

A Review and Summary of Research on Adult Mathematics Education in North America (2000-2012)

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Research in adult mathematics education is spread across the publications of several disciplines – adult learning, mathematics education, and educational theory – or lies hidden in doctoral dissertations. This paper presents findings from a two-year study that identified journal articles and dissertations indexed by the major United States scholarly databases. Primary and secondary themes that emerged are used to categorize the findings. Interesting findings or trends are discussed although that analysis phase of the project is still a work in progress.

Introduction

At ALM-7 in 2000 I presented a paper that analyzed and categorized the research conducted in adult mathematics education during the period 1980-2000 (Safford-Ramus, 2001). That study examined both doctoral dissertations and journal articles, summarizing them separately. The paper was organized around the traditional journalists' questions: Who, what, when, where, how, and why?

During the past two academic years the same approach was taken to examine published research over the intervening twelve years. Aided by a research assistant, Amelia Rotondo, dissertations and articles were identified and copies obtained for analysis. The work of reviewing each document was split between us—the dissertations fell to me while Amelia assumed responsibility for the journal articles. This report, therefore, presents each effort separately.

We attempted to follow the protocol used in the 2000 study but found that the categories had changed. The earlier study was organized by the themes of that ALM conference which were not a perfect fit for this work. New categories had emerged while others had lapsed. Changes were also needed for locating journal articles. The indexing agencies had changed radically since the earlier study. Articles were now identified using academic search engines and, for the most part, readily available in full-text format electronically.

The Journalists' Questions

The first question posed was "Who is conducting research?" Was it an individual, possibly a doctoral student, a pair of researchers, or a team working as part of a large research project? Linked to that response was the issue of the funding source. Was the researcher independent or supported by the institution, a private grant, or government funding?

The second question asked was "What?" We looked at the type of research, qualitative or quantitative. Themes emerged as the abstracts were analyzed. Many studies had multiple themes

so we ended up classifying each document by primary and secondary theme. As stated earlier, we began our efforts with the themes from the 2000 project as a framework but quickly determined that the new study would be compromised by forcing the data to conform to the 2000 framework so we allowed new themes to be added and unused themes to be dropped.

The third, and rather important, question in the context of our study was “When?” Adult mathematics education takes place at several levels: adult basic education, adult secondary education, tertiary instruction—both developmental and collegiate, and graduate education. The same question could be answered by the year the research was conducted and the year it was reported.

To answer the next journalists’ question, “Where?” we focused on the institution where the study was conducted. In the United States there is variation in the location where adult basic and secondary instruction takes place. It could be a community-based organization site, a public property such as a library or school, a workplace, or at a community/junior college. We typified the institutions as academic (adult basic education site, community /junior college, or college/university), industrial, or government (military or prison).

The query, “How?” registered the source of the research data. Studies used student records, questionnaires or surveys, pre- and post-tests, classroom observations, and interviews. A few were intensive case studies. Finally, we asked “Why?” the study was undertaken. For example, was it a degree requirement or a report to a funding agency?

Dissertation Research

The majority of accredited universities in North America submit their doctoral dissertations to *Dissertations Abstracts International* (DAI) for listing or publication. The publisher, ProQuest, estimates that between 95 to 98% of all United States doctoral dissertations are included in DAI (<http://www.umi.com/en-US/catalogs/databases/detail/dai.shtml>, accessed October 8, 2012) An advanced search was conducted on the DAI index subject headings (SU) using the search argument “Adult” AND “Mathematics” AND “Education” for the years 2000 through 2012. Seventy seven dissertations, four of which are Canadian masters theses, were returned. Two of the dissertations had been included in the 2000 ALM-7 study. After a review of the abstracts, three others were discarded because they were not truly adult subjects, leaving a total of 72 dissertations for review. Appendix A lists the dissertations in chronological order.

Who and Why?

These are rather moot questions as the research was conducted by doctoral candidates to fulfill a degree requirement. They appear to have chosen a question sparked by a problem or situation in their work environment. While many acknowledged emotional or occupational support from colleagues, financial support was not apparent. No one seemed to be reporting a segment of a large, grant-funded project.

What?

Fifty-seven percent of the dissertations were quantitative studies while 36 percent were qualitative. Only seven percent were hybrids containing both quantitative and qualitative methodologies. Nineteen themes emerged as either primary or secondary foci. Figure 1 contains a graph by theme.

When?

The research was overwhelmingly tertiary in nature. Fifty-three dissertations focused on either developmental (22) or collegiate mathematics (31) while three addressed issues on the graduate level. Only ten examined issues in adult education: adult basic education (6) and adult secondary education (4). This is probably a reflection of the earlier questions about “Who and why?” The shift towards a doctoral credential at the community college and administrative levels of tertiary careers may have been the impetus for many of the candidates to seek an advanced degree. After reading a dissertation I often attempted to contact the author with a brief note of congratulations on their research. It was not uncommon to find that they had taken a different post after achieving their degree. From a reverse perspective, there is little impetus for an instructor at the ABE or ASE level to seek a doctorate as it would have little impact on their career path.

Figure 1. Dissertations by Primary and Secondary Themes

Where?

Not surprisingly, the majority of the doctoral research was conducted at tertiary institutions: 25 studies at community colleges and 30 in university settings. Geographically they were all over North America. Six of the more recent degrees were from Capella University, a for-profit institution.

How?

There were no trends evident in the instruments used to gather data. A variety of survey documents were employed, often designed by the researcher. The least used tool was classroom observation by a peer.

Journal Articles

A search of the Education Resources Information Center (ERIC) database was conducted using the search criteria: “Adult” AND “Mathematics” AND “Education”. The search was limited to full text and peer reviewed journals. 225 results were found. After each abstract was read, the citations were saved in folders labeled “Useful,” “Might Be Useful,” and “Not Likely.” Sixteen abstracts were saved as Useful. Forty-eight abstracts were saved as Might Be Useful. One hundred sixty-one abstracts were saved as Not Likely. The abstracts that were categorized as “Not Likely” were not appropriate for the study because they either discussed middle school mathematics, high school mathematics, or overall education. After the abstracts were categorized, the “Useful” and “Might Be Useful” articles were found.

All of the “Useful” articles were read, and out of the 16 articles, 13 articles were determined to be appropriate for the study. The other three articles were not useful because one discussed self-esteem in all classes, not just mathematics; one discussed how people’s adolescent education affected their level of education; and one discussed “young people’s” attitudes towards math and technology and how high schools need to teach the importance of math thinking. Then all of the “Might Be Useful” articles were read, and out of the 48 articles, 24 articles were determined to be appropriate for the study. There were 19 articles that were not useful because they mostly discussed elementary and high school mathematics or overall education, not solely mathematics. The other five articles could not be found.

A search of the EBSCO database was conducted using the same search criterion that was used on the ERIC database, but all 169 results were the same abstracts that were found in ERIC. No new articles were found. The search continued on the ProQuest Central database. In the ProQuest Central database, the search criteria used was: “Adult AND Mathematics AND Education” in Subject Heading from the date range 1999-2011. The search was narrowed by source type: Books, Conference Papers and Proceedings, Scholarly Journals, and Trade Journals. 96 results were found. Each abstract was read. 17 abstracts were saved as Useful. 14 abstracts were saved as Might Be Useful. Sixty-five abstracts were saved as Not Likely. After the abstracts were categorized, the “Useful” and “Might Be Useful” articles were found and read. Out of the 17 “Useful” articles, 8 were appropriate for the study. Three articles were not useful. Three articles had already been found in the ERIC database, and the other three articles could not be found. The “Might Be Useful” articles could not be found and therefore could not be classified as appropriate to the study.

Who and Why?

The researchers who conducted these studies picked topics in areas that they found interesting or areas that they noticed have problems. In most of the articles, the researcher used his/her classroom or institutional department as the setting. But in some of the articles, it is apparent that the researcher sought out participants for their study. For example, some researchers sent out requests to homes in a particular neighborhood or city.

What?

This question looks at whether the research method used was qualitative, quantitative, or both, and what were the primary and secondary themes. There was an even amount of qualitative and quantitative studies. Out of the 46 articles found, 16 were quantitative and 17 were qualitative. The rest of the articles used both qualitative and quantitative methods. Out of the 17 articles that

used qualitative studies, half of them used information gathered from other studies to discuss their research question. The rest of the articles used their own information gathered from observations and case studies conducted at adult basic education sites, community colleges, universities, homes, and workplaces. Out of the 16 articles that used quantitative studies, 13 used tests and questionnaires to gather information. One article used Raven's standard progressive matrices, test number series, and self-report questionnaires. Another article used a ten-question survey, analyzed with a Simple Analysis of Variance and Two-Way Univariate Analysis of Variance. One article used statistical samples of entire populations. The other 12 articles that used both quantitative and qualitative research methods used questionnaires, tests, observations, and case studies to gather their information. One article was unclear whether or not a quantitative or qualitative study was conducted.

The primary themes varied greatly among the 46 articles. While reading some of the articles, it was hard to determine one primary theme because two or more themes were very important to the question studied by the researcher.

When?

There are five levels of adult mathematics learning that the articles focused on: adult basic education, adult secondary education, post-secondary developmental, undergraduate, and graduate. One study took place at both the adult basic education and adult secondary education levels. One study focused only on adult secondary education. One study took place at both the adult basic education and post-secondary levels. One was at the graduate level. Two studies were at the post-secondary development level, focusing on teachers. One study focused on both undergraduate and post graduate levels. One study focused on undergraduate and post-secondary development. It was unclear in one study what level of mathematics learning the researcher studied. Of the remaining 37 articles, 18 focused on undergraduate mathematics learning in community colleges, colleges, universities, and one researcher conducted their study in an undergraduate nursing school. Nine studies were conducted at the adult basic education level, and the remaining nine studies were conducted at the post-secondary development level.

Where?

Most of the studies were conducted outside of the United States. Out of the 46 articles, only 15 of the studies were conducted in the U.S. Eight of the studies were conducted in the United Kingdom, and four studies took place in Canada. Two did not state where the study took place. The rest took place in Europe, Asia, and Australia. These countries include Finland, France, Ghana, Greece, Ireland, Japan, New Zealand, Pakistan, Scotland, Spain, Sweden, and Turkey.

How?

Out of the 17 qualitative studies, half used information gathered from other studies. The rest used information gathered from observations and case studies. Out of the 16 quantitative studies, 13 used tests and questionnaires to gather information. The other three used methods that pertain to the specific study. Out of the 12 articles that used both, the researchers used tests, questionnaires, observations, and case studies.

Observations

We know a great deal about students who are at-risk and they have a similar profile to students at risk in elementary and secondary school: women and minorities. Math anxiety is perhaps greater

than that of the younger population because earlier negative experiences have had time to ferment in memory. On the other hand, self-efficacy proves to be the clearest indicator of success.

We know a little about interventions that can help students be successful. A few studies altered classroom methods and achieved some degree of success. A disturbing fact that emerged from the studies that varied the use of technology was that online courses carry a high risk of dropout or failure even for adult students whom theory alleges are self-motivated and desirous of online work. As a personal observation, there has been a rush in the United States to offer online courses to all students, particularly adults, without sufficient research to determine whether this is an appropriate delivery system for mathematics instruction. The studies included in this research suggest caution.

Adult students need assistance when moving to tertiary studies. Secondary completion and tertiary placement assessments are not aligned which is a detriment to a smooth transition for students who often find themselves in developmental classes after successfully passing the high school equivalency examination. Non-traditional and adult students need support services that help them successfully adjust to the college classroom – services that address their emotional fragility and academic skills.

Concerns

By the conclusion of this study, I have read about 100 doctoral dissertations from the past 32 years. It was my hope that I would see a steady progression of work that built upon earlier research and experiments designed to incorporate andragogical theory in practical classroom methodology. Sadly, this is not what I found. In some ways we have regressed. Few of the literature reviews referenced the body of earlier doctoral research and many of the theoretical frameworks were similar, based on decades-old theory. There is no coherence to the body of work and I found it to be illumination by firefly rather than spotlight. The geographic dispersal of the scholars and the lack of funding for research are just two possible reasons for this state of affairs.

Quantitative studies that predict student success continue to be pursued, probably because the data is readily available and analysis with statistical software is easy. Such studies are not intrinsically deficient but they revisit the diagnosis of the patient without exploring a possible cure for the ailments. They are terminal rather than seminal. The population of the United States continues to diversify yet I found scant attention paid to classroom methods or interventions that addressed the needs of minority students or women. Study after study determined that self-efficacy is the best predictor of success when all other factors are considered. How then, do we promote that quality and assist adult students to succeed in the mathematics classroom?

The lack of journal articles that our project found is very disturbing. Both the ALM proceedings and journal are missing. If we are writing about research and practice and no one indexes our work, how do we get the message out? In the topic group last year in Dublin I began the session with the old question “If a tree falls in the woods and no one hears it, does it make a sound?” We need to be proactive in advancing the indexing of work published by our members both in our publications and the wider circle of journals.

Moving Forward

At the conference this slide referenced an old Beatles song that offered the challenge “You say you want a revolution...” Based on this research study I suggest the following agenda for action:

- We need to design and assess interventions that help:
 - Decrease Math Anxiety
 - Increase Self-Efficacy
 - Initiate a Shift in Student Perspective.
- We have to align the secondary school proficiency assessments with the college placement tests.
- We need to design and teach adult and developmental mathematics courses that reflect the mathematics adults need to succeed in our democratic societies.
- We need to imagine and execute innovative tactics to jumpstart non-traditional students entering tertiary study
 - Intense, pre-entry classes
 - Short, repeatable modules
 - Effective, appropriate use of technology.

Adults Learning Mathematics—A Research Forum is the only organization dedicated to adult numeracy that spans the delivery system from adult basic education through graduate school and professional development. As we approach our twentieth conference I would respectfully suggest that we focus our work to illuminate the efforts of the thousands of instructors who teach millions of adult mathematics students across the globe.

References

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