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

- What are the attributes of a highly effective K-12 Teacher Leader?
- What are the parameters of a Teacher Leader’s work?
- What are necessary learnings for a highly effective Teacher Leader?
- What can a Teacher Leader do to effectively change the school learning environment?
- What are the necessary sustaining factors for the Teacher Leader to continue into the future?

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

In the Southwestern Pennsylvania Math Science Partnership, numerous professional development opportunities in mathematics and science are provided to enhance a teacher’s content and pedagogical content knowledge. This abstract will concentrate on mathematics. Opportunities are delivered by Math and Science Coordinators and partnering STEM faculty who are trained by the developers of nationally-recognized, research-based materials. Opportunities include:

- Two-year Elementary Math Teacher Leader Academies equip teachers, in 8 days each year, to facilitate 25 hours of professional development in their buildings using Developing Mathematical Ideas (Education Development Center), Mathematics Task Framework (Smith, University of Pittsburgh), Thinking through a Lesson Protocol (Smith, University of Pittsburgh), and Curriculum Topic Study (Keeley and Rose).
- Two-year Secondary Math Teacher Leader Academies equip teachers, in 8 days each year, to facilitate 25 hours of professional development in their buildings using VideoCases for Mathematics Professional Development (WestEd), Mathematics Task Framework, Thinking through a Lesson Protocol, and Curriculum Topic Study.
- Seven-day Lesson Study (based on Catherine Lewis’s work) Academies enables Teacher Leaders in this third academy to serve as a resource for conducting lesson study in their districts.
- The Learning Laboratory Academy (inspired by Deborah Ball) follows with a three-day experience in the summer providing K-12 teachers and administrators a concentrated experience to better recognize and investigate students’ thinking and learning during math and science lessons that are being taught.
- Quarterly Academies are designed to further investigate previous learning in more depth.
- Teacher Fellow opportunities are provided in which the participant works at a partnering institute of higher education. They participate in courses to enhance their math content
knowledge and work with a mathematics professor to redesign a math course to adhere to State standards in content and delivery.

- Additionally, *Lenses on Learning* (Education Development Center) is a 38 hour seminar series conducted over a year to better prepare administrators to understand math pedagogical content knowledge, to observe for student learning, and to conference based upon the learning observed.

Several of the MSP Teacher Leaders have been through the teacher academy series and have conducted onsite professional development to different degrees. One of the MSP highly effective Teacher Leaders will be highlighted in this document to provide a concrete example of what qualities such an individual must possess. Tamar McPherson, a high school mathematics teacher in a partnering k-12 district, will serve as that model. This Teacher Leader, since she also serves as the K-12 Math Department Chair for the district, felt a strong need to participate in academies at all levels, Elementary Math, Secondary Math, Lesson Study, and Learning Lab. Furthermore, she participated in *Lenses on Learning* with her district administrators. Additionally, she served as a Teacher Fellow. Documentation verifies that her learning does not stop there. Making change in her daily lessons to affect the math learning of all students enables her to learn from recognizing and analyzing the student thinking in her classes. She also worked to push the building administration to block daily time for the high school’s math department to meet in order that she could facilitate the academy learning with her colleagues, maintaining credibility because she “walks the talk” in her classroom and shows effective results by sharing student work and student reflections. Students, as a result of the teacher understanding the math content and using appropriate pedagogical practices, recognize what they know and do not know and, even more importantly why it is useful to know particular content. As one student in a pre-calculus class wrote in a reflection, “This class has greatly helped with my understanding of mathematics. I don’t just mean memorizing new formulas by rote, I mean seeing beyond the numbers and formulas and realizing their many applications. This class has also helped with my ability to make connections between seemingly distinct incompatible concepts. Once all of the mathematical clutter is removed, you start to realize that all the great ideas in math are very intuitive. Once you really understand the concepts, you start to see how practical math can really be.” This is coming from a student, who unfortunately is in a system where math grouping in ingrained, has been assigned to low or average math sections in his schooling. To get to this point with students, the teacher must recognize and understand how students learn math, knowing that that is different for different students; as a result, the teacher must have a deep understanding of the content. Furthermore, on a daily basis, the teacher must challenge students to answer the “hows” and “whys” behind even the simplest problems and share that learning with others. This is the type of learning that is shared with colleagues and extended to help them understand how to get at such learning from all students. Tamar not only understands the content of the SWPA MSP academies, she effectively applies that content in her math classes and then works to help colleagues understand the content and pedagogy to better address the thinking and learning of the wider student community.

Heath and Heath emphasize the value of telling the story. *Hearing the story acts as a kind of mental flight simulator, preparing us to respond effectively.* Thus, the purpose of this abstract is to relate more concretely the role of a highly effective Teacher Leader by using the example of one although there are many in the 905 Teacher Leader group that the SWPA MSP has trained.
3. Claim(s) or hypothesis(es) examined in the work (anticipating that veteran projects will have claims, newer projects will have hypotheses):

The SWPA MSP, which is currently operating in its seventh year, project recognizes through data collected from a large number of Teacher Leaders the following lessons learned:

- Teacher Leaders gain credibility based on their teaching experience and expertise as well as content knowledge.
- Good professional development has a co-focus of pedagogy and content knowledge.
- Teachers have learned and used a variety of inquiry and reform-based strategies to increase potential for student engagement and deeper conceptual understanding.
- Teacher Leaders have grown in their ability to make use of professional learning communities in their schools through various strategies such as lesson study, monthly professional development activities, engaging administration support, curriculum alignment and use of performance assessments.
- Teacher Leaders exhibited very strong evidence of effective practice in lesson implementation, including identification of prior student knowledge and common misunderstandings, the teacher as a facilitator, student engagement, teacher’s use of questions and the communication of “big ideas” for math and science.
- Teacher Leaders come to accept that all students can learn math and science, regardless of prior expectation (by student or the teacher).

Teacher Leaders are at different places in their learning, just as their students are in their classrooms. The highly effective Teacher Leaders, as exampled by the previously cited “story of one,” actively exhibit all the above characteristics.

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

The SWPA MSP Evaluation Team verifies the aforementioned lessons learned through analyzing a variety of documentation:

- K-12 Case Studies
- Focus Group Interviews
- Teacher Surveys
- Lesson Study Observations and Interviews that are conducted after the completed process
- Event Documentation which consists of reflections on learnings that teachers completed at the close of each day of every academies
- Analysis of Learning Lab Journals that participants complete on a daily basis
- Learning Lab Focus Groups
- Analysis of Student Work

This data has been collected and analyzed yearly representing various groups of same academy events. Since the beginning of the partnership, over 900 teachers have attended the content-related Teacher Leader Academies.
5. Key insights (retrospective for veteran projects, prospective for newer projects) that have value for the Learning Network:

As stated earlier, SWPA MSP has several strong Teacher Leader examples in addition to the cited “story of one”. Educators often question the research and display disbelief as to what has been proven to be effective. Sharing the stories that have been created as a result of the SWPA academies, helps them to recognize that what is being developed in the sessions is happening effectively in this region with students from this area, not some far off place.

What are the characteristics of a highly effective Teacher Leader? To better guarantee that the Teacher Leader continues to grow into the future, two qualities are essential:

- The Teacher Leader must recognize and, more importantly understand, that all students can learn, in this case math.
- The Teacher Leader must be committed to ongoing learning, learning from research, from colleagues, and from students. Furthermore, the leader must be confident in and willing to share that learning with others.

Can anyone be an effective Teacher Leader? It’s possible, but not necessarily probable. Our highly effective Teacher Leaders accept responsibility; never do they say, “I can’t do that because the district doesn’t provide the time (or resources).” No fault is ever assigned. They take, as in Tamar’s case, the initiative and make things happen, thereby enhancing the learning of all students. Road blocks require creative solutions; an example of this would relate to Tamar’s story:

- This year she is working with a new building administrative staff. Buy-in is weak, so she is bringing them into her classroom and assigning each one a student to observe for evidence of learning in more than one lesson (following Learning Lab format). Thereby, she can then discuss that learning and what effectively contributed to it.

To institute such an approach, the Teacher Leader must be willing to take a risk. The Teacher Leader must have the confidence that what he/she has learned, both in content and delivery, will have an impact on student learning. The highly effective Teacher Leader must also command the respect of colleagues; they must know how to listen and how to make people listen to them. Again, they must “walk the talk.” These are the leaders that will help to sustain the effective changes in the schools and classrooms. In the fourth year of the partnership, SWPA MSP discovered, as a result of a RAND survey, a 50% turnover in building administrators in partnering districts. Furthermore, by the end of fifth year, 70% of the partnering district superintendents had changed. There is a better guarantee that the teachers are the constant.

Can the necessary traits for effective teacher leadership be learned? Yes, but some, because of their own character traits, could find the change overwhelming. For most educators, it is enough to make the necessary changes in their classrooms to enhance the thinking and learning of all students. ALL teachers can do that!