

**Best Practices in Professional Development: Lessons Learned**  
**Jack Rhoton**  
**ETSU Northeast Tennessee STEM Innovation Hub**

ETSU, through its Center of Excellence for Mathematics and Science Education and, more recently, through the ETSU Northeast Tennessee STEM Innovation Hub, has provided professional development for hundreds of math and science teachers, at all levels. Our professional development has focused on improving instructional strategies/practices with the ultimately goal of improving student achievement. Based on our work, we have identified several best practices in our professional development for math and science teachers. Our findings are consistent with several recent studies that have documented the importance of professional development on teaching practices and student learning. The ETSU model of professional development has been published in various journal articles and books. Although there is a large body of research that has examined the effectiveness of professional development, the evidence is often uneven given the differences in resources, system level and school leadership, and teacher knowledge gaps. These factors can be complicated when teachers return to the classroom without the necessary support structure to practice and reflect upon the innovation. Also, district policy changes and budgetary constraints can influence researchers who need to control these changes. However, the best practices in professional development that we have been able to identify are listed below.

**Our research and practices suggest that professional development is most effective when it:**

1. Benefits from the use of a Project Management Team
2. Focuses on specific content in the disciplines
3. Engages teachers in active learning, witnessing models of inquiry teaching
4. Allows curriculum materials that are educative for teachers and students
5. Enables the collective participation of teachers
6. Allows for coherence (aligned with school curriculum and practices)
7. Sufficient duration (both in intensity and contact hours)

Each of these best practices is elaborated on below with implications to consider when planning and implementing professional development for math and science teachers.

**Makes use of Project Management Team (PMT)**

In many cases, professional development offered at ETSU is offered during the summer months with follow up, on-going support during the academic year. The summer PD provides 50 to 70 hours of teacher training, both in content and pedagogy. The professional development provided is informed by the Project Management Team (PMT). The STEM Hub works closely with each layer of the project and serves as a vital link among the ETSU science and math faculty, education faculty, local education agencies (LEAs) and the Project Management Team (Rhoton

& Shane, 2006). In addition to the project director, the PMT consists of central office curriculum directors with decision-making authority, school principals, university science and math professors, and science and math teachers, all of whom represent participating school districts. Nine months before each of the summer professional development programs are implemented, members of the PMT meet bi-monthly to establish an agenda based on the needs assessment. The PMT designs the summer institutes and follow-up academic year professional development activities for the subsequent year. The PMT meets throughout the academic year to realize the project goals and build leadership capacity. Our feedback from PMT members and local LEAs provide evidence that the PMT approach provides coherence in planning and implementing professional development (Nivens & Rhoton (2012).

**Implications:** Individual schools and school districts need to consider ways to make use of school and student data to inform professional development. Schools need to consider ways to support teachers in receiving PD. This can consist of providing adequate time for teachers to plan and work with peers, provide teachers access to outside expertise, and allow time for teachers to align PD with existing curriculum.

### **Focuses on specific content in the disciplines**

Teachers cannot teach what they don't know. They cannot help students understand what they don't understand. Our studies have shown when professional development focuses on specific (subject) or grade level content, it leads to enhanced teacher content knowledge and skills, and improved student achievement. For example, Rhoton & McLean (2008) found that student achievement in science was higher in schools where teachers had extensive professional development related to specific science content, compared with schools that did not receive the professional development. In addition, if teachers are expected to teach to new standards, including complex thinking skills, such as found in the NGSS and Common Core, it is essential they have a firm grasp of the content. The ETSU Eastman Scholars Mathletes program, which provides mathematics subject matter training, has shown, for schools that have participated in the program, vast improvements in school's TCAP data and EOC in Algebra 1.

**Implications:** Professional development, when focused on subject-specific teaching methods, such as increasing teachers' understanding of a particle view of heating and temperature in chemistry or the way middle school students solve logic problems in mathematics, avoids more general teaching methods such as lesson planning or cooperative learning grouping methods.

### **Engages teachers in active learning, witnessing models of inquiry teaching**

Our research has supported the notion that effective teaching practices should be modeled for teachers just as teachers should model effective teaching to their own students (Rhoton, J.; Madrazo, M. & Motz, L, 1999; Zhao, N. & Rhoton, J. 2013). Active learning involves teachers in meaningful and relevant learning activities designed to support the existing curriculum. Teachers are more effective in engaging their students in active, "hands-on-minds-on" learning

when they possess subject matter knowledge and pedagogical content knowledge that goes beyond what they typically gained in one-shot professional development programs (Rhoton, J. & Wojnowski, B., 2006).

**Implications:** Professional development for teachers should connect to disciplinary content in a variety of ways by using inquiry-focused activities, interactive lecture, hands-on lab/field experiences, and other active strategies. Professional development should place teacher participants in real situations that model desired classroom approaches during the training to project a clearer vision of the proposed changes.

### **Allows curriculum materials that are educative for teachers and students**

We refer to educative curriculum materials as resources designed to promote teacher learning as well as student learning. Rhoton and Zhao (2013) provided professional development for high school chemistry teachers that reorganized basic chemistry models designed to increase structural coherence. The teachers were provided a complete set of course materials. The teachers worked through these activities alternately in the roles of student or teacher. Making use of a matched comparison group design, the authors were able to show positive results from the chemistry Modeling workshop. For example, participating teachers increased their subject matter knowledge, pedagogical content knowledge for topics, and pedagogical content knowledge for disciplinary practices, while their students showed an increase in student achievement.

**Implications:** Teachers should have opportunities for actively engaging in meaningful discussion of the content they teach, including modeling, demonstrating, and practicing lessons. This may include observing expert teachers and being observed by their peers, planning classroom implementation, as well as reviewing student work. Activities and/or curricular materials should be a part of a coherent program of teacher learning, aligned with both state and school district standards. On-going communication and follow up helps to sustain teacher motivation and support for new approaches and changing teacher practices.

### **Enables the collective participation of teachers**

Even though we have not performed any rigorous investigations that show a link between “collective participation of teachers” in professional development and instructional practices or student outcomes, we do have survey data and opinions from teachers and administrators, as well as practitioner’s wisdom, that the collective participation of teachers is an important consideration when planning for teacher professional development. It has been our experience that professional development that emphasizes teachers in the same school, department, or grade level can allow teachers to work across classes and grade levels to make better decisions that impact the needs of students.

**Implications:** When planning professional development, the following should be noted: Teachers from the same school, department or grade level are more likely to share resources, common curricular materials, while integrating what they have learned into their own curriculum. Teachers from the same school, department or grade level are more likely to build a shared professional culture and learning community as they establish instructional goals, methods and practices. Teachers have more time to meet and talk about what worked and what didn't work.

### **Allows for coherence (aligned with school curriculum and practices)**

Based on our work through the Project Management Team (as described above), it has been our experience that when professional development is planned and designed based upon school and teacher needs as well as student data, the professional development is directly related to increased teacher learning and improved classroom practices. When professional development is planned and implemented with the input of teachers and administrators it is more likely to be built on activities that are consistent with teacher needs and goals. The professional development and associated activities are more likely to be coherent when they support the school curriculum, disciplinary standards, and assessments. Professional communication through the PMT has played an important role in involving teachers directly in the decision making regarding the type of professional development offered.

**Implications:** Teachers should be involved in planning of their professional development. School, teacher and student data should be considered when planning and implementing professional development. Professional development should be part of an integrated program of teacher learning.

### **Sufficient duration and sustainability (both in intensity and contact hours)**

Our research has shown when teachers receive 50 to 70 hours of professional development it can lead to increased changes in teacher learning, classroom practices, and student achievement. Lasting changes in professional development results when teachers are given sufficient time and duration to focus on subject-area content, opportunities for active learning and engagement and sufficient time to carry out the innovation. Professional development programs that are designed as "one shot deals" or short duration do not provide participants sufficient time to develop their belief structures and attain acceptance of the desired change or practices (Rhoton & Stiles, 2006). Our research has also shown when teachers received on-going, sustained support following the professional development; they have opportunities to share progress, ideas, difficulties, and successes. In addition, Yoon et al., (2007), after examining several controlled studies of PD efforts to identify how much time is necessary for impact, found that when professional development was less than 30 hours, there was no significant effective on student learning. He

found that when professional development ranged from 30 to 100 hours, with an average of 49 hours, there was a positive and significant effect on student achievement.

**Implications:** When planning professional development it should be of sufficient duration, at least 30 hours, to allow time for teachers to increase their understanding of the content and to participate in active learning. Teachers need sufficient time to implement new strategies in their classrooms, to gather feedback, and time to reflect upon what they have learned.

## **Books**

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Rhoton, J. & Bowers, P. (2001) *Professional Development Planning and Design*. (Eds.) Co-published by National Science Teachers Association and National Science Education Leadership Association, NSTA Press: Arlington, VA.

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## **Articles**

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