, run by Morar and attended by two visiting U.S. doctoral students. Second, a group from the Western Cape was formed at the first Research School, attended the second school, and is interested in hosting the next school.

The final form of outcome concerns sustainability. This is a key issue for any funded project, and the South Africa-U.S. collaboration discussed in this paper is no exception. It is useful to focus on two aspects of sustainability: funding and structures. With respect to funding, in the U.S. the NSF grant runs out at the end of 2004 and will not be renewed, due to changes in funding priorities. In South Africa the NRF is likely to continue its funding. Nevertheless it is clear that other sources of funding will need to be found if the project's activities are to continue at current levels. With respect to structures the question is whether

the *ad hoc* structures established for this project can be institutionalized within interested organizations. The issue has been extensively discussed in the Liaison Committee, leading to the identification of possible structures involving relevant southern Africa institutions. In particular, these included the NRF, the Southern African Association for Research in Mathematics, Science and Technology Education (SAARMSTE), and universities with doctoral programs in science and mathematics education. At an *ad hoc* meeting held at the second research school in June 2004, there was a consensus that SAARMSTE, with the support of the NRF, was the most appropriate institution. At the time of writing, the SAARMSTE executive has approved a proposal to establish a sub-committee with responsibility for exchange programs and Research Schools that will be presented to the membership for approval at the next annual general meeting in 2005.

Implications for International Collaboration

This project has general implications for international collaboration. These include the development of effective communication between partners, and the need to pay attention to various critical issues facing collaborations that involve significant numbers of participants.

Effective communication strategies and structures are essential if international collaboration is to be successful. While this is not an exclusive requirement of collaborations that are international in scope, its importance is magnified when partners are drawn from societies and countries that might differ significantly from one another with respect to goals, resources, and cultures. At one level, open communication is necessary in order to address the variety of issues, whether practical, structural, or philosophical, that inevitably arise in any project. Responding to issues, both immediate and long term, in a timely, sensitive fashion is not only good management practice; it also facilitates evolution of the project in responsive ways. At another level, successful collaboration between partners requires not only shared common purposes, but also awareness of, and respect for, differences between them. Partners need to recognize that they are likely to bring different strengths, make different assumptions, and be affected by different external issues. Recognizing, respecting, and indeed celebrating differences such as these increases the likelihood that the collaborative partnership will not only be successful, but also produce outcomes that no one had envisaged; failure to do so will doom it from the start.

There are several critical issues that collaborative partners need to pay attention to, particularly in projects that involve many different participants. These issues may not arise in the day-to-day management of a project but, if not addressed, can in time sap its energy, resolve, and direction. One is the need to ensure equity between partners. All participants need to feel that interactions are fair and respectful, particularly when there are significant differences in resources between partners. Open communication and a willingness to question implicit assumptions are keys if inequitable interactions are to be identified and addressed. Another critical issue is the need to develop leadership within the collaboration whether its activities are to continue over time or expand in size. Leaders who initiate a project are likely, for a variety of reasons, to move on to other activities, or may not have the skills,

desire, or capacity to continue or expand their involvement. A third critical issue for any initiative is the need to build capacity for sustainability, if that is its intent. Developing leadership is, of course, a key component in building the capacity of a sustainable initiative; but there are other dimensions of capacity beyond the individual, human level. These include the cultural level in which expectations are set, and norms are established - these support and validate collaborative activities - and the structural level in which these activities and the structures that support them are institutionalized.

Conclusion

This article describes a project to develop collaborative relationships between science and mathematics education researchers in South Africa and the USA. The most significant activities of the project were exchange visits for pre- and post-doctoral researchers between the two countries, and the establishment of Research Schools in South Africa. These activities were facilitated by strong communicative structures, the most important of which was the Liaison Committee with members drawn from both countries. There are two other, evolutionary, characteristics of the project that are worth commenting on. First, the relative importance of the systemic aspects of the project increased over time: while the initial focus on individuals was essential at the outset and continues to be important, once a sufficient comfort level had been attained, it was necessary to pay more attention to the institutions and systems within which they worked. Second, the relative importance of the two partners in the collaboration changed over time, with greater proportions of leadership being taken, and expertise being provided, by South Africans. The ultimate goal is a partnership willingly entered into by independent, autonomous parties.

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