



MERiT

Mathematics Education Research in Texas

Proceedings

Second Conference

on

Mathematics Education Research in Texas

November 6 & 7, 2008

Sam Houston State University
Huntsville, Texas

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Editor

Sam Houston
STATE UNIVERSITY
A Member of The Texas State University System

Preface

The first Mathematics Education Research in Texas (MERiT) conference was held early in 2008. Judging from conversations with participants and conference evaluation forms, this time was very enjoyable, encouraging, and professionally rewarding. Because of this, we decided to organize a second MERiT conference, to be held in November of 2008.

The MERiT Conference is designed to encourage and promote mathematics education research in the state of Texas, particularly for faculty members at four-year comprehensive universities. With that in mind, we sought to present a program that would allow participants to share research interests and current work, promote collaboration across campuses, and provide informal mentoring opportunities for newer researchers and faculty members.

In addition to research, there are many demands on our time as faculty members. Because some of these demands are more visible or pressing (such as teaching or committee work), it is a bit easier to push research to the back burner. In light of this, and with tongue in cheek, I offer these:

Top 10 Excuses for Not Doing Mathematics Education Research

10. My recent appointments to the Curriculum Committee, Faculty Senate, Grievance Committee, and Committee on Committees have taken too much of my time.
9. My collaborators refuse to call and tell me what to do.
8. I was trying to use recent election ads as an argument for learning statistics, but got angry with *<insert candidate's name here>*.
7. My 450-page review of the literature is not yet complete.
6. I am still looking for data that support my anticipated results.
5. I was trying to use recent Olympic events as an argument for teaching place value, but got too excited watching Michael Phelps.
4. I'm still trying to convert my doodles into a theoretical framework.
3. I am not avoiding research. I faithfully recopy it to next week's to-do list every Friday afternoon.
2. I was reading my e-mail from Jerry Becker.
1. I was getting ready for the MERiT Conference.

Looking back on the second conference, I believe that we are well on our way to establishing a strong collaborative group of mathematics education researchers in the state. I look forward watching our collective efforts mature and ultimately improve mathematics education.

Dustin Jones, Conference Coordinator
Sam Houston State University

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Conference Overview

The second *Mathematics Education Research in Texas* (MERiT) conference was held on the campus of Sam Houston State University on November 6 and 7, 2008. The conference was hosted jointly by the Department of Mathematics and Statistics and the Reeves Center for Mathematics Education at Sam Houston State University. Funding for the conference was provided by the Reeves Center for Mathematics Education and the Office of Graduate Studies at Sam Houston State University.

Mathematics education researchers from similar institutions across the state of Texas were invited to participate in the conference. Nearly half of the participants had also attended the first MERiT Conference, and the group was almost equally split between tenured and tenure-track faculty. For this conference, we hoped to address the following areas as they relate to mathematics education research in Texas: research tools and methods, research reporting practices, cross-institutional research collaborations, and the mentoring of novice researchers. Participants were invited to present papers on one of the four areas.

The conference began on the evening of November 6 with a dinner and a summary of recently published reports. On Friday morning, participants had informal discussions about their current research interests and participated in one or two working groups. To prepare for the working groups, participants were encouraged to bring some work-in-progress. There were three types of working groups:

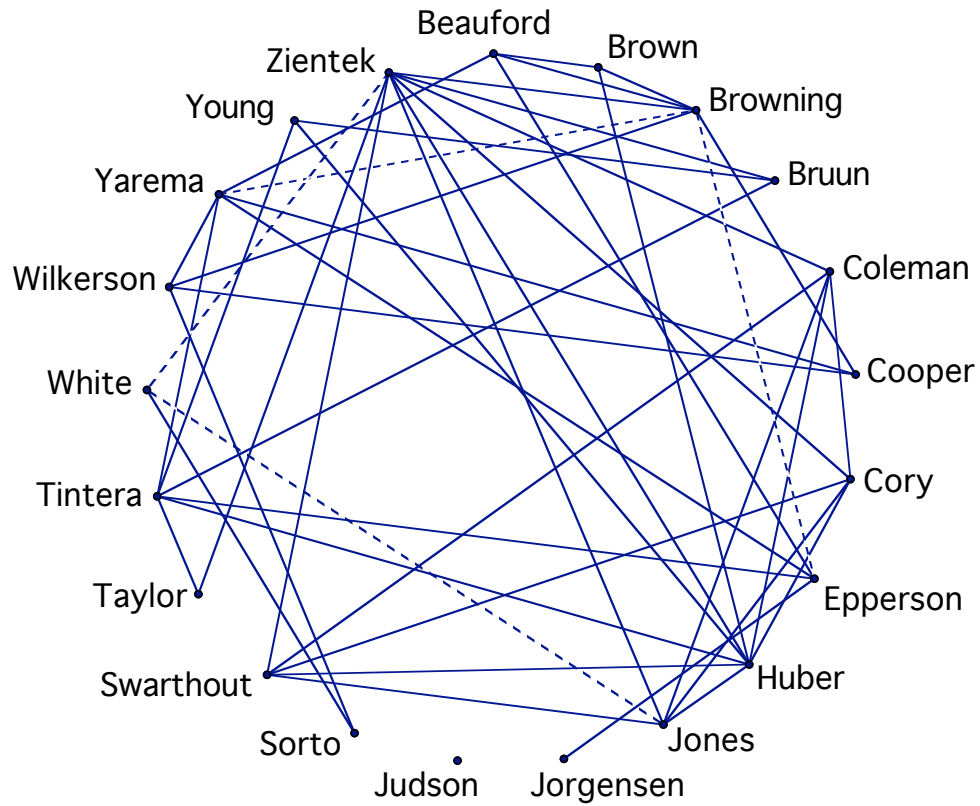
1. *Designing a Study*. Participants in this group were in the initial stages of designing a research study. The group provided helpful feedback related to the refining of research questions, sample selection, methodology, and reporting practices.
2. *Writer's Workshop*. Participants shared manuscripts, at various stages of development. Colleagues provided helpful feedback to encourage and work toward the ultimate goal of publication.
3. *Generating Collaborative Research Agendas*. Time was set aside for participants who were interested in working together on a research project but are located in different cities.

Following lunch on Friday afternoon, three presentations were given. Dr. Judy Beauford discussed the issues inherent in translating research instruments for use in other cultures. Dr. Alex White shared Dr. Alejandra Sorto's experiences with a cross-institutional research collaboration of mathematics and statistics educators. Dr. Sue Brown provided examples of how her department supports tenure-track faculty in their research within a mentoring program.

Participants in the second MERiT Conference

| | |
|-------------------|------------------------------------|
| Judy Beauford | University of the Incarnate Word |
| Sue Brown | University of Houston–Clear Lake |
| Sandra Browning | University of Houston–Clear Lake |
| Faye Bruun | Texas A&M–Corpus Christi |
| Max Coleman | Sam Houston State University |
| Sandi Cooper | Baylor University |
| Beth Cory | Sam Houston State University |
| James Epperson | University of Texas at Arlington |
| John Huber | Sam Houston State University |
| Dusty Jones | Sam Houston State University |
| Theresa Jorgensen | University of Texas at Arlington |
| Tom Judson | Stephen F. Austin State University |
| Alejandra Sorto | Texas State University–San Marcos |
| Mary Swarhout | Sam Houston State University |
| Judy Taylor | LeTourneau University |
| George Tintera | Texas A&M–Corpus Christi |
| Alexander White | Texas State University–San Marcos |
| Trena Wilkerson | Baylor University |
| Connie Yarema | Abilene Christian University |
| Elaine Young | Texas A&M–Corpus Christi |
| Linda Zientek | Sam Houston State University |

In the following network, edges indicate that the linked participants have worked together in some fashion in the past. The meaning of the dashed edges was defined by the individual, and varied across cases.



Reporting Recommendations in Education Research

Linda Reichwein Zientek, Sam Houston State University

Education organizations have adopted standards for guiding researchers through the design, implementation, evaluation, and publication phases for both quantitative and qualitative research. These include the American Educational Research Association (AERA; 2006), the American Psychology Association (Wilkinson & the Task Force on Statistical Inference, 1999), and the American Statistical Association (2007). Following and adhering to standards will help “advance high-quality research in education and to foster excellence in reporting on empirical research” (AERA, p. 33).

While agreement exists across the standards on many research recommendations, each set of standards provides a different research perspective. Therefore, becoming familiar with all sets of standards will help researchers in their endeavor to conduct and publish quality research. An evaluation of reporting practices in teacher education conducted by Zientek, Capraro, and Capraro (2008) found that “schools of education and professional organizations together need to promote awareness among education researchers regarding the importance of effective reporting practices” (p. 214). In addition to reporting standards, mathematics education researchers can consult books specifically designed for helping mathematics education researchers understand how to improve research practices (e.g., McKnight, Magid, Murphy, & McKnight, 2000).

Consulting national reports such as the *Report of the AERA Panel on Research and Teacher Education* (Cochran-Smith & Zeichner, 2005) and the *National Mathematics Advisory Panel Report* (2008) is important. Both reports provide an extensive overview of teacher education research with the inclusion of study abstracts and recommendations for future studies. Utilizing published analysis of research such as the AERA Panel Report and National Mathematics Advisory Panel Report will enable researchers to build on existing studies (i.e., encourage meta-analytic thinking), which is recommended by the educational organizations as an important step in improving education research.

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A Summary of *PRIME Leadership Framework*

Mary Swarthout, Sam Houston State University

The PRIME Leadership Framework: PRinciples and Indicators For Mathematics Education Leaders is a document published by the National Council of Supervisors of Mathematics (NCSM; 2008) to address the question: As a leadership organization, what are the leadership principles, indicators, and actions that NCSM should endorse and that all mathematics education leaders should aspire toward? The document provides a vision of what “ought to be” in school leadership Pre-K–12 and provides tools to discover what it means to be a mathematics education leader. The information presented encourages mathematics education leaders to develop a voice and asks that leaders take responsibility and accountability for leadership practices that will result in mathematics programs that are both equitable and excellent.

Four essential leadership principles are used to organize the presented material: Equity, Teaching and Learning, Curriculum, and Assessment. Each principle begins by sharing the NCSM vision for that area and contains 3 indicators that can be used to help leaders to reflect on leadership. For each indicator, three stages of growth are articulated including, Stage 1: Leadership of Self, Stage 2: Leadership of Others, and Stage 3: Leadership in the Extended Community. The document concludes with ideas for using the framework, reproducible forms that support self-evaluation, and questions that can be used by individuals or groups in a variety of settings.

Reference

National Council of Supervisors of Mathematics. (2008). *The PRIME leadership framework: Principles and indicators for mathematics education leaders*. Denver, CO: Author.

A Summary of *No Common Denominator*

Dustin L. Jones, Sam Houston State University

In June 2008, the National Council on Teacher Quality (NCTQ) published a document entitled *No Common Denominator: The Preparation of Elementary Teachers in Mathematics by America's Education Schools*. This report, which is available on the NCTQ website, represents an effort to determine the current status, and make recommendations for improvement, of the mathematical preparation of elementary teachers. The Mathematics Advisory Group included both teachers and mathematicians, and begins with a brief history of the "Math Wars."

Based on an existing body of recommendations from several national organizations, the report puts forward five Standards for the Mathematical Preparation of Elementary Teachers. Briefly, they are:

1. Mathematics courses should provide opportunities for the acquisition of deep conceptual knowledge in courses tailored specifically to the needs of elementary teachers, in the areas of numbers & operations, algebra, geometry & measurement, and (to a lesser degree) data analysis & probability.
2. Set higher standards for admittance to education schools, applicants to demonstrate knowledge of high school mathematics.
3. Programs should require that elementary teachers demonstrate a deep understanding of mathematics content as a condition for program completion/licensure. Currently, no such assessment exists.
4. Mathematics content courses should be closely tied to a methods course. The methods course should emphasize numbers & operations and provide numerous practice-teaching opportunities, with an emphasis on delivery of mathematics content.
5. Mathematics content courses belong in the mathematics department, and should be taught by instructors with adequate professional qualifications in mathematics, an appreciation for the responsibility of training educators, and an understanding of the need to connect content to elementary classroom instruction.

The report includes the results of a review of syllabi and textbooks for mathematics content and methods courses. These were selected from 77 institutions located in 49 states and the District of Columbia, which represents more than 5% of the U.S. institutions that offer elementary teacher certification. Using the institution's teacher education program as the unit of analysis, a total of 257 courses (both content courses and methods courses) were selected for study. Ultimately, researchers analyzed 126 syllabi from these courses, as well as the 18 textbooks required for these courses. The programs were rated according to breadth (as measured by the inclusion of 12 essential topics) and depth (as measured by time spent on topics).

The findings of the study were not very encouraging. There is little consensus among programs (and among states) about the mathematical preparation needs of elementary teachers, in both the type and number of courses. In general, programs were classified as having low standards for admission and completion. The report stated that the content and student expectations were not demanding in many courses. In particular, it was noted that

few programs cover the mathematics content needed by elementary teachers, especially algebra, and a number of instructors of content courses did not have adequate professional qualifications. Additionally, the *elementary mathematics* in methods courses was often absent or not emphasized. Finally, while textbooks were found to vary widely in quality, most courses used inadequate textbooks.

Based on these findings, the report includes several recommendations. To address the absence of assessments of conceptual mathematical knowledge needed for teaching, the Association of Mathematics Teacher Educators is called on to develop such assessments for course and program completion and licensure. Education schools are urged to require three content courses (designed especially for prospective teachers) and one methods course in mathematics and give higher priority to algebra in content courses. The report also includes recommendations to eliminate some programs (e.g., Pre-K–8 certification) and courses (e.g., methods courses for mathematics and another subject).

Several appendices are included in the report. One is a consensus on recommended mathematics topics that elementary teachers must understand, which was used to identify the 12 essential topics mentioned above. The ratings of textbooks elementary mathematics content courses are listed. There is also a set of questions from actual course assessments that show the difference between problems for children and problems for teachers. The report concludes with an “Exit With Expertise” Assessment: a list of items that well-prepared elementary mathematics teachers would be able to correctly answer.

Reference

National Council on Teacher Quality. (2008). No common denominator: The preparation of elementary teachers in mathematics by America’s education schools. Retrieved January 14, 2009, from <http://www.nctq.org>

Using Translated Instruments in Research

Judith E. Beauford, University of the Incarnate Word

The “need for global exchange” of research called for by Schmieding and Kokuyama (1995, p. 820) and Maneesriwongul and Dixon (2004) is apparent in all areas of study, both because of the global interchange of commerce and the improvements that can be accomplished worldwide as we learn from one another. The globalization of higher education includes cross-cultural research projects often conducted by teams from many countries and the presence of students from many countries in American universities. As these students prepare theses and dissertations they naturally and appropriately want to apply their research efforts to topics of interest in their home countries. They often choose research instruments and techniques designed for Western cultures to be applied to their native culture.

Many of the instruments designed for use in research in the social sciences have established records in English speaking cultures (Mason, 2005). Using them rather than developing a similar instrument for the target population often saves time, money, and effort. Hambleton and Kanjee (1993) note that the technical expertise for developing a new instrument may not be available in the target culture. Translation also allows for cross-culture comparative studies. In some instances, the use of translated instruments facilitates testing in one’s primary language in an attempt for equity among students from several language heritages (Hambleton & Kanjee, 1993).

Cultural Appropriateness

Every culture has unique values, organizational systems, and environments. Awareness of these is essential to understanding national, ethnic, racial, linguistic groups. Cultural sensitivity, deeper understanding, and respect for other cultures are necessary for valid translation and cross-cultural research. Differences in value structures and social mores can dramatically affect how a sample responds to a survey, questionnaire, or other research instrument even with the best translations possible. Questions about personal opinion, social habit, and even business practice that might seem innocuous to one culture can be seen as highly offensive to another. For example, a primary difference observed by international students is the American sense of individualism, which can be seen in sharp contrast to the group-orientation of many cultures. As another example, Confucian respect for authority results in uneasiness in employees when asked to evaluate their leaders. Hofstede (2001) explains, “In some cultures and subcultures, being polite to the other person is more important than supplying objectively correct information; in some, respondents will never use *no*” (p. 21) as such a response would be considered rude. This might impact how Japanese participants, for example, would respond to a questionnaire asking for an opinion, perception, or preference.

“Language and translation of research instruments are crucial, as is the matching of samples from the different cultures for functional equivalence” (Hofstede, 2001, p. 1). Hierarchical structure in business and educational institutions can radically change to roles and responsibilities of persons in what seems to be similar position. For example, the principal in an American school may play a much different role from the head of a cram school in

Taiwan. High power-distance¹ in some cultures influence the appropriateness of some leadership behaviors that seem quite natural in cultures with low power-distance.

Translation protocol in the literature

When the need for translation is known at the time of construction of the instrument, care can be taken to facilitate conversion to the second language. “Choice of item formats, stimulus material for the instrument, vocabulary, sentence structure, and other aspects which might be difficult to translate well can all be taken into account in the initial instrument development to minimize problems later in translation” (Hambleton & Kanjee, 1993, p. 6). Taking both languages into consideration in the writing process, words that have no equivalent are avoided (Chang, 1994; Hambleton & Kanjee, 1993). Care must be taken to assure clear purpose and content meaning (Yu, Lee & Woo, 2004; Chang, 1994), perhaps by adding context to difficult terms (Chang, 1994; Hofstede, 2001). Simple sentences in the active voice are most easily translated.

Translation strives to achieve conceptual equivalence (Schmieding & Kokuyama, 1995; Mason, 2005). “Conceptual equivalence implies that an item may be translated into different words, but the original meaning or conceptual framework remains intact” (Mason, 2005, p. 70). The translation strives for “equivalence of item meanings and idioms in both cultures” (Yu, Lee, & Woo, 2004, p. 310). But “the wider apart the structures of the two languages, the less simple the task” (Hofstede, 2001, p. 21).

Efforts to clarify meaning can introduce unwanted results. Hofstede (2001) recommends the “transfer [of] desired meaning through circumlocution” (p. 21). But “varied cultural experiences and worldviews” (Mason, 2005, p. 69) confound the problematic use of idiom and context. Yu, Lee, and Woo (2004) list common errors to include “(a) distorting the meaning of a word or phrase, (b) adding extra meaning to the original intent, and (c) erroneously deleting the meaning of some words in the [source language] version” (p. 314). Hambleton and Kanjee (1993) cite test format as a source of difficulty with the translation of instruments. “It cannot be assumed that all students are as familiar with multiple choice items as U.S. students” (p. 4). The issues must be addressed in both cross-cultural research and intercultural research using translated instruments, to avoid differences found being attributed to groups when they are actually caused by errors in translation (Schmieding & Kokuyama, 1995).

The literature is fairly consistent in its recommendations for translation strategies. Many suggest that multiple translators be used in the process (Hambleton & Kanjee, 1993; Maneesriwongul & Dixon, 2004) and that translators be most familiar with the target language and culture (Hambleton & Kanjee; Hofstede, 2001; Schmieding & Kokuyama, 1995). They should be familiar with the subject matter (Chang, 1994; Hambleton & Kanjee, 1993) and trained in testing and scale construction (Hambleton & Kanjee, 1993). While it would be rare for all translators available to a project to possess all these characteristics, a

¹ The *power distance index* for a country is a measure of the extent to which less powerful individuals within that country expect and accept that power is distributed unequally within organizations or institutions (Hofstede, 2001).

mixture where each is represented works well. Using a committee approach, the translation is developed and then tested for equivalence (Hambleton & Kanjee, 1993; Maneesriwongul & Dixon, 2004).

Hambleton and Kanjee (1993) recommend checking for equivalence of frequency counts of words. For instruments with strong test-retest reliability, a pilot test-retest with bilingual participants using the two versions (Hambleton & Kanjee, 1993; Maneesriwongul & Dixon, 2004; Yu, Lee & Woo, 2004) can be useful if time is allowed between administration of the two versions to assure that the responses to the second are in response to the questions rather than recall of the first version (Griffiee, 2001). Many use interview or focus groups of bilingual persons (Chang, 1994; Griffiee, 2001; Hofstede, 2001; Maneesriwongul and Dixon, 2004) to review each item and reach consensus on the best translation.

Multiple techniques should be used in all cross-cultural research. ...[When] semantic equivalence cannot be achieved, researchers should consider replication of the instrument development process in the target language, rather than using an instrument which will not make sense in the target language. (Maneesriwongul & Dixon, 2004, p. 183)

Establishing Validity and Reliability

The literature is not as consistent in recommendation for the establishment of validity of translated research instruments by statistical methods. With a compilation of recommendations from several sources and personal experience, a strategy evolves.

“Validation is the offering of evidence that the persons answering the questionnaire items understood what the items were asking in a way reasonably the same as the questionnaire developer” (Griffiee, 2001, p. 2) and consequently a measure of the extent to which an instrument measures what it intends to measure. Reliability is a measure of the stability of result for equivalent subjects. “Reliability and validity of the source language version should not necessarily be assumed for the target language version” (Maneesriwongul & Dixon, 2004, p. 182). When any change is made to a research instrument – whether survey, questionnaire, attitudinal measure, cognitive measure, etc. – the result is a new instrument that must be tested for validity and reliability (Griffiee, 2001). Mason (2005) suggests that even without change such instruments must be validated for each new study population.

A pilot study with participants from the population should be conducted to establish descriptive statistics and Cronbach alphas for each item and the whole, which are then compared with the original version of the instrument (Mason, 2005). Application of the instrument in both the original and translated versions to bilingual participants should result in strong correlations as would be expected in other test-retest studies.

The need for factor analysis is indicated when “there is a possibility that an instrument with adequate internal consistency may have a different underlying structure than the original version” (Mason, 2005, p. 71). Principal components analysis is appropriate when the analysis is exploratory in nature; a confirmatory factor analysis is needed “when particular underlying factors are assumed to be indicated by previous studies” (p.71). Mason recommends a sample size of 20 participants per variable with “caution ...for small sample

sizes such as 100” (p. 71). Again, results should be compared with the original version of the instrument.

Our experiences

In use of translated instruments for both cross-cultural and intercultural research, we have experienced most of the drawbacks and have experimented with most of the translation strategies mentioned in the literature. Assuming that if asked the same question, bilingual participants would give the same answers in both languages, Pai (2006) used a small (n=10) pilot study to check for translation accuracy. In his instruments measuring health-related self-efficacy, physical activity identity, and stress, he found good correlation between English and Chinese versions of the instruments. J. Wu (2006) did not, however, have the same experience. Her instrument was a measure of comfort level with a particular course and she found that the answers varied widely with whether the survey was given in the first or second language of her pilot sample. She concluded as Chang (1994) and Hofstede (2001) had that comfort with the language being used influences comfort levels reported for the course. Seeing this result, M. Wu (2006) devised a method from recommendations in the literature (Chang, 1994; Griffiee, 2001; Hofstede, 2001; Maneesriwongul & Dixon, 2004) and used his bilingual pilot sample to help achieve a consensus about the translations of his instruments measuring perceived leadership styles and effectiveness in higher education. Ko (2006) used a well known leadership style instrument published in both English and Chinese on a sample of 753 students in Taiwan and found a difference between the versions in the underlying constructs using a principle components analysis. With appropriate response to these translation validation efforts followed by statistical measures of reliability and validity, interpretations of results from these studies were reported with care.

UIW translation protocol

Our practices continue to develop. At this point the recommended protocol is as follows.

- 1) An initial translation is evaluated by a committee of bilingual professionals in the field of study of the research. Requirements for familiarity with the culture and field are usually met. Expertise in scale construction is rare. The translation is amended according to their suggestions until there is consensus about the accuracy and validity of the instrument.
- 2) The instrument is tested on a small focus group of 3 to 10 bilingual participants as close to the study population as possible. Item analysis and interviews with this focus group result in further amendment of the instrument as is warranted.
- 3) A larger pilot study is run with a sample of 20 to 50 from the target population and descriptive and reliability statistics are compared with the published results of the original instrument. Only egregious problems with these results produce change at this point.
- 4) The instrument is applied to the full sample in the research study.
- 5) The results are evaluated for reliability by the use of Cronbach’s alpha.
- 6) A principal components analysis is performed with each subscale of the instrument, checking for satisfactory loadings on each component within the subscale.
- 7) Items, subscales, and factors that do not reach satisfactory levels for the Cronbach’s alpha and principal components analysis are removed from further analysis.

- 8) Cronbach's alphas, principal components analysis, and occasionally structural equation modeling are used to establish validity and reliability of the resultant instrument for analysis of research questions.

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Collaborative Projects in Statistics Education Research

M. Alejandra Sorto, Texas State University

Overview of CAUSE-sponsored Research Clusters

The Consortium for the Advancement of Undergraduate Statistics Education (CAUSE) is an organization that has been promoting undergraduate statistics education since 2002. The Research Advisory Board (RAB) of CAUSE is comprised of 9 members from 7 institutions of higher education and has adopted as part of its mission statement the “promotion of statistics education research.” More specifically, the RAB intends to foster high quality research, to promote research that is cumulative, and to support apprentice researchers in statistics education. In an effort to accomplish these three goals, RAB created and is currently mentoring three collaborative research clusters consisting of 3-4 apprentice researchers per cluster. The next paragraphs provide a brief history of this creation and mentoring process.

In late 2006, the RAB outlined a process by which participants would be selected for the research teams. In outlining this process, discussions were held about the nature of successful collaborative teams. It was understood that a tension existed between structure and flexibility. Having established goals for the program and identifying general expectations, RAB solicited applications. Several applications were received and reviewed by all members of RAB. Twelve individuals were invited to participate; these 12 individuals attended USCOTS II in May 2007. The day prior to the conference, all the participants met with RAB members in order to get to know one another, discuss the purposes of the collaborative endeavor, and explore statistics education research. Participants and RAB members were encouraged to attend research sessions together at the conference, to talk with one another, and to learn of current research interests.

After the two-day conference, RAB created three collaborative research clusters based on participants’ input, interests, and dispositions. At least two RAB members were assigned as mentors to each cluster. Specific research tasks were outlined and general deadlines were established. Collaboration within the research cluster was nurtured through regular (monthly) phone conferences. During these phone conferences, participants identified and explored research topics and ideas by sharing what they had thought and learned as they read relevant research literature and reflected on what had been done in the field of statistics education. General topics were narrowed and viable, interesting research questions emerged. Preliminary plans were also made for designing and carrying out research plans.

This attempt to foster collaboration among young statistics education researchers appears to be useful and productive. It is a dynamic process that requires ongoing reflection and flexibility to ensure that it meets its intended goals and purposes.

Research Clusters Projects

1. Lexical Ambiguities in Statistics

Cluster Members: Diane G. Fisher (University of Louisiana – Lafayette), Jennifer J. Kaplan (Michigan State University), Neal T. Rogness (Grand Valley State University)

RAB Advisors: Sterling Hilton (Brigham Young University), John Holcomb (Cleveland State University), Marsha Lovett (Carnegie Mellon University)

The use of domain-specific words that are similar to commonly used English words may encourage students to make incorrect associations between words they know and words that sound similar but have specific meanings in statistics that are different from the common usage definitions. The words or phrases that are the same or similar but can be used to express two or more different meanings are said to have lexical ambiguity (Barwell, 2005). In order to create instructional materials that aid teachers in confronting lexical ambiguities in the statistics classroom, more must be known about the nature of lexical ambiguities in statistics and their effects on student understanding.

2. Prerequisites for Understanding Sampling Distributions

Cluster Members: Dale Berger (Claremont Graduate University), Tisha Hooks (Winona State University), Michael Posner (Villanova University), Michelle Sisto (International University of Monaco)

RAB Advisors: Bob delMas and Andy Zieffler (University of Minnesota)

Students in introductory statistics courses often encounter difficulties when introduced to hypothesis testing. Our cluster was initially interested in this problem, so we started a literature review on student understanding of hypothesis testing. Soon, we discovered that several issues that come before hypothesis testing deserve the attention of researchers. This led us to our current research question: How does understanding the theoretical prerequisites of sampling distributions relate to students' understanding of sampling distributions?

3. Teacher Efficacy for Teaching Statistics

Cluster members: Leigh M. Harrell (Virginia Tech), Teri J. Murphy (University of Oklahoma), Rebecca L. Pierce (Ball State University), M. Alejandra Sorto (Texas State University)

RAB Advisors: Felicity B. Enders (Mayo Clinic), Randall E. Groth (Salisbury University), Lawrence M. Lesser (University of Texas–El Paso)

Preservice teachers have been the focus of much research, including studies that focus on teacher preparation and/or teacher beliefs and attitudes. An idea central to teacher beliefs and attitudes is teacher efficacy. Teacher efficacy has been defined as a teacher's "belief that they have the skills to bring about student learning" (Ashton, 1985, p. 142; see also Gresham, 2008). Teacher efficacy is important as it affects teacher motivation, willingness to use more innovative techniques, student achievement, and time spent teaching certain concepts (Czerniak, 1990; Riggs & Enochs, 1990; Wenta, 2000).

Research about teacher efficacy in science and mathematics education has shown that levels of teacher efficacy are related to teacher content knowledge, teacher pedagogical content knowledge, and teacher beliefs and attitudes regarding the content (Cakiroglu, 2000; Gresham, 2008; Huinker & Madison, 1997; Swars, 2005; Wenta, 2000). Teacher efficacy to teach statistics is a potentially more complex concept than in mathematics or science education as teachers of mathematics and statistics in grades K-8 tend to be graduates of mathematics education programs rather than statistics undergraduate majors or graduate students. However, as state-mandated standards incorporate statistics and probability into K-8 mathematics curriculums, the teacher efficacy to teach statistics increases in importance.

The purpose of this phase of our study is to examine pre-service middle school teacher efficacy about teaching statistics. We are developing an instrument to measure levels of this construct based on the GAISE guidelines for K-8 curriculum (Franklin et al., 2007), as well

as the state standards for teacher knowledge and student learning outcomes that have specific statistics requirements.

The initial items for the instrument on teacher efficacy about teaching statistics will be piloted this fall at Virginia Tech and Texas State. The pilot study will include the recently developed items along with questions aimed at determining the amount and type of course work completed in statistics, attitude towards statistics, and experiences that influenced the development of both attitude towards statistics and efficacy for teaching statistics. Based on the results of the pilot study, the items will be revised and a larger study at multiple institutions will then be conducted.

Participation in the Collaborative Experience

The 11 participating members of the research clusters come from different colleges and universities in nine different states in the United States and from the Principality of Monaco. Some are relatively new to their field, while others have many years of experience in both teaching and research. What they all have in common is a passion for teaching statistics and providing a quality experience for their students.

There are three research clusters. Each cluster, along with their Research Advisory Board members, work on a particular research project. What they learn from their individual projects is shared with other statistics educators through presentations and publications.

The cluster members and their advisors meet once a month by telephone and approximately once a year in person at national conferences. The communication is sometimes challenging due to the different time zones and work schedules. However, between conference calls the clusters take advantage of electronic communication technologies, such as Learning Management Systems, Google Docs, and ReadyTalk.

Despite the difficulties of working across distance, the members have found it to be a valuable and rewarding endeavor. They no longer feel like isolated statisticians. The members enjoy working with others who, although they may be thousands of miles away, have similar interests. They have found that working with others and reporting monthly their individual progress has made them set deadlines and get the work done. Perhaps the greatest benefit the cluster members have received is that, through their reading, research, and discussion with other members, they have become better statistics teachers.

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Mentoring New University Faculty

Sue Brown, University of Houston–Clear Lake

New tenure-track faculty face challenging and stressful times as they accept their first university position and begin the tenure process. The tenure-track time line is established at the time of appointment and the demands on new faculty are tremendous. They are expected to teach their classes well (from the sometimes conflicting perspectives of scholarship, relevance, and student evaluations); provide substantive service to their departments, universities, and professional communities; and develop and implement a research agenda with a focus on publications in nationally refereed journals. Rice, Sorcinelli, and Austin (2000) suggest universities develop systematic and sustained support systems for new faculty. This paper describes the features of the University of Houston–Clear Lake School of Education faculty-mentoring program in its eighth year of implementation.

Review of Literature

Many studies have examined the challenges and stresses faced by new faculty (Hamilton, 2005; Nir & Zilberstein-Levy, 2006; Rice et al., 2000; Solem & Foote, 2004). They found that, in general, new faculty lead an unbalanced life, do not feel a sense of community or collegiality, and experience an ill-defined tenure system. According to Rice et al. (2000), novice faculty often experience isolation, separation, fragmentation, loneliness, and competition.

Sorcinelli (1992) also found that stress does not lessen after the first year of employment. She found that 33% of first-year faculty reported they were “very stressed.” That number increased to 49% in year two and 71% in year five. Thus, familiarity with the university environment did not lessen the stress level of untenured faculty. It may be that the stress level and the time to the tenure decision are inversely related.

Mullen and Forbes (2000) surveyed 60 untenured faculty from the United States, Canada, and Australia. Faculty reported little formal discussion to clarify what is involved in attaining tenure. According to one faculty:

“One of the greatest challenges of nontenured track faculty is the mystery that surrounds the tenure and promotion process. ... Even after attending two tenure and promotion seminars given by our Dean, I still don’t know what the criteria will be. ... I hate obsessing over this, but my future depends on it. (p. 34)

New professors in this study reported feeling more connected to their past institutions and colleagues from other universities and further noted that the formal mentoring they received was inadequate. Various researchers (Ebersole, 2003; Gillespie et al., 2005; Nir & Zilberstein-Levy, 2006) have described support systems that are in place at their institutions, but limited empirical evidence was reported on the success of these mentoring programs. Greene et al. (2008) surveyed 96 tenure-track faculty in colleges of education from eight public universities in one Southeast state. The faculty responded to a number of questions, but of particular interest were questions dealing with the support system in place at their universities. Faculty identified how they have been supported in their progress toward tenure

and described an ideal support system for new faculty. Approximately 58% of faculty reported they had been assigned a formal mentor, but only 17% of the faculty who had been assigned mentors described the mentorship as helpful. Reasons stated that mentors were not helpful were: the mentor did not have time to meet with the mentee, the two individuals did not have similar research interests, and the mentor did not show an interest in publishing with the mentee. The following data document responses of the mentees:

- 63% said the most helpful support came from colleagues,
- 26% stated that clear expectations and feedback from the administration had been helpful, and
- 10% reported they received no support or that nothing had been helpful.

When faculty were asked to identify the support they would have liked, but had not received, 36% of the faculty indicated that they would have liked additional support with research. Suggestions included: having a senior faculty member to collaborate with on research, writing groups, start-up funds for research, more travel money, assistance with grant funding, sharing research with peers, and more time.

To support new faculty, Greene et al. (2008) suggest colleges of education provide:

- a collegial and welcoming environment,
- a document that outlines clear expectation for annual review and tenure and promotion expectations, and
- regular communication with untenured faculty, including
 - an orientation session for new faculty;
 - a presentation given by the chair of the personnel committee on how to assemble a personnel portfolio and a list of reappointment dates, dossier due dates and any additional personnel workshop dates;
 - semiannual or annual feedback meetings; and
 - progress toward tenure meeting

UHCL School of Education Mentoring Program

The School of Education (SOE) at the University of Houston–Clear Lake has 34 tenured or tenure-track faculty (of which 15 are untenured) and a dean, an associate dean, and three chairs. The Mentoring Committee composed of the SOE administrators was formed in 2002 with the primary purpose of supporting new faculty through the tenure process. The chair of the committee rotates each year among the three chairs. Each new faculty member attends a SOE orientation meeting the week before classes begin. At this meeting new faculty are introduced to procedures that will help them navigate the first few months of the semester. In addition to the large group meeting, faculty meet with their chairs for information specific to their teaching area. During the fall semester, all SOE faculty are invited to luncheons in August and December. In addition one “tea” is held each semester immediately after one of the monthly SOE faculty meetings and an end-of-semester luncheon is held in May at a faculty home.

The mentoring committee sponsors four luncheons just for new faculty. The sessions focus on research, the annual review process, teaching, and mentoring evaluation and feedback. This article focuses on the research session and additional faculty support for research. One

component of the research session is a panel review with the Dean, the chairs, and a research librarian. The Dean, a former journal editor, discusses publication through the eyes of an editor. The chairs discuss their experiences as journal reviewers, and the librarian discusses how she can support faculty in their literature and journal reviews. In addition to the panel discussion, the Associate Dean (Sherrill, 2002) provides the following suggestions for research:

Carve out some time for scholarship

- Block out one day per week for scholarship. Keep this appointment with yourself!
- It is easy to let your writing time slip between the cracks.

Let people read your work early

- The more eyes that “see” an idea, the better defined it becomes.
- The more eyes that see a manuscript, the better it becomes.

Colleagues at your university

- Everyone wants you to succeed.
- Lots of “soul mates” around.

Colleagues at other universities

- Friends, fellow doctoral students, etc.
- Mentors and professors

Use your own classes

- If you have two sections, use one for the control and one for the experimental group.
- Make use of other classes as well.

Some of your students are full-time employees in schools

- They have access to lots of students and classes.
- They have problems they want solved or questions they want answered.
- They can be very helpful in helping you gather data.

Master’s and doctoral students

- Assist both your student and yourself by co-authoring an article based on the thesis, project or dissertation.
- Give them your idea for a research study.

Independent study

- The student obtains course credit and receives a wonderful research experience.
- You get a research assistant.

At least two birds with the same stone

- Everyone is too busy to be linear when it comes to doing research.
- Presentations can and should be turned into publications.

Not every suggestion is appropriate for every faculty member, however, the list provides ideas that new faculty may not have considered that can assist in their research agenda. *The School of Education Policy and Procedure Manual* is also discussed at this meeting. This document details the tenure process, requirements, and timelines.

The committee has discussed and surveyed the new faculty on whether to assign mentors to each faculty. The overwhelming response was “No”, but new faculty did want to know what areas faculty publish and where they publish. The chair of the mentoring committee surveyed the faculty and presents a list of faculty, their research interests, and publication venues.

In the spring, after the faculty’s annual review is evaluated by the Associate Dean (AD), each new faculty member meets with the AD and chair. During this meeting, the faculty’s progress toward tenure is discussed. After this meeting the chair and the faculty meet to discuss an action plan for the next year. This plan is structured differently based on the preference of the faculty. Some action plans are detailed with potential article titles, publication venues, and dates. Specific meeting times with the chair and faculty are included in the plan. Other faculty do not desire this much structure and simply develop a plan, but without scheduled meetings with the chair. The chair routinely contacts untenured faculty via email as well as face-to-face meetings.

Each faculty completes a third year review, which requires the completion of a portfolio. The promotion and tenure (P&T) committee, the Associate Dean, and the Dean review the portfolio. The faculty committee and AD both write third-year review letters and following the receipt of these letters, the faculty member meets with the Dean, AD, chair, and chair of the P&T committee. These individuals summarize the faculty’s progress toward tenure in the areas of teaching, research, and service. The following semester, the faculty member receives a one-course reduction in teaching load to focus on the issues raised in the third year review. In the tenure portfolio, faculty are required to document how they addressed the tenure recommendations from the third year review process.

Since this support system has been implemented, only one faculty member who sought tenure was denied. This person failed to address and rectify the tenure recommendations from the third year review.

Even though the mentoring program at UHCL has been in place for seven years, the program continues to evolve. Each year based on feedback from new faculty, the program is modified. For example, the addition of faculty publication venues occurred in the 2008 academic year. The impact of the program has been felt among prior participants. According to one faculty, now tenured, “If you cannot receive tenure at UHCL, you cannot get it anyplace. UHCL provides the support necessary to support you in the tenure process.”

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Epilogue

We share a common goal: the improvement of mathematics education. This is easily stated, but difficult to define. As mathematics education researchers, we strive to use research to discover and explore problems and issues, as well as to implement, evaluate, and improve policies and practices. It is apparent that increased communication and collaboration can only help to further our numerous and diverse efforts toward our shared goal. It is my personal hope that this document, along with the conference, has helped us to make progress.

I wish to express my deepest gratitude to my colleagues at Sam Houston State University for helping make this conference a success. Special thanks go to Max Coleman for organizing the meals, Beth Cory and John Huber for handling registration, and Mary Swarthout and Linda Zientek for planning the program. I also appreciated having Mary's help in preparing this document – but I take the responsibility for any errors that may be found.

The third MERiT Conference has been scheduled for Thursday and Friday, November 5 & 6, 2009. Details will be made available at our website (<http://rcme.shsu.edu/~merit>) in the near future. We hope to see you there!

Dustin Jones, Editor
Sam Houston State University

Conference Evaluations

The conference evaluations were overwhelmingly positive. Once again, everyone (or at least everyone who responded to item 10) was interested in participating in another MERiT Conference. Several people made thoughtful suggestions as to the structure of the next conference. There is also evidence that this conference helped to serve as a catalyst for encouraging more research in mathematics education in our state (see the responses to item 13). Below, we provide the aggregated results of the collected surveys.

Compilation of evaluation comments

(SD=Strongly Disagree, D=Disagree, N=No Opinion, A=Agree, SA=Strongly Agree)

| Survey item | Ratings | | | | | |
|---|---------|---|---|---|----|----|
| | SD | D | N | A | SA | |
| 1. The arrangements for this meeting were handled well. | | | | 4 | 12 | |
| 2. The meeting was well planned and organized. | | | | 4 | 12 | |
| 3. The meeting schedule and agenda were satisfactory. | | | | 3 | 12 | |
| 4. There were sufficient breaks and opportunities for individual interactions provided. | | | | 1 | 15 | |
| 5. The opening session on Thursday made a valuable contribution to the meeting. | | | | 2 | 13 | |
| 6. The working sessions on Friday morning made a valuable contribution to the meeting. | | | | 3 | 13 | |
| 7. Which working sessions did you attend? (Check all that apply.) | | | | | | |
| ○ Designing a Study ($n = 8$) | | | | | | |
| ○ Writer's Workshop ($n = 7$) | | | | | | |
| ○ Generating Collaborative Research Agendas ($n = 8$) | | | | | | |
| 8. The presentations on Friday afternoon made a valuable contribution to the meeting. | | | | 2 | 7 | 6 |
| 9. There were sufficient opportunities for questions and discussion. A participant rated this as N "due to need to actually participate in all 3 morning sessions and I was limited to two." | | | | 1 | 1 | 13 |
| 10. I would be interested in attending another MERiT conference in the future. | | | | | | 15 |
| 11. Overall, the meeting was a worthwhile use of my time. | | | | 1 | | 14 |

Questions 12, 13, and 14 were free-response items.

12. What types of events/activities do you recommend for the next MERiT conference?

- Three comments from this participant:
 - The three themes were a good way to organize this.
 - I would envision 5-person groups where people can “rotate” every 20 minutes or so to increase the small group interactions by research/interest.
 - I enjoyed the informal atmosphere.
- Four comments from this participant:
 - The formal/informal discussions were very helpful – more of the same
 - Discussion of journals
 - Include list of participant’s published articles (with abstracts) (with last ~5 years)
 - Also include info about where participants are housed i.e. in College of Ed or math depts.
- Continued collaboration
- Create during conference some document summarizing interests of each participant
- A more well-organized writer’s workshop time
- This was my first MERiT Conference so I did not know exactly what to expect. I did enjoy the collaboration with colleagues. Maybe an activity could be brainstorming of ideas for research topics. What do we need to know and how can we research the topic? How can we continue to be connected after the conference is over?
- Combination of some key presentations to focus our thoughts but maybe include a small amount of time for continued collaboration. Also a brief time of sharing new resources in math ed research – could have an “assigned” reading to discuss at the meeting.
- Three comments from this participant:
 - It was very helpful to hear about others’ research and to be able to make connections from this information. I wonder if there would be a way to facilitate these connections, even before the conference. What if all participants submitted their research interests prior to the conference, then breakout sessions could be organized based on these common interests. Then, we could bring documents that would contribute to these discussions (such as books, articles, data collected, etc.).
 - Instead of the individual afternoon sessions, what if all participants prepare a poster session – these posters might be displayed for the entire conference time so that we could all view at various times.
 - I think this group should work to identify the main issues that NEED to be addressed (in math ed) for the state of Texas. Then we need to make plans for how we might work as a group to organize this research.
- Two comments from this participant:
 - Time to plan more on collaborative projects; i.e. actually design a project
 - Time to participate in all 3 morning sessions
- More discussion of everyone’s research
- The lack of rigid structure worked well. It might be good to have some presentations first thing to generate discussion during the day.

13. What action(s) will you take as a result of this conference?

- Follow up with colleagues on lesson study
- Keep in contact with colleagues across the state with similar research interests
- Three comments from this participant:
 - Begin writing a manuscript
 - Able to meet others with similar interests so we can collaborate as a result in the future
 - Get questions answered about a research project I'm working on
- So much is on my list now
 - Have ideas to finish half-baked research project
 - Will acquire many articles/reports discussed in presentations
 - Will learn some new software for data analysis
 - Will attempt to establish collaboration with colleagues from grad school who are in math ed
- Two comments from this participant:
 - Define research ideas
 - Complete 3 articles in "storage"
- Try to design a new study
- Invite participants to Texas State to talk
- Two comments from this participant
 - Submission of articles
 - Renewed focus on research work
- Have some written documents for review from this group
- Four comments from this participant:
 - I hope to actually continue a research idea we began in one of the groups
 - I also want to get some of the resources shared Thursday that I do not have.
 - Also – I want to remember to review the journal website given last year
 - And – I plan to consider using your circle activity with our department! If you do not mind!
- I plan to stay in communication with a couple of people I found common interests with – we may be able to begin some research together or collaborate on a grant project.
- Two comments from this participant:
 - More readings, i.e., review of literature in new area of interest
 - Try to revise current manuscript to resubmit for publication
- Three comments from this participant:
 - Finish writing 1 article
 - Start analyzing data for another project
 - Move beyond pilot to gather data for a 3rd project
- Collaboration with at least two other colleagues. I'll also be writing up some topics in anticipation of being able to share them in the future.

14. What other comments do you have regarding this conference?

- Excellent conference!
- This was excellent for a newly minted math ed faculty member. For next iteration, really seek out new faculty – they have most to gain from this informal atmosphere
- Well done
- This was a very good conference. To me the time is just right – an evening and a day. The conversations were great and I made some great friends. Thank you for inviting me to attend.
- Thanks for gathering us together & allowing discussion time.
- I like the idea of a keynote speaker on Thursday evening and look forward to Bob Reys next year.
- Thank you to all who planned this conference – you serve this community in Texas well by organizing this conference. Also thank you to Dean [Muehsam] for taking such an interest in this work to such a degree that funding was provided for it.
- Great – keep it up!
- This was a great opportunity. Thanks!

