1. Questions(s) or issue(s) for dialogue at Learning Network Conference session:

Are working interactions between STEM Post-docs and current high school mathematics teachers a valuable learning experience for both?

Can a teaching focused post-doctoral position be a true professional development experience for a researcher interested in an academic career?

What can a high school teacher bring back to his or her students after spending a year teaching and working in a university mathematics program?

2. Context of the work within the STEM education literature and within your MSP project:

The overarching principle of the Arizona Teachers Institute (ATI) project is the building of vertically integrated communities of mathematics educators: Middle school teachers learning from and learning with high school teachers; high school teachers learning from and learning with mathematics post doctoral fellows; high school teachers and post docs learning from and learning with mathematics faculty. This talk will concentrate on the transforming aspects of the postdoctoral and high school teacher program, and particularly the interactions between the participants in these different programs. Two ATI post-docs and at least one high school teacher participant will talk about their experiences in the program.

A 1995 National Science Foundation workshop emphasizes the broadening the content of graduate programs. The report of this workshop http://www.nsf.gov/pubs/stis1996/nsf9630/nsf9630.txt included the finding: “The skills and knowledge acquired by new Ph.D.’s are too narrowly focused, and are not adequately applicable to the diverse business and industry environments in which most Ph.D. scientists actually work.” It also included the recommendation, “There should be a move to broaden the intellectual content and increase the diversity of skills acquired during Ph.D. training.” One objective of the postdoctoral part of the ATI project is to follow this recommendation by expanding the finding to include providing new PhD’s with experience in in-service teacher training. Well trained graduates from top research programs often have no familiarity with the issues of precollege mathematics teaching. However, many of these aspire to careers in departments responsible for pre-service and in-service teacher training. New PhD’s have the mathematical skills that school teachers need, but they may not have any experience with things like state and national standards, school and district curriculum requirements, or standardized assessment testing and the impact this has on the classroom.
The main hypothesis behind our project is that this experience can be gained by arranging opportunities for new PhD’s to work as equal colleagues with experienced high school teachers. Vertical integration has been a major discussion point in STEM education for a number of years. In 1997 an NSF Division of Mathematical Sciences Special Emphasis Panel made recommendations that eventually led to the establishment of the Vertical Integration of Research and Education program. Evaluations and reports on this VIGRE program: (E.g. The Report of the AMS, ASA, MAA and SIAM Workshop on Vertical Integration of Research Education in the Mathematical Sciences (Reston, VA) AMS, Providence, RI, 2002; http://www.ams.org/amsmtgs/VIGRE-report.pdf and Evaluation of NSF’s Program of Grants and Vertical Integration of Research and Education in the Mathematical Sciences (VIGRE) NRC 2009 Washington DC The National Academies Press) cite many examples where students and faculty interactions were created in grants under this program. However, there were fewer examples where educators of various levels of mathematics worked together on educational projects.

The ATI project is structured to provide a continuous model of cooperation among mathematics educators from middle school through university faculty. There are three major components of ATI. The first and largest project is the development of a master’s degree program for in-service middle school teachers. The second is a program where a high school mathematics teacher spends a year as a visitor in the Mathematics department. In that year, they teach entry level undergraduate courses, attend undergraduate courses, and assist in the teaching of some of the middle school master’s degree math courses. The third component is the main topic of this talk. The post-doctoral program is designed so that new mathematics PhD’s work directly with high school teachers and middle school teachers as instructors, colleagues, and cooperative learners. We see this as an opportunity for the next generation of college and university faculty to gain experience in the issues of educational training of K-12 teachers. Teaching post-doctoral positions are increasing in popularity but not without some controversy. (Meghan Guinnee, Postdoctoral Teaching: Savvy Career Move or Distraction From Research?, Science Career Magazine, May 12, 2006.)

At the same time the visiting high school teachers also benefit from the interaction. Sabbatical and professional development leaves are not common for high school teachers, but the idea has been around for a long while: William R. Hazard, The In-Service Sabbatical, The Phi Delta Kappan, Vol. 49, No. 10 (Jun., 1968), pp. 598-599, Phi Delta Kappa International, http://www.jstor.org/stable/20372187. The ATI educators are given three responsibilities both semesters of their one year visit. They teach one entry level mathematics course, typically Algebra. They teach or assist in an ATI course or activity, and the audit one undergraduate course, but work one on one with an ATI post-doc on the mathematical content and teaching strategy used in the class. Each of these activities is monitored by an ATI faculty member to assure that it is a valid professional development opportunity. The entry level program at Arizona is highly structured and carefully monitored. Instructors come from all faculty levels from the department, although most are instructors or graduate students. New teachers are mentored and supervised as a normal practice. The entry level courses have long set standards for homework, grades, and other student expectations and these are frequently discussed throughout the semester. High school teachers see firsthand what the university will expect of the students that they normally prepare for college math. The high school teachers also co-teach
ATI Mathematics courses with university faculty or post-docs. They provide the perspective of a
school teacher provided the important role of placing the abstract mathematics of the course into
the actual middle school curriculum. At the same time, the high school teachers gain their own
appreciation of the classroom issues unique to the middle school classroom in the planned
discussions of pedagogy integrated into the content courses. Finally the most experimental part
of the visitor program is the weekly meeting with a post-doc to discuss their observations in an
undergraduate course. Visiting high school teachers often want the opportunity to refresh their
skills in a subject like calculus or statistics or to take an advanced course like linear algebra or
analysis. Rather than enroll in an undergraduate course, the teacher enrolls in an independent
studies graduate course taught by an ATI Post-doc. The teacher and post-doc meet weekly to
discuss the mathematical content of the course, the instructor’s methods, and the students’
reactions.

In this presentation, there will be a quick overview of the full program, but the main focus will
be on the experiences of the post-docs and the high school teachers.

3. Claim(s) or hypothesis(es) examined in the work (anticipating that veteran projects will
have claims, newer projects will have hypotheses):

Hypothesis: STEM post doctoral students can learn as much about K-12 education from
experienced high school teachers as the teachers can learn about mathematics from the post-docs.

Hypothesis: Cross working interactions between educators at different levels of training and
experience and with different incoming interests are positive learning experiences for all
involved.

4. Evaluation and/or research design, data collection and analysis:

Pending

5. Key insights (retrospective for veteran projects, prospective for newer projects) that
have value for the Learning Network:

Many, if not most, university and college mathematics departments have primary responsibility
for presenting the required mathematical content need by pre-service K-12 educators. Further,
the continued mathematics education of in-service teachers often takes place in mathematics
departments. Most mathematics graduate students have little or no opportunity to gain guided
experience working with school teachers. Arranging work projects for teams of post-docs and
experienced school teachers is a powerful learning experience for both, and the products of such
collaborations are definitely high quality.