



Final Evaluation Report

MINNESOTA NUMERACY INITIATIVE

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Table of Contents

Abstract	page 1
Key Findings	page 1
Introduction	page 2
The Model	page 4
Strengths of the Model	page 5
Challenges of the Model	page 7
The Excitement and Challenge of Changing Teacher Practice	page 9
MNI Objectives	page 11
Content Knowledge	page 11
Instructional Strategies	page 14
Self-confidence	page 17
Community of Practice	page 18
Wiggio	page 18
Partner Meetings and Mentoring	page 19
Peer Observations	page 20
Math PD Capacity	page 23
Online Professional Development	page 24
State PD Staff, Course Facilitators	page 25
Teacher Perceptions of Learner Impact	page 26
Participant Willingness to Continue	page 28
Conclusion	page 29

Minnesota Numeracy Initiative Evaluation

Abstract

August, 2010 – April, 2011 marked the first year of the Minnesota Numeracy Initiative (MNI), a multi-year, comprehensive professional development effort for teachers of adult numeracy. Twenty-four teachers participated in MNI during year one; 23 teachers completed the entire program, and the one teacher who didn't complete participated fully in all but one activity.

MNI was designed and administered by Astrid Liden of the Minnesota Department of Education and Kim Johnson of Hamline University. The initiative was overseen by an Advisory Team that included Ms. Liden and Dr. Johnson along with an additional Hamline staff member and four participating teachers.

MNI is intensive, extended, interactive, hybrid (combining online and face-to-face) professional development. The initiative had three components in year one: online courses, an electronic community of practice (ECoP), and partner/peer mentor activities, organized into three phases:

- Phase 1: participant recruitment and selection; a face-to-face, kick-off meeting; online course 1 (*Foundations of Teaching Adult Numeracy*); partner meetings during course 1; a webinar; and ongoing participation in an electronic community of practice (ECoP). August – December, 2010
- Phase 2: the period between course 1 and course 2; participant self-assessments and reflections; peer mentor/partner observations; ongoing participation in the ECoP. January – February, 2011
- Phase 3: online course 2 (*Teaching Reasoning and Problem-Solving Strategies*); partner meetings during course 2; collaborative development and provision of a presentation to peers at a face-to-face wrap-up meeting; ongoing participation in the ECoP. February – April, 2011

Key Findings

- MNI reflects the features of effective professional development including duration, content focus, active learning, coherence, job-embedded, collective and collaborative, and technology-supported.
- MNI is based on sound adult numeracy pedagogy.
- Participants strengthened their math content knowledge based on their participation in MNI.
- Participants implemented effective and more varied adult numeracy instructional strategies in their classrooms.

- Participants increased their self-confidence and comfort with teaching adult numeracy.
- Participants created and contributed to an ongoing, statewide virtual Community of Practice that expanded networking, communication, resource sharing, and collaboration with their peers.
- Participants gained experience providing numeracy professional development and some are now more willing to provide numeracy professional development.
- Participants gained comfort and confidence with participating in online professional development.
- Participants can describe impacts on their adult learners resulting from implementing MNI practices in their classrooms.

Introduction

The Minnesota Numeracy Initiative (MNI) is a multi-year, professional development project designed to improve numeracy instruction for adult learners in Minnesota. MNI is sponsored by the Minnesota Department of Education (MDE) in partnership with ATLAS, Hamline University, School of Education. MNI is designed and led by Astrid Liden, ABE Professional Development Specialist, MDE, and Kimberly Johnson, ATLAS Director/Assistant Professor, Hamline University, with assistance from Marisa Geisler, ATLAS Program Administrator. The Initiative was overseen by an Advisory Team (the A-Team) composed of Astrid, Kim, Marisa, the course facilitators (Jean Stephens and Mary Barbara Hanna), and four MNI participants: Andy Albee, Nikki Carson-Padilla, Laura Prettyman, and Amy Vickers. The A-Team met monthly to discuss and refine MNI's goals, identify and address needs, select participants, plan and debrief processes and activities, develop tools (applications, self-assessments, etc.), and conduct the ongoing, formative evaluation of the initiative. This evaluation of year one of MNI was conducted by Sally Waldron, World Education, Inc., with funding from the LINC'S Region 1 Regional Resource Center (RRC1) funded by the Office of Vocational and Adult Education (OVAE), U.S. Department of Education.¹

In 2010-2011, MNI focused on general professional development for numeracy instructors, whether new to or experienced with teaching math to adults. Participants were chosen for MNI by the A-Team through a statewide application process, using a rubric and criteria to make selections.² There were 60 applicants for the 24 MNI slots. The A-Team looked for teachers with stronger math backgrounds and experience who they felt could be successful as this new professional development initiative was

¹ RRC1, with OVAE funding, also supported aspects of the MNI model, primarily the two online courses (*Foundations of Teaching Adult Numeracy* and *Teaching Reasoning and Problem-Solving Strategies*) provided through ProfessionalStudiesAE.org.

² The MNI application rubric had three criteria: teaching assignment and learners (ideally > 50% teaching math, benefits to teaching and students, and experience teaching math. Other considerations included regional distribution, administrative support, identified partners, and performance on past PD initiatives.

developed, launched, and refined. Participants received a \$500 stipend after completing all MNI activities.³

MNI is intensive, extended, interactive, hybrid (combining online and face-to-face) professional development. The initiative had three components in year one: online courses, an electronic community of practice (ECoP), and partner/peer mentor activities, organized into three phases. This evaluation was conducted between January and June, 2011 and covers the initial three phases of MNI:

- Phase 1: participant recruitment and selection; a face-to-face, kick-off meeting; online course 1 (*Foundations of Teaching Adult Numeracy*); partner meetings during course 1; a webinar; and ongoing participation in an electronic community of practice (ECoP). August – December, 2010
- Phase 2: the period between course 1 and course 2; participant self-assessments and reflections; peer mentor/partner observations; ongoing participation in the ECoP. January – February, 2011
- Phase 3: online course 2 (*Teaching Reasoning and Problem-Solving Strategies*); partner meetings during course 2; collaborative development and provision of a presentation to peers at a face-to-face wrap-up meeting; ongoing participation in the ECoP. February – April, 2011

Online course 1, *Foundations of Teaching Adult Numeracy*, was facilitated by Jean Stephens, who also attended the kick-off meeting. Online course 2, *Teaching Reasoning and Problem-Solving Strategies*, was facilitated by Mary Barbara Hanna, who also attended the final project meeting.

The methodology for this evaluation consisted of document review and data analysis, based on the data already being collected by MNI. MNI was committed to formative and summative evaluation and collected extensive data from participants throughout the initiative, including: participant applications, course assignments and discussion boards, pre- and post-participant surveys, weekly notecards from participants during both online courses, webinar discussion notes, self-assessments and reflections related to the partner observations, post-MNI administrator survey, Wiggio postings and discussion, and documentation of professional development presentations. The evaluator also attended the wrap-up meeting held at MDE on April 29, 2011.

This evaluation examines two aspects of MNI: the model as a whole and the progress/achievement to date of initiative objectives.

³ MNI participants who were unable to accept a stipend based on the rules of their parent programs received payment in the form of numeracy materials and resources for their programs.

The Model

MNI is a comprehensive professional development model that encompasses the key features of effective professional development and sound numeracy pedagogy. The literature on professional development in K-12 education and adult education reflects general agreement on the considerations for effective professional development:

- *Duration* – professional development that is of longer duration, iterative, and offers applications to practice.
- *Content* – professional development that focuses on subject matter knowledge and integrates theory and application.
- *Active learning* – professional development that focuses on student work and thinking and includes analysis, reflection, practice, and observation.
- *Coherence* – professional development that is consistent with national, state, and program policies and priorities and teacher beliefs.
- *Job-embedded* – professional development that connects what is learned in the professional development and the teacher’s work context.
- *Collective and collaborative* – professional development that supports teachers to work together and encourages participation of teachers from the same program.
- *Technology-supported* – professional development that uses appropriate technology to prepare and support participants before, during, and after the intervention.⁴

As noted above, in year one, MNI had three components:

1. Online courses – two, facilitated, 6-week courses: *Foundations of Teaching Adult Numeracy* and *Teaching Reasoning and Problem-Solving Strategies*.
2. An electronic community of practice – a Wiggio group for participants and a webinar conducted after the first course.
3. Partner and peer mentor activities – participant pairs with teachers based in the same program, where possible. Pairs met weekly during the courses and reported on these meetings to MDE and ATLAS. Peer observations by the partners were conducted following course 1.

There is also growing agreement on what constitutes strong math pedagogy. In *How Students Learn: History, Mathematics, and Science in the Classroom*, the authors

⁴Desimone, L.M. (2009). Improving Impact Studies of Teachers’ Professional Development: Towards Better Conceptualizations and Measures. *Educational Researcher*, 38(3), pp. 181-199; Sherman et al. (2006) An Environmental Scan of Adult Numeracy Professional Development Initiatives and Practices. American Institutes for Research, Washington, DC.; Smith, C. & Gillespie, M. (2007). Research on Professional Development and Teacher change: Implications for Adult Basic Education. *Review of Adult Learning and Literacy*, 7; Timberly, H., et al. (2007). Teacher Professional Development and Learning. Wellington, NA: New Zealand Ministry of Education.

advocate for math classrooms that are “learner-centered, knowledge-centered, assessment-centered, and community-centered.”⁵ And *In Adding It Up: Helping Children Learn Mathematics*, the authors define proficient math students as having conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition.⁶ The NRC framework was also used for *The Components of Numeracy* article published by the National Center for the Study of Adult Learning and Literacy in 2006.

Strengths of the Model

The key features of effective professional development are clearly and comprehensively embedded in MNI:

- Duration – The first year of MNI extended over 7 months, beginning with a face-to-face kick-off meeting in October and ending with a final face-to-face wrap-up meeting in April where the partners presented samples of their work. The weekly time commitment, especially during the online courses, was substantial. Participants reported that they spent 5-6 hours per week on coursework and meeting with their partners.
- Content – MNI focuses on numeracy and mathematics content and supports teachers to advance their subject matter knowledge and deepen their understanding of mathematics concepts. Both courses integrate research-based theory. Statements about numeracy content ran throughout the weekly notecards (partner meeting documentation) provided to MDE and ATLAS. For example,
 - Wow ... constructivism, levels of math knowledge, and multiple intelligences all in one ... stimulating and exhausting at the same time.
 - For me, it can sometimes be difficult to see more than one way of solving a math problem, so it was interesting to discuss this ...
 - [Name] and I talked about including algebraic thinking even at the lowest levels.
- Active learning – MNI is based on active learning and MNI demanded ongoing application to practice. For example, activities in course 1, *Foundations of Teaching Adult Numeracy*, include: easing math anxiety, working with students with learning disabilities and/or language issues, and analyzing and assessing students’ mathematical thinking. Courses are geared to participants who are currently teaching math, and participants are asked to try out new perspectives and ways of working with their math learners, with time for analysis, reflection,

⁵ National Research Council, the Center for Studies on Behavior and Development, and the Committee on How People Learn. (2005). *How Students Learn: History, Mathematics, and Science in the Classroom*.

⁶ Kilpatrick, J., J. Swafford, and B. Findell (Eds.). (2001) *Adding It Up: Helping Children Learn Mathematics*. Mathematics Learning Study Committee, National Research Council, National Academy Press: Washington, D.C. <http://www.nap.edu.openbook.php?isbn=0309069955>

- practice, and observation. Postings from weekly lessons and notecards underscored just how active the learning in MNI was. As one participant stated in her reflections on course 1: “The course itself was a good example of constructivism at play. Throughout our MNI project, I have been impressed with the online course information and by the way the course is taught using the very teaching methods being explained in the course.”
- Job-embedded – Teachers applied what they were learning in their math classrooms, and, where possible, were paired with a teacher from the same program. Mentor pairs observed each other during the period between the two online courses. Program administrators were asked to support their MNI participants.
 - Collective and collaborative – In addition to the partnerships, MNI has a Wiggio-based ECoP where participants shared resources, posted questions, accessed tools, dialogued, etc. Participants are a cohort, starting and completing year one of the initiative together.
 - Coherent – MNI was designed to align with the Minnesota ABE PD Standards. Throughout MNI, teachers were asked to determine and examine their beliefs about numeracy and math content and context and how they approached teaching numeracy to adult learners. MNI does not always align with existing teacher beliefs. For example, one participant stated in her weekly notecard: “My experience with math curriculum has made me very resistant to ‘new approaches and philosophies’, and I’ve been making a conscious effort to be open-minded. I really appreciate [name’s] perspective and constant positive attitudes to the discussion.” Such different perspectives were valued in the discussion threads within the course where participants were supportive of each other and, at times, questioned each other. Partners also provided ongoing peer support.
 - Technology-supported – MNI combines face-to-face events (the kick-off and wrap-up meetings and peer observations) with technology-supported activities including the online courses, phone and email communication between peer mentor pairs situated in different programs, a Wiggio-based ECoP, the webinar, and online surveys to solicit feedback and document participant outcomes.

It’s also important to note that the two online courses chosen for year one of MN reflect strong math pedagogy. For example, *Teaching Reasoning and Problem-Solving Strategies* is structured, in part, around the five processes used to solve math problems: conceptual understanding, adaptive reasoning, strategic competence, procedural fluency, and productive disposition. As one participant reflected, “I spend a lot of time thinking about productive disposition of learners (though I just learned to call it that!). For me, the way to impact productive disposition is to create new situations where the learner is able to experience success along with seeing others in the class experience success. ... I explicitly talk about this to learners. For example, ‘maybe word problems used to be difficult for you, but today you could learn something that will change that.’”

Challenges of the Model

The primary challenge for MNI participants was time; a few participants had initial challenges related to technology; and one or two participants were challenged, at the beginning, with understanding what was expected of them. These challenges are to be expected but worth noting as plans are being made for MNI in future years.

There were three challenges related to time: finding/making the time for full participation, finding common times to meet with partners, and finding that the time needed, especially for course participation, was more than initially expected. ABE, ASE, ESOL, and transitions teachers already experience competing demands on their time, and MNI added to these demands. The MNI teachers held themselves to high standards; they wanted to participate fully in MNI and they wanted to do a good job. References to time as a constraint in the weekly notecards and surveys include the following:

- I am finding myself very crunched for time for MNI.
- We're both feeling overwhelmed, because we like to have thoughtful posts and to read through the other posts and materials provided by Jean, but at the same time we're starting up new programming and putting in more hours than usual at our sites.

The 22 responses to "What were the challenges of the weekly partner meetings?" - a question on the phase 1 survey - include 11 responses related to time (finding time in and of itself and finding a common workable time):

- Finding the time to do it.
- Time. Meeting by phone worked best.
- Finding a convenient time.
- Time.
- Timing and staying on task.
- Setting aside time to meet.
- Time, as usual.
- Finding a good time for both of us.
- Finding time to meet. Many things tend to slip by in the hustle and bustle of the work week and this was one more thing to do.
- Finding time in the day and sticking to it.
- We are both busy teachers here. Finding time when we can both drop out and meet was sometimes difficult.
- As far as the 2-3 hours/week, I [have] easily [been] putting 2-3 times as much time as that (depending on the week). It really does take time to meet with partner, read everything, post on the boards, and comment on other posts, not to mention time in the classroom. I guess I just wasn't thinking it would take this much time, but it has been VERY interesting and educational.

Time-related issues also come up in other surveys in response to questions about challenges:

- Although, I feel I'm learning a lot and I'm being challenged in my thinking, I do feel that the time necessary to put into the course, is a bit more than expected. There is a lot of reading, course work, classroom activities, and constant checking and reading discussion boards. It's been a bit harder to work in than I had prepared for, but I do appreciate what I'm learning.
- The only comment I have is that I think this course takes more like 4-5 hours a week to do well.
- It is taking me a lot longer to do the assignment than first advertised. It could be me just not being familiar with the technology.
- The biggest challenge was finding the time in a busy week.
- Time was tight, but not insurmountable.

Prior to MNI, participants had differing levels of experience with online courses (16 out of 25 participants surveyed had previously taken an online course) and with social networking (16 out of 25 had used a social networking site of some sort). When asked to rate how frequently they had used various online communication tools, however, the highest response in each category was as follows:

Communication Tool	Most Frequent Response
Instant messaging	Rarely
Chat boxes	Never tried
Phone calls via the Internet	Never tried
Video calls	Never tried
Online meetings	Never tried
Wikis	Never used

N = 25

On the other hand, 92% of respondents said that they were comfortable trying out new technology tools. So, without constituting a big problem, there were a few initial tech-related challenges, some related to participants' prior experience and some to the limitations of the Learning Management System and the social networking platform:

- I am not sure if it is just me, but I can't login on Wiggi...is there anything you guys know? This is the message I get when I try. (week 1 notecard)
- We talked about how the program works especially the online program...I have also found out that I cannot post to the discussion group for lesson one on Sunday. So I am including it here. I guess I missed that part in the instruction. This is my first online class. I will do better next week. (week 1 notecard)
- [Name] hadn't posted yet, and had questions about how to do it, so I could show her where everything was on the online course website. (week 2 notecard)

- The main computer at the house is having all sorts of problems, so I am hobbling together computer time on available computers either at work or family members. (week 3 notecard)
- A set of recommendations for technical posting to the discussion boards would be helpful. The lack of formatting ability just about drove me insane. (phase 1 survey)
- I was a little frustrated last night because the website the lesson is on was down. I called tech support and they weren't real helpful about when it would be back up. Thankfully it's back up tonight. (week 1 notecard)
- ... he has had a bit of trouble logging in and viewing some of the articles from his site. (week 1 notecard)
- [I] brought all my notes/laptop but had lots of technical difficulties so did not get to post things as I had wanted. I am definitely technologically challenged ... (week 1 notecard)

The notes from the Advisory Team meetings also note that “the online course system seems so clunky.” (November 18, 2010 meeting notes)

Despite clear presentation of the MNI components in recruitment materials and in the materials provided to participants, at least one participant was unclear about what was expected of her. She states, “OK, I knew there was something I was missing. Is this something I need to find in my notebook? Is it listed in the assignments? Or just in my notes? I seem to recall that we just type out a few lines in an email. When in the week is this due? ... I'm having a little trouble juggling all the different parts of this, partly because things are in so many different places ...”

Astrid replied to this query immediately, clarifying the primary focus (the online course and weekly partner meeting) and adding that that partner meetings didn't need to be face-to-face. So, things quickly sorted themselves out and the participant responded, “I'm sure things will be fine. I've been working my way again through even the introductory chapter, and refreshing my memory.”

The Excitement and Challenge of Changing Teaching Practice

It goes without saying that it is both exciting and challenging to make changes in one's teaching practice even with strong, ongoing professional development and collegial support. From the onset, MNI pushed participants to reflect on, experiment with new approaches and activities, and ultimately make changes in their teaching practice. Participant reflections within both courses point to both the energy and challenge of making change, from participant's initial goals through trying out new approaches in their classrooms to final course reflections. For example,

- Through this course I hope to learn and try new classroom activities that are more discovery-oriented and break away from the “explain it” and then “try it” model that I use now.
- I guess my questions center around my desire to implement some of this in my own classroom and wondering how that will happen. “Restructuring the environment” sounds exciting but it may be closer to baby steps for me.
- I was frustrated with the Productive Disposition part of the article. I don’t see anything moving forward in this part at all. How to address any of this in class, how do you help make changes?
- I am surprised just how complicated teaching math is ... for adults. ... I was proud of myself with the last lesson to be able to incorporate so much of what we learned into lessons ... now I am worried about getting this into the lessons as well... This is going to be one challenging session for me ... hopefully my students will enjoy the challenges. How are [we] going to teach reasoning skills, logical thinking, critical thinking skills all in a one hour class four times a week? It feels like we are going to try to teach good sense.
- I also share your concern about being able to pull it all together into great lessons ... we’re learnin’ right along with our students.
- Over[all] the article was good, but like I said it’s easier to talk about this than actually apply it.
- So true about needing more time. The students definitely need more time if they are to gain a deeper understanding that can be used in their various contexts. I need more time as a teacher to prepare and grow if I am to help them with it!
- One of the things I found myself thinking about A LOT over the course of this class is the challenge of being a good teacher. So often, I feel like I am in a race to get my students prepared for something. Like everyone here, I often have students come in who need their GED ASAP ... Sometimes I feel like I rush, rush, rush to help learners meet a one-time goal, instead of being able to take the time to foster numeracy skills that will last a lifetime. This course really made me think about how to be a better teacher by incorporating those things into my lessons while still striving to meet student goals!
- Now I know I need to teach numeracy using the constructivist approach. I also know that it will take time to change my curriculum to reflect that. It’s always easier said than done. This was a great class to have as a stepping stone to understand this subject at a deeper level.
- Packets and drills will still have a place, but at this point we really need to focus on context, and moving through the levels of understanding. Workbooks are used far too often and for too much of the teaching. This is going to be a big challenge and require great amounts of time and effort to change entire programs.
- I know I have a long way to go to achieve a more relevant and engaging learner-centered math classroom but now I have a road map of sorts and the support from my MNI friends, if I get lost along the way.

MNI Objectives

In year one, MNI had seven primary objectives, as follows. MNI participants will have:

1. Strengthened math content knowledge.
2. Implemented effective adult numeracy instructional strategies in their classrooms.
3. Increased self-confidence with teaching numeracy.
4. Contributed to and created an ongoing, statewide virtual Community of Practice for professional networking, general communication, and housing and sharing resources related to numeracy.
5. Expanded networking and collaborative opportunities with peers.
6. Gained experience and confidence in providing numeracy professional development.
7. Gained an increased level of comfort and confidence with participating in online professional development.

Below, we look at the seven objectives and the questions that were defined for each.

Content Knowledge

- Have the participants strengthened or acquired new math content knowledge?

Practitioners entered MNI with differing math credentials, content knowledge, and experience. As summarized by Mary Barbara Hanna in her memorandum of December 1, 2010, three MNI year one participants have BA degrees in math and three have a teaching license in math. The sizable majority acquired their math teaching skills through on-the-job training (22 participants) and through professional development (20 participants). Some also commented that they had math training as part of their work in elementary education. Eight participants have been teaching math in any context for less than five years and 13 have been teaching math to adult learners for five years or less.

Participants entered MNI with differing goals for their participation. Based on their initial applications, six of the 24 MNI participants seemed to have an explicit or implied goal related to strengthening their math content knowledge:

- I was motivated by two factors: that math is not my strongest area and that I want to improve my delivery of instruction to our learners. I want to gain a better understanding of math concepts and strategies to improve math instruction.
- Also, it is always good to improve my capabilities for teaching math and strengthen my math skills to make the learners improve their outcome.

- Since math has always been a weakness for me, going through the program will strengthen me as a teacher... I hope to fill in some of my own math “gaps”...
- When I was a student, I hated math. I took the minimum number of classes to obtain my degrees. When I became a teacher, I realized that in order to help my students, I had to learn how to do math myself ... I hope to gain a better understanding of mathematical concepts.
- I would like to know about resources to improve my own personal math skills.
- As a science teacher teaching math, I want to develop more of a foundation in math ...

Some of these practitioners also commented on their desire to improve their math content knowledge in their stated goals for the first course, using phrases such as:

- Build a broader base for my own knowledge of math
- Gain a deeper understanding of how math works for myself
- Gain a better math foundation and then relay that to students

In their math autobiographies in course 1, 11 participants express a desire to strengthen their math content knowledge:

- My weakness is that my mathematics education is very shallow.
- I feel comfortable with the content areas although I wonder how I would teach differently had I been trained as a math teacher. I did not take calculus which has made me doubt my foundation and understanding of math on a deep level.
- The English teacher in me now helps me with word problems but I can struggle with long equations, especially finding ways to help the student come to the answer. I’m hopeful that this course will help lessen my struggle.
- I know I got an A in the class, so I think I felt fairly successful but in the big scheme of things, I still knew there were a lot of gaps in my understanding...
- My weaknesses are that I don’t have any formal training in teaching math and I haven’t taken math classes beyond Algebra and Geometry ... I haven’t run into any situations where I’ve had to teach something beyond my ability, but if I’m ever called upon to teach GED math, I may be quite challenged.
- The areas I feel less confident is when it comes to factoring trinomials and then, even thinking of trig or calculus. I haven’t done the last two since high school.
- Now as a teacher I always think about learning trigonometry and calculus better even though I don’t teach those. They were two subjects that always gave me difficulties.
- Trig and some Geometry still escape me and I have nothing to offer the students here.
- ... because my early education was a bit haphazard, I feel I have gaps.
- I feel a little shaky about delving into some of the math my transitions students need for college, though.

- I need to improve with algebra especially in connecting it to the larger world... sometimes I think that I get rusty, scared and feel ill-equipped, and therefore, approach teaching algebra rather tentatively.

As the end point of ABE, ASE, and ESOL moves from GED/high school completion and English language acquisition to transitions to college and careers, the content demands on teachers will become more rigorous. Learners will need strong algebra skills to test out of developmental education and enter credit-bearing courses directly. One participant shared in her math autobiography that she had taken a pre-calculus class the prior year; this class was a review as she had taken calculus as a freshman in college. She was motivated to take the class as her commitment to college prep learners grew.

In the end, almost half the group (11 out of 24 participants) either felt that they had gaps in their math content knowledge or that they needed to become more skilled in algebra, geometry, and trigonometry. The need to strengthen content knowledge in these three areas wasn't directly addressed by the two courses chosen for year one. If resources allow, MNI may want either to add online courses that focus on algebra, geometry, and further content such as trigonometry, or add optional college math courses in future years. MNI might also sponsor a content-focused course for MNI participants. Such a course might be taught by one or more of the MNI participants with stronger math backgrounds.

The final MNI participant survey directly addressed the question of whether participants were more comfortable teaching various math content areas and whether they had increased their math content knowledge. Nineteen participants responded to the question related to increased **comfort** with teaching different content areas as follows:

Content Area	Increased Comfort
Number sense	84.2%
Word problems	94.7%
Geometry	36.8%
Algebra	26.3%
Data analysis and probability	36.8%
Graphing	26.3%
Solving multi-step problems	68.4%
Use of a calculator	5.3%
College math/math for Accuplacer	10.5%

N = 19

In addition, two participants indicated that they were more comfortable teaching math in general:

- I don't know if I have a better understanding of the topics not marked, but my math teaching in general has improved, which may help in those areas as well.
- I am more comfortable teaching math in general.

Another participant commented that s/he was more comfortable teaching the math they teach:

- I'm more comfortable teaching what I teach, in a better way. I don't open the textbook much now, except to see what we should be working on. Then we start doing puzzles and asking questions and playing with manipulatives to figure out the concepts.

When asked on the final survey if they felt their math **content** knowledge (as opposed to comfort level) had been strengthened in any way, participants are split in their responses specific to content strengthening: seven participants say "yes"; five participants say "no"; the balance don't answer the question directly.

Instructional Strategies

- Have teachers implemented effective instructional strategies gained from participating in MNI?

Many participant goals related explicitly to the second objective: implementation of effective instructional practices. Instructional goals included developing and applying stronger, more effective, and more varied instructional strategies; better understanding adult learners and developing adult learner-focused strategies; and exploring/learning about the numeracy research base, as follows:

- I just want to be better. I want to grow with new ideas and finding out what others are doing and why they find it successful, and apply this knowledge to my students.
- I feel that right now I am kind of forcing things on students rather than understanding what/how they are thinking and feeling about math. I would like my students to feel that they own numbers in the same way that they own the languages that they speak. If I taught better, they might get to that point.
- I want my students to see the reality of numbers in all facets of their lives, feel more comfortable and confident of their abilities to use math skills, ...

In the webinar following the first online course, participants articulated changes in their awareness of levels of math instruction, of multiple intelligences, of the need to take a broader approach to numeracy, of the importance of taking a constructivist approach, of thinking about teaching math differently, and of relating math instruction more to the real world and to other content areas learners are studying. Participants related a need to combine both formative and summative assessments in their classrooms, and they spoke of increased learner involvement and better communications with and among

learners in their classrooms. Finally, they also noted new methods and strategies they had adopted: problem of the day, open problems, warm-up questions, puzzles and patterns, using cell phones, integrating algebraic thinking across all levels, slowing down, using more manipulatives, and making more connections to and depicting real life situations.

In their weekly notecards, discussion board postings during both online courses, and reflections at the end of both courses, participants point to changes in their practice and to the fact that changes in practice take time.

- I will definitely include more open problems and allow my Ss to be uncomfortable a bit as they learn together. And I will use Levels of Math Knowledge in a more deliberate and thorough manner.
- I reflected on numerous definitions of numeracy and began a dialogue with my students about their histories and ways of doing math. ... I viewed math as a different animal and relied on the familiar workbook ...
- The whole open-ended question thing really threw me off my kilter – I thought we just plowed through the workbooks and did the problems, then we'd all be ok. It's been great fun to explore these new ideas and approaches, to open up the classroom, to try to see math as life, which is messy, and doesn't follow the flow of the book. My learners are still looking at me like I'm crazy (I very well may be!) ...
- My favorite part is the open-ended approach to solving problems. Both my ELL and native speakers really enjoyed this type of activities and it provided me with lots of insight into how they think.
- To help them understand that life is a word problem and we are not answering the problem in the same way, there is no one right answer at the back of the book. ... I am excited about being able to do lessons that required thinking outside the workbook for both me and the student.
- This class has also made me really start taking a second look at the way our classes are structured. ... I might suggest a slower paced class where students really get the chance to work on problems together more and to discuss things.
- This course really pushed me to step out of the same old methods for teaching math. ... I really love these extended trainings because I have time for all this new information to marinate and I can reflect with other teachers.
- In class, I often ask learners to explain their solutions because this enhances learning for that student and other students. The research in the reading reinforces that idea and encourages me to add more learner explanations to lessons.
- I think I can be more deliberate in showing students what numeracy situations they already excel at managing, even if they can't always give me the "right" answer to the work we're doing in class.
- Many of my students bristle at first when we do problems more than once to show different styles of solving. They just want one. However, they do start to

acknowledge that the way they want it done may not be the way others want it done. So they start to accept that there is more than one way and that they don't have to use just one way.

- I should add that upon reflection, I realize that I don't always process/discuss the experience with the students as completely as I could. The list of facilitation questions should help me develop this skill. I frequently ask for alternate ways of solving a problem but I definitely see that I can improve my questioning and drawing out of the students.
- I started with looking for patterns, the second problem, from the thinkquest.org site: how many steps in the staircase, using blocks. My students' favorite strategy is to wait for me to tell them what to do. So we worked together for a while. Then I backtracked. The next day I started with the quote, "Good problem solvers start by trying." We talked about what that meant. Then we talked about solving problems and the different ways a person could go about that. ... I did, however, stay with just three strategies: draw a picture or diagram, making a list, and working backwards.
- The first strategy I tried was simplification using rounded numbers. ... [This] caused problems for a couple of my learners. They had always been taught to find the correct answer, not the almost-correct answer. ... We talked about situations when you might want an approximate answer, but not necessarily an exact answer. Once the students seemed to be getting the hand of it, I added elimination as another strategy.
- I am listening to the students more and really encouraging them to teach each other.
- ... there is much more to learning and therefore teaching math than computational skills. Numeracy, like literacy, requires skills for functioning in the classroom and in the world; it is about reasoning and solving problems. I learned that I can set up activities for conceptual understanding and provide activities including games to give practice in logical reasoning. I can teach and model strategies for expressing a problem and I can promote Habits of Mind...
- The class encouraged me to try new things and step out of the traditional math handout/drills. I am especially excited about incorporating habits of mind into my discussion with students.

There are also many responses to the final survey that attest to participants increased familiarity and ability with different instructional approaches:

- I felt very strong in my math content knowledge before, but I really feel that it's strengthened my ability to vary the way I teach it.
- ...I do think my math teaching methods have been strengthened tremendously.
- Yes, even though math isn't my strong suit, I feel stronger because I can break things down into steps and take students to the next level much easier by giving them little things to work on and strengthen and then they can run with it from there.

- Yes, I use better techniques for teaching.
- I learned how to teach problem solving strategies, and new and better ways to present content.
- ...it changed so much of how I'm trying to teach.
- The main improvement for me was being comfortable presenting them in different ways, trying to hit the different ways that people learn math...I vary the way a teach more, I focus more on the "concepts" of each operation instead of just jumping into it. I'm really trying to think of ways to teach so that people can maximize their learning.
- I am doing more with concrete learning before doing the abstract. I really need to get into teaching the habits of mind.
- I don't feel that my math content knowledge has been specifically strengthened. However, I do think my math teaching methods have been strengthened tremendously.

Self-confidence

- Have teachers increased self-confidence in teaching numeracy as a result of participation in MNI?

Participant course postings, reflections, notecards, and survey responses point to increased confidence and the pure joy of learning experienced by participants. Many of the quotes noted above resound with this confidence as do the comments displayed below.

- In summary, through this course I have gained the background to confidently decide that my math classes will focus on learning and thinking, and as student develop those, the math will come.
- I have learned to weave the threads of numeracy into my ESL lessons more smoothly and I seem to be more able to come up with math problems spontaneously when a topic lends itself to a problem to solve.
- Wow! I can't believe we are done with this course! I have to say, I learned a lot! ... It gave me lots of ideas to shake up my instruction.
- I think I have a better understanding of numeracy and have some more tools to take with me to my classroom. I liked finding out what kind of math learner I am and how that can drive a learner who does things differently CRAZY!
- I have some ideas of how to use those areas with my level. I feel more comfortable adapting materials. I believe that things can be taught at all levels in a new way.
- I feel more confident introducing basic math concepts with my learners. I'm using the levels of knowing, open-ended questions, and explicit instruction.
- My students are much happier about math and so am I.
- Yes, I personally feel more confident in content areas. Especially using and working with story problems and making them more applicable to my students.
- I feel more confident and competent.

- I love talking about how it's important to understand the concepts behind what we're doing. I am much more confident in teaching math.

In response to "As a result of your participation in MNI, how do you now cope with a situation where you do not feel confident in your mathematical ability?" participants responded:

- I am trying to get more comfortable with my occasional mistakes and show that false starts are a part of problem-solving. I am trying to have "beginners mind", that is open to learning, to seeing what happens.
- I try to relax, and then look for a more basic approach to the material. I ask for help.
- ...occasionally when I'm teaching A+dvancer College Level Math, and I forget things, I just tell them that I need to review it. I go look it up and come back. I hope to send the message that no one remembers everything, and when we forget, we go review...It's what we do next that matters most – quit or find a way to keep going.
- I am trying to be more student-led. So if I'm not sure I remember how to explain a solution, I let one of the students explain it.
- I choose to be curious about how to solve the problem. I am persistent in searching for ways to solve the problem. I own the problem and choose to want to solve it. I try to figure out the problem, ask others for help. Then I think about what I learned and how I learned it, so I can share that with others.
- I have a lot more resources, including all the people from the class, that I can reach out to if I need help with particular subjects.

Community of Practice: Networking, Communication, and Resource-Sharing

The many pieces of MNI in year one worked together to build a community of practice, enhancing networking, communication, and resource-sharing among among participants. The kick-off meeting, discussion boards within the courses, partner meetings and peer observations, webinar, Wiggio, and wrap-up meeting with presentations from the partners, all supported the development of trust, communication, and community in addition to increasing numeracy content knowledge, teaching skills, and resource-sharing.

Wiggio

- How has the Wiggio helped to promote or not promote networking and general communications regarding numeracy instruction?
- Has the Wiggio helped to promote or not promote sharing of numeracy resources?

The verdict on the Wiggio is mixed. It was useful for some participants, and less useful for others. Responses to "How useful did you find the MNI Wiggio to be? varied from "I

would need to say that I didn't use it much" to "I didn't use the Wiggio as much as I should have" to "It was a great way to connect with other participants, to get encouragement and feedback" and "Useful for posting info." Overall, the responses are fairly evenly split between participants who found the Wiggio useful or somewhat useful (10 responses) and participants who found the Wiggio either not useful or confusing/cumbersome to use (10 responses).

Participants liked the Wiggio as a repository and means to share information that won't disappear when the online courses end. Some also clearly preferred the original version of the Wiggio to the newer version: "The second version was unpleasantly difficult to use. I couldn't find things that I knew were there." Others commented that using the Wiggio felt like double work, and "It seems like just one more assignment in a program that had lots of things to do – meetings, report cards, assignments in the class."

The primary suggestions for how to use the Wiggio in the future is, if possible, to combine it with the online course discussion board so that participants need only to log in to one place, or to find a similar but better (more user-friendly) tool.

Partner Meetings and Mentoring

- How did the partner relationship and weekly meetings support or hinder teachers' participation in MNI?
- How did the partner relationship and weekly meetings support or hinder teachers' understanding of course content?
- What impact did the partner relationship and weekly meetings have on teaching?

Although challenging to schedule and maintain consistency around, the weekly partner meetings were a central MNI component and the vast majority of participants found them to be useful for: sharing ideas and resources, processing experiences (both good and challenging), providing/receiving support and encouragement, keeping participants accountable/on track in the online courses, maintaining connection to the initiative, clarifying expectations, exploring different perspectives and experiences, planning activities for students, clarifying concepts, evaluating what was being learned and tried, and planning and developing final presentations.

Participants remarked:

- Our conversations made what I was learning come alive even more than reading and writing online posts.
- Sometimes my partner would remind me of deadlines. Also, there were times when I did not understand an element of an assignment and my partner gave me clarification and examples. He was also ready with ideas for the classroom if I needed them.

- Support, encouragement, and discussion of application of new ideas to my teaching.
- The weekly online meetings were essential. By discussing the topics with a colleague, it helped me to expand on them, see different sides of them, and explore them. When I was skeptical on topics, we discussed them, and I was able to see other viewpoints, which really helped me.
- Again, it was a time to clarify or review concepts and figure out logistics with regard to implementing ideas with current students.
- I think this was a highlight for both me and my partner and I would highly recommend doing this again.
- The partner work made all the difference for me this year. I know that I would not have gotten near as much out of the course as I did, had I worked on it alone.

Suggestions for strengthening the partner meetings include providing somewhat more structure for the weekly discussions (for example, discussion questions related to each unit) and allowing more time for work on the final project/presentation.

Peer Observations

- Did participants get enough supports or training for the peer mentoring process to make it valuable?
- What did teachers learn from observing their partner and how did that impact their own numeracy instruction?
- What did teachers learn from being observed and how did that impact their numeracy instruction?

Most participants found the self-assessment tool (grid) to be helpful in preparing for the partner observations. This tool helped them to further connect to the material covered in the first online course, reflect on and evaluate their teaching, and focus and clarify their goals for the observation. While a few participants found some overlap in the grid categories or may not have understood a category, they also felt that the self-assessment helped both to guide and expand their thinking. One participant stated, “The self-assessment tool was helpful because it forced me to really evaluate not only what I teach, but how and also why I teach the way I do. It helped me to break out of my comfort zone, and start thinking outside the box. It made me realize that I have areas that I really am happy with the results, but also areas that I need to tweak and change.”

It is striking to read the pre-observation reflections. Participants are specific about their strengths and about the areas they’d like to explore more deeply, underscoring things they’ve learned and been thinking about since the first online course. For example, areas for further exploration included:

- More open problems. These are interesting, creative, and lend themselves to students' differing abilities.
- As I go through this numeracy class, I am exploring my own feeling about math and math anxiety.
- I want to work harder at getting interaction between the students...I would like to incorporate activities that would appeal to the students' sense of urgency and promote communication within the class. Getting them to teach each other more, demonstrate problem solving, etc.
- I'd like all the learners to be involved, trying to understand, working things out. I'd like to bring more real-life into the classroom, be more open-ended and use small groups.
- I need to find the time to make my lessons fit more of the "levels of knowledge of math." I think many do, but I need to sit down and really make sure.
- One area I would like to explore more deeply is building some kind of file of real-life math that happens in a variety of jobs.
- Areas for growth include: embedding math in real-life contexts, increasing learner awareness about what he/she knows, facilitating goal setting for what each learner does not know, and promoting alternative solutions.
- I would like to cover the concrete level more (as time allows), and I would like to have the six levels overlap more, be more continuous, and have a real sense of "flow" as we go through them.
- Encouraging Ss to pose more open-questions, posing more open-questions as the instructor as well.
- I would like to get the students to interact more with each other rather than with me.

In general participants felt prepared for the observations. One wished that s/he had planned more thoroughly, and some thought they would have benefitted from having a clearer format for the observation. One wished for some observation training. While some participants appreciated having different options, others wished for more structure and direction on what should be observed. Two people mentioned that they would like to see videos of teachers demonstrating some of the techniques presented in the first course.

The primary challenge around the observations was time – finding a workable date for planning, observing, and follow-up discussion. Other challenges related to nervousness about being observed, anticipating how many students would show up on the day of the observation, and fitting a lesson connected to the course into the timeframe for the observation.

The observations were valuable because they provided an opportunity for feedback and for more accurate assessment of teaching strengths and needs. As one participant remarked, "I was not seeing some of the things I was already doing in the classroom as evidence of an instructional practice...It was also done in a supportive way and I realized

that even someone with much more experience than me had his own challenges and weaknesses.” Other participants liked that the feedback was specific to one teaching practice that they had chosen, rather than a general evaluation, and also appreciated that the partners had a shared language from MNI. “I wanted to know if another teacher observed the same things I thought were happening in class. In other words, did what I think was going on actually happen as far as student involvement, participation, interest, questions, etc.?”

Both roles in the observation process were valued; several participants focused more on what they learned from observing another teacher than on what they learned from being observed. “I finally got to see a higher level math class...It was nice to see someone able to teach more of the levels of math in one night, rather than taking weeks to get through all the levels with one math point.” “It was interesting to see another site, teacher in action, level of learners. Sometimes we get so used to what we do, we’re blind to different strategies (not necessarily un-open to them).”

Teachers liked being observed by other teachers. For example, one participant said, “It really helped to get impartial feedback from another teacher, not an administrator. Since we had gone through the class together, it was nice to have a partner looking for the things we’d learned about.” And teachers learned about their students through the process. “She was very specific, and I learned a lot about the student’s responses in the classroom.” “Yes, she confirmed things I suspected that I need to improve and things that I was doing well.” “Having someone watch how my students were responding and catching or not.” “I appreciated another set of eyes. She could see the problem from a different lens. She also could see my students from a different perspective and offer other ways she would present the problem.”

Participant reflections throughout speak to the strong sense of community, collaboration, and networking:

- I am in awe of all the creative, supportive, make-it-work, fine teachers and admin team in our group.
- The greatest thing I’ve gained from this class is the camaraderie with my classmates.
- ... now I have a roadmap of sorts and the support from my MNI friends, if I get lost along the way.
- First of all it was great to start out meeting everyone in class knowing that we will continually connect and support each other for years to come.
- I enjoy learning with other math teachers. Relation is a powerful learning tool.
- I have appreciated my colleagues and their openness and feel that I have learned as much from them as I have from the reading and our assignments and journals.
- I have enjoyed working with this group and the give and take of ideas and resources. This will last well after we are finished.
- I agree! I learned so much from everyone’s postings. What a good group!

- I love to learn in community, ...

When reflecting on the final meeting, participants state:

- The best part of the final meeting was getting together with everyone.
- It was great! I felt the strength of our cohort in the large-group discussions...partner presentations were the highlight. The environment of support and enthusiasm was ideal for listening to everyone’s ideas!
- I loved to see how everyone took the ideas presented in the course and made them their own. I came away with so many good ideas, several of which I have already tried in my classroom!

As one participant summarized her MNI experience after the Summer Institute, “One thing that surprised me about MNI was the level of camaraderie I feel with the cohort. I think I chatted about math with every MNI participant that was at SI. People wanted to talk about links posted on the Wiggio, things they'd tried in their classrooms, and asked about what was going on in my classroom. It was really neat! I have never felt like I had such a meaningful connection with other participants from a PD event before!”

Math PD Capacity

Do participants feel more confident about providing numeracy PD to peers?
Did participants provide PD at local and/or statewide venues?

Participants were asked in the final survey about what contexts, beyond the presentations at the final meeting, they had presented on an MNI or numeracy topic.

Type of Presentation	Percent
Not presented or delivered numeracy PD	61.9%
Regional presentation	23%
Program or consortium presentation	14.3%
Statewide conference presentation	4.8%
Presentation at another venue	9.5%

N = 21

The majority (61.9%) state that they have not presented or delivered numeracy PD. 23%, however, have presented at regional events, 14.3% at program or consortium events, 4.8% at a statewide conference, and 9.5% in some other venue (staff meetings, working with peers). Over time, these percentages should increase as many participants responded that they were more willing to present or deliver numeracy PD. Some say, not sure, not yet, maybe, and not at this point, but these responses may also indicate

some willingness to consider presenting in the future. As one teacher said, “Maybe. I am a bit shy about it and would like to first see summer institute and how much work these presenters put into their presentations.” And as another said, “Not at this point. I need more time to feel comfortable in my presentation abilities.”

By the fall 2011, 13 out of 20 respondents to a pre-survey to the returning cohort for year two of MNI, had presented on numeracy issues at the Summer Institute, a regional event, or in their local programs since the April, 2011 institute.

Online Professional Development

- Do teachers feel more comfortable and confident about participating in online courses? In webinars? In an online networking tool (ECoP)?
- Are teachers more likely to take an online course as a result of participation in MNI? Participate in a webinar? In an ECoP?

Teachers finished the first year of MNI with greater comfort and confidence about participating in online courses and webinars and using networking tools. When asked how likely they are to take online professional development courses in the future, most participants say very likely or willing to do so again, although some comment that participating in an online course takes more time than you think. Of 21 responses, only one participant states “...probably not. The course did not let me move at my own pace and [I] felt either rushed or stymied by the pace.” Even this participant is not objecting to online courses as a form of professional development, but rather seems to be saying that s/he would prefer a self-paced course or tutorial.

Participants are more divided on the value of the webinar. While some say that they would be likely to try a webinar again, and found the webinar to be fun and efficient, others did not find the webinar to be as useful as other aspects of MNI stating: “I did not find our webinar very useful.” “I don’t favor webinars. I find the presence of a screen with no one watching me to be distracting.” “I don’t feel that webinars are an effective form of PD. I would prefer not to participate in one, but would if there were no other options.”

As for the Wiggio, participants are split between loving it, seeing this and similar but better tools as having potential, and not seeing themselves networking this way.

Organizational Supports and Structures

- How did local organizational supports help or hinder participation in MNI activities?
- How did local organizational support help or hinder the implementation of new instructional strategies?

From the participant point of view, most administrators supported their participation by excusing them from work responsibilities, arranging for subs, and/or allowing them to

have a small math group for a time. In a few cases, the administrator went beyond these supports to provide needed materials, create the opportunity for a managed enrollment class, and offer encouragement and interest. Participants did not necessarily expect substantial support from their administrators, recognizing that administrators have a lot on their plates. One participant stated that her supervisor was more supportive than she had ever hoped for.

In their responses to the administrator survey conducted at the end of year one of MNI, program managers point to many benefits of MNI including reenergizing and refocusing their teachers, increasing participant teaching strategies, providing opportunities to connect with other teachers, supporting the development of consistent program-wide and consortium math curriculum, identifying teachers with a strong interest in math, supporting teacher growth and collaboration, and increasing teacher comfort with teaching math. It also seems likely that the survey itself encouraged program administrators to discuss MNI with their participating teachers, perhaps leading to increased administrator understanding and support in the future. When asked if they will encourage other teachers to participate, all but one of 16 respondents said yes.

State PD Staff, Course Facilitators

- How did state PD provider supports help or hinder teachers' participation in MNI activities?
- How did state PD provider support help or hinder the implementation of new instructional strategies?
- How did online course facilitator supports help or hinder teachers' understanding of course content?
- How did online course facilitator support help or hinder the implementation of new instructional strategies?

The support from state PD staff was excellent. Astrid, Kim, and Marisa were open, available for help, well organized, responsive, understanding, and enthusiastic. As one participant notes: "They would move obstacles of all shapes and sizes for us if necessary." Participants appreciated the support on partner presentations, encouragement to participate in regionals, and provision of excellent tools and resources. "They want to help you be successful and are available to make that happen." "MDE and ATLAS were outstanding."

For the most part, participants felt very supported by the online course facilitators, commenting:

- Responses were thoughtful and encouraging; final meeting activities and presentation by the course facilitator (MB) were helpful and fun.
- MB was amazingly on top of the course, our responses and assignments. She asked great questions and was very encouraging.

- The course facilitator was very present, timely with her comments and even offered resources to fill in the gaps when we didn't fully understand something.
- I always felt the online course facilitator was truly reading and thinking about postings, assignments, and exams. Very good instructor.
- The feedback was great and always appreciated. I couldn't believe how much of it that there was.
- They always got back to me when I needed help and provided feedback, comments, and suggestions.
- This is the most responsive group I have ever worked with in an online course environment.

One participant felt less connected to the first course facilitator perhaps because s/he had met her at the kick-off meeting. And one participant felt that the feeling of community fell apart towards the end of a course. It's not clear if this comment pertains to the first or second online course. One other participant didn't remember getting much feedback on the lessons s/he submitted. It's also not clear which of the two courses is referenced. In commenting on the first online course, one participant wanted more emails and discussion within the threads from the facilitator, and another wished that the facilitator had more time to give specific feedback.

Teacher Perceptions of Learner Impact

After only one year of MNI, the initiative has not looked at learner data to examine/determine the impacts of MNI on learner attendance, retention, and educational gains. The participating teachers, however, definitely observed learner impacts as they implemented MNI approaches and activities in their classrooms.

Dialogue within both online courses reflects teacher perceptions of these impacts as they implemented MNI-inspired activities in their classrooms. For example:

- Once they got the hang of it, they found it interesting and then started making fractions from the pack after I let them open one and chew some. One student said, "I have just chewed $\frac{1}{5}$ of the pack." That was kind of fun to see as this student struggled with the concept of fractions a month ago.
- One student said he understood better how division and subtraction were related, he had never connected them before.
- I said to one student, "Usually you are the one trying to solve the word problem but in this activity you are in charge of creating the problems." I was impressed that my students worked well in pairs, and came up with really creative word problems. One group used examples from a zoo ... I was surprised how elaborate the example got and they were all appropriate for the specific operations.
- It was so fun to see their feeling of accomplishment when they finished their set of problems and how eagerly they worked on the other problems. ... using the

objects, and discussing it with their partners, it seemed to really help them to see and reason it out.

- The students are getting much better, as we've practiced this once again with our Banking Unit dictation. They are also improving on asking higher level thinking questions (involving using operations and numbers not present in the sentences) instead of blatant questions that can be answered via skimming/scanning.
- I think your activity proves that people can learn complex math concepts no matter what "level" they are at! If you were to suggest that you wanted to teach exponential relationships to students who had never gone beyond adding and subtracting, most people would have said you are crazy!
- By the end of the week the learners were having fun and feeling challenged, and deciding they might be up to these challenges. There wasn't any math they couldn't do.
- [Name] and I were amazed how confident my student became while working with this game. One thing that helped was putting them into pairs – that really helped them to try out new strategies. They began to use higher level thinking plus logic.... Afterward I asked for a show of hands if this game helped anyone become more comfortable with numbers and strategies and almost every hand went up!
- I asked my adult diploma/college prep algebra class to read and discuss the Habits of Mind handout. It is a really good fit for that class since I focus on learning how to learn as much as algebra. I asked the questions: "Which of these has developed over the past few months? What are some ways that these have developed? Which would you like to improve?" Many students felt that they had developed persistence or curiosity. A few were able to describe how they wanted to improve ownership.
- Then they explained how to answer the questions. Some of the students became very enthused about how they determined what and how they chose to ship packages. They really seemed to take ownership of the problem and its solution.
- I asked her if she knew that for many math problems that there were lots of ways that would work, though some would be faster. She answered that before she came into my class, she did not know that. She just thought there was one way and she could rarely figure out that one way. She was quite excited that there were lots of ways!

In the wrap-up meeting, participants were asked to write down examples of learner success stories that connected to MNI. Examples include:

- After doing a lesson on percentages with another student, I heard the coveted words we love to hear, "Hey, I got it!" This came after verbal complaints of, "I don't know how to do percentages," "I hate this," "I will never understand this!"

This came with using 'real life' group work and using something they already know.

- Chelsea had seen her mother do puzzles like Sudoku and Kakuro but had no confidence in her abilities to solve them. With encouragement and help she completed a difficult puzzle. With her new confidence, she has passed her math GED test.
- The subtraction problem (in the first session) we were to put on the board and allowed students to show multiple methods of solving. When my students allowed time to see another perspective, many of my students connected with alternative ways to solve something they had difficulty with before.
- It has been exciting to see the change in anxious math students after incorporating some of the ideas I learned in MNI. As we do classroom activities, utilizing the levels of knowing mathematics, I can see students grow into confident, curious and active learners.
- I have a student who now tells the volunteers about the math problems we do daily. A practice I picked up at MNI. She used to be terrified even to write the numbers on her paper. Now working with numbers excites her as much as working with words.
- "I'm so happy I got my GED," said one ex-student after working on it for the last six years. All I did was give him an opportunity to be himself and help him to take ownership of his learning.
- I taught a culinary arts math class in the fall. The goal was for the students to improve their Accuplacer score. This did happen for those who completed the class. However, the big success was that students really got it! Many told me they still apply the procedures I taught them as they work in the kitchen. I think they appreciated the fact that I could break down concepts so they would be easier to understand, plus pair and group activities. Finally, discussing anxiety about math helped students relax too!
- After doing a fraction lesson (using edible fractions) plus lots of other activities, a student who was quite afraid of fractions/math was overheard saying, "Hey, math is fun!" I was thrilled!

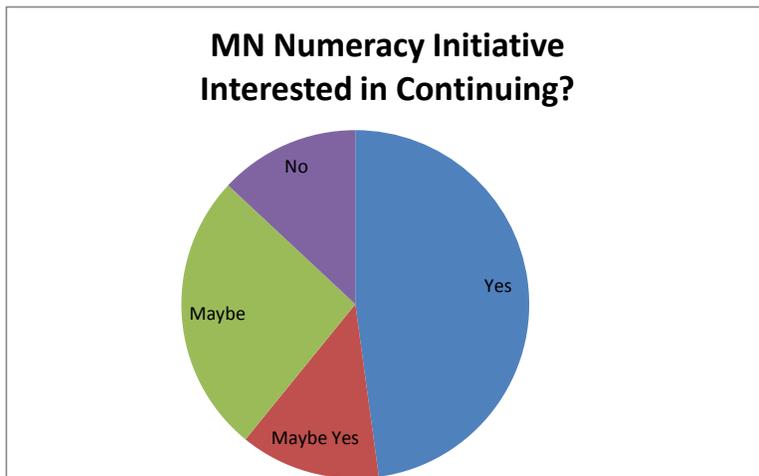
In response to "How do you believe your students have been impacted by your experience as an MNI teacher?" on the final survey, participants responded:

- My math teaching is a work in progress but I believe that the small changes I have made in my teaching, for example, more small group work and real-world problems, have had a positive impact in the classroom. There is more of a dialogue in the classroom and an openness to alternate ways to solving a problem.
- They are more engaged, don't dread it like they used to, their confidence has grown as I have become more confident and that speaks volumes for this training.

- They just spent 3.5 hours working on math and loved it. Before it was pulling teeth to do one problem.
- They feel empowered by it, especially the ESL learners.
- With the classes I taught, most of the students were very appreciative of what we did. They said they finally understood the math we were doing and they were able to gain levels on their TABE tests. That was real rewarding for them and for me to see. These students were not as afraid of trying more math lessons.

Participant Willingness to Continue

At the April wrap-up meeting, MNI teachers were asked if they wanted to continue with MNI for year two. Of 23 participants who responded re their interest in continuing, 11 said “yes”; three said “maybe-yes”; six said “maybe”; and three said “no”.



Conclusion

Mathematics instruction is arguably the weakest area in adult education in the U.S. Based on large national surveys, more U.S. adults lack adequate math/numeracy skills than lack adequate literacy skills. Performance on the GED Mathematics Test, COMPASS, and ACCUPLACER also shows that many students have weak numeracy skills. Teachers’ subject matter knowledge is important in adult learners’ numeracy progress, but the adult education system “assumes” that all adult education teachers can teach math instead of seeking teachers with strong math qualifications or, for the most part,

encouraging and supporting teachers to develop these skills through high quality professional development.⁷

The Minnesota Department of Education, in partnership with ATLAS at Hamline University, decided to systematically address this area of weakness through an extended, multi-year, comprehensive numeracy initiative.

Year one of the Minnesota Numeracy Initiative was a rich and fulfilling professional development endeavor. Twenty-four Minnesota math teachers, with varying levels of experience, credentials, and math content knowledge, representing adult basic education, English as a second language, adult secondary education, and transitions classes started and 23 finished, armed with stronger math content knowledge and an understanding of what is meant by “numeracy”, more diverse and pedagogically-sound instructional strategies and approaches, greater comfort and confidence in teaching numeracy skills, and stronger relationships with their peers.

⁷ Ginsburg, L. (2011). Adult Numeracy Demand & Provision. *Adult Numeracy: A Reader. Four Papers from CAAL's January 2011 Roundtable on Adult Numeracy*. Council for Advancement of Adult Literacy. New York, NY.