Learning from the Field
Preparing STEM Faculty to Work with K-12 Teachers

Directions: The following insights on preparing STEM faculty to work with K-12 teachers were provided by experienced practitioners. Individually, review these insights and the accompanying text. Select two insights to discuss as a team using the discussion questions that follow.

1. Create a shared vision of effective teaching and learning.

Experienced project leaders stress the importance of building a shared vision of effective teaching and learning among all members of the professional development team, including STEM faculty. Although it is easy to agree in the abstract that everyone wants improved teaching and learning for all students, there will likely be different visions about what constitutes quality mathematics and science education. Intentionally working to build a common understanding of the program vision creates the groundwork for consistency in the design and implementation of program activities. Although the press of project activities can make it difficult to find the time to reconcile differences and create a shared vision, moving ahead without doing so can lead to problems downstream.

MSPs used a variety of strategies for building a vision of effective teaching and learning that helped ensure that people had a common understanding of the language being used to describe instruction. (Terms like "inquiry-based instruction," for example, are interpreted very differently by different people.) Some projects engaged STEM faculty in viewing videos of science lessons; others involved STEM faculty in experiences as learners that modeled the desired type of instruction, and then used those experiences in talking about their vision.

2. Create a shared "theory of action" for the work.

Once project team members, including STEM faculty, have at least a good start on a shared vision of effective teaching and learning, they can begin to work toward a shared understanding of how the project will go about attaining its goals. (One of the benefits of applying for funding is that it provides an opportunity to develop a shared theory of action among the core team; the proposal development process typically includes consideration of different goals and alternative strategies for addressing those goals.)

MSPs used different approaches to ensure that all of the key players were on the same page, understanding not only how individual project activities were expected to contribute to the development of teacher knowledge, but also how they were intended to work in concert. Often, the people who designed the initiative convened meetings of participating STEM faculty and other key players to discuss project plans. It may take a great deal of time and effort, but project leaders report that the work involved in coming to agreement on strategies for attaining the project vision is well worth the effort.

3. Ground STEM faculty in the world of K-12 education.

Projects that involve STEM faculty are more likely to be effective in helping teachers if participating faculty understand the realities of K-12 education. Especially if they have not had experience with the K-12 sector since they themselves were in school, STEM faculty may not realize that teachers are responsible for many hours of instruction each week, typically under less than optimal working conditions. For example, most elementary teachers provide instruction not only in mathematics and science, but also in reading, writing, social studies, etc. Similarly, a middle grades science teacher may be responsible for topics in the life, earth, and physical sciences, and at any given time, a high school mathematics teacher might have classes in algebra, geometry, and calculus.

Project leaders noted that STEM faculty members were sometimes surprised by the content deficits they encountered when they started working with K-12 teachers. Enabling STEM faculty to anticipate where teachers are starting avoids having them blindsided by the gaps they encounter, and may help them focus on the glass being half full in terms of teachers' content knowledge.

MSP leaders suggested a variety of strategies to help STEM faculty understand the world of K-12 teaching in the partner districts, including orienting them to unfamiliar contexts, such as schools serving American Indian students or large numbers of English Language Learners. Having STEM faculty observe K-12 teaching was viewed as particularly important, including observations of both "typical" teachers and master teachers to get a sense of how the vision of quality mathematics and science instruction plays out in the classroom. At the same time, MSP leaders cautioned that simply exposing STEM faculty to K-12 education is not sufficient; projects also need to provide time and structure for STEM faculty to consider what they are learning about K-12 education and the implications for professional development. In particular, MSP leaders noted that it is important to be explicit with STEM faculty about "how content useful for teachers is similar to and different from the content they might include in their other graduate courses."

4. Design professional development for STEM faculty based both on where you are heading and on where you are starting.

STEM faculty may have any of a number of different roles in K-12 initiatives. For example, STEM faculty may be called upon to design courses for teachers/teacher leaders, facilitate investigations and discussions, provide explanations, and/or develop instruments to assess teacher content knowledge. Clearly different tasks require different kinds of knowledge and skills, and individual STEM faculty will bring different prior experiences to a given task. The support provided to STEM faculty needs to be based both on what they will need to do and what they already know how to do. Although MSP project leaders could anticipate some of the preparation needs of the STEM faculty, they recognized that they did not always know what support faculty would find helpful. They recommended querying STEM faculty directly, and then providing the requested assistance.

STEM faculty who have had extensive prior experience in working with K–12 teachers may be able to move easily into roles as professional development providers. Those with less experience will likely need opportunities to develop, practice, and hone their skills. A number of MSP leaders described the extensive professional development they provided for STEM faculty, consistent with a gradual expansion of their roles over time.

For example, one project first had STEM faculty "engage as learners, attending sessions as participants before co-facilitating sessions." Physicists would investigate biology concepts along with the participating teachers, and biologists would explore earth science ideas, etc., getting a sense of the courses from the learner's perspective. Others described how they modeled, and later talked about, the kinds of instructional strategies STEM faculty would be expected to use in their work with K–12 teachers, noting that "modeling inquiry-based pedagogy and small group discussions helps scientists experience the value of active learning."

MSP leaders also recommended embedding opportunities for reflection throughout the project. One strategy included setting aside time to debrief after professional development activities, considering what had worked well, and what needed to be improved for future workshops and courses.

5. It helps to involve people from different backgrounds in "real work" where collaboration is essential.

Even when higher education and school district partners join forces with a shared mission and the best of intentions, culture clashes are likely. STEM faculty and K-12 teachers have had different training, work under different conditions, and are judged by different standards. Under these circumstances, miscommunication and misunderstandings are to be expected. On the one hand, teachers (and education faculty) may feel like they are treated as lower on the totem pole, with the knowledge they bring to the table undervalued compared to the disciplinary content expertise that STEM faculty bring. On the other hand, STEM faculty may feel they are being stereotyped as poor teachers or somehow lacking in social skills. The best approach, MSP leaders counsel, is to establish "a collaborative and mutually respectful relationship among those groups, recognizing that each brings vital information and insights, was essential to the functioning of the project."

MSP leaders recommended involving people from different backgrounds in "real work," drawing on the collective expertise of the group, highlighting the fact that no one had all of the necessary knowledge, but that everyone had something to contribute to solving the problems that had been identified.

Project leaders stressed that establishing a culture that values the contributions of each member of the team does not happen by accident. They emphasized the need to provide both formal and informal opportunities for STEM faculty to engage with K-12 educators.

Still, MSP leaders caution that while collaboration is essential, it isn't easy. Projects will need strategies to defuse the tensions that will inevitably continue to surface. Said one MSP leader "We have a saying 'Isn't collaboration fun?' which we use when things get touchy."

These insights come from a number of knowledge reviews about involving STEM disciplinary faculty in deepening teacher/teacher leader content knowledge, prepared by the KMD project. See http://www.mspkmd.net/blasts/stem.php