

# ***NCSM Journal***

*of Mathematics Education Leadership*

FALL/WINTER 2010-11

VOL. 13, NO. 1



*National Council of Supervisors of Mathematics*

[www.mathedleadership.org](http://www.mathedleadership.org)

## Table of Contents

<b>COMMENTS FROM THE EDITOR</b> .....	1
Linda Ruiz Davenport, <i>Boston Public Schools</i>	
<b>LETTERS TO THE EDITOR</b> .....	4
<b>MOVING BEYOND THE WORD WALL: HOW MIDDLE SCHOOL MATHEMATICS TEACHERS USE LITERACY STRATEGIES</b> .....	6
Ellen S. Friedland, Susan E. McMillen, and Pixita del Prado Hill <i>Buffalo State College</i>	
<b>AN ACTIVITY-BASED APPROACH TO TECHNOLOGY INTEGRATION IN THE MATHEMATICS CLASSROOM</b> .....	19
Neal Grandgenett, Ph.D., <i>University of Nebraska at Omaha</i> Judith Harris, Ph.D. and Mark Hofer, Ph.D., <i>College of William and Mary, Williamsburg, Virginia</i>	
<b>OBSERVING MATHEMATICS LESSONS: WHAT DOES IT MEAN FOR PRINCIPALS TO BE UP-TO-SPEED?</b> .....	29
Amy Shulman Weinberg, <i>Education Development Center, Newton MA</i>	
<b>USING PROFESSIONAL DEVELOPMENT MATERIALS PRODUCTIVELY: THE ROLE OF ADAPTATIONS</b> .....	35
Judy Mumme, Nanette Seago, Mark Driscoll & Rachel Wing DiMatteo	
<b>NCSM MEMBERSHIP/ORDER FORM</b> .....	46
<b>INFORMATION FOR REVIEWERS</b> .....	47

## Using Professional Development Materials Productively: The Role of Adaptations<sup>1</sup>

Judy Mumme and Nanette Seago, *WestEd*  
Mark Driscoll & Rachel Wing DiMatteo, *Education Development Center*

*Sara, a district coach, was planning a workshop for teachers focused on helping them learn how to identify, describe and foster students' algebraic thinking. She decided to use a particular professional development program because it matched her goals. The program's six sessions consisted of a series of core activities, each important in achieving the program goals. Although the materials called for three-hour sessions, the district only allowed her two hours for each. Sara was faced with a problem—the professional development is designed for eighteen hours, but she only has twelve.*

*Frank, a regional supervisor, used the same set of materials in a workshop for middle grade teachers preparing to implement new standards-based instructional materials. Unlike Sara, he was able to conduct the full program of six three-hour sessions. In session three, as the discussion unfolded one teacher brought up a mathematical idea that could be pivotal to discussions in later sessions. This idea was not the topic for the particular activity at this time so Frank had to decide whether to take it up now or set it aside for the later sessions.*

The decisions Sara and Frank face are among the many that leaders of professional development confront on a regular basis. Although they are each using a set of professional development materials carefully designed to achieve specific learning goals, each leader is faced with decisions that may be considered adaptations to the original program. In Sara's case the adaptations were forced—a result of time constraints imposed by her district. To use the materials she will need to make decisions that impact its overall design. What gets modified? What changes can she make and still adhere to the program goals? Should Sara try to shorten the time allocated to each activity, or does she omit some? If, so, what? Unlike Sara, Frank is faced with a situation that unfolded during a specific session. Does he take up of the opening<sup>2</sup> to discuss the ideas now? How does this impact the flow and timing of the session? How does it impact future sessions? How well does either choice further the goals? Both Sara and Frank are faced with making choices about what will best support teachers' attainment of their goals. Both cases involve consideration of making adaptations (both large and small) to professional development materials.

This article aims to shed light on the issues related to adapting professional development (PD) materials. Nanette Seago, in her article on fidelity and adaptation identified issues related to modifying PD materials (Seago, 2007).

<sup>1</sup> Funding for this work was supported in part by National Science Foundation (ESI-0243558). Opinions expressed are those of the authors and do not necessarily reflect those of the Foundation.

<sup>2</sup> "Openings" are when unanticipated questions, challenges, observations, or actions on the part of participants in professional development that require facilitators to make on-the-spot decisions about how to guide the discourse, and when successfully navigated, provide facilitators with opportunities to foster learning by capitalizing on mathematical or pedagogical issues as they arise and connecting these to the learning goals of the professional development (Remillard & Geist, 2002).

We build on this earlier article to further explore adaptations that facilitators make, identify additional considerations in the use of professional development materials to effectively support teacher learning and end with some advice to facilitators on making adaptations. We hope this article will help facilitators consider how they might use published professional development materials effectively by carefully considering the importance of the overall goals of the materials, reflecting on the purposes of specific activities within these materials, and making adaptations in light of these goals and purposes.

### Some History

There has been a tradition of facilitators of professional development creating their own activities for teachers. For the most part this had been due to the fact that there were few carefully constructed programs of professional development curricular materials available. Over the years facilitators have worked hard to find and create activities to use with their teachers. Sometimes this involved seeing or experiencing a great activity themselves and then turning around and using it with their teachers. Sometimes it meant scouring books or articles to find worthwhile activities that related to their specific needs and context. This often resulted in cobbling together sets of activities, which unfortunately translated into fragmented, disconnected experiences for teachers. Akin to teachers creating their own curriculum, developing a carefully constructed program of professional development is beyond the reach of many facilitators, either in terms of available time or required experience.

Research has demonstrated that practice-based professional development that utilizes artifacts such as samples of student work, video and/or narrative records of classrooms, provide powerful contexts for teacher learning (Borko, 2004; Smith, 2001). The recent arrival of published practice-based mathematics professional development materials, many of which have been developed through grants from the National Science Foundation, provides facilitators of professional development with more coherent, well-specified programs that target specific learning goals and provide carefully sequenced activities to achieve those goals. (Driscoll, M., 2003; Driscoll, et. al., 2008; Miles Grant, et. al., 2003, 2009; Schifter, Bastable, & Russell, 1999-2008; Seago, Mumme, & Branca, 2004; Smith, Silver, & Stein, 2005). Significantly, these high quality materials are the result of years of development and field-testing by educators with a depth of mathematical background and vast experience in supporting teacher development. More

than a collection of disconnected efforts, developers of many of these materials have been learning from and building on the work of one another.

In the opening scenario both Sara and Frank were using a published professional development program and although the materials were well-designed, each leader needed to consider adaptations. “Adaptation is inevitable because it means to take seriously the context (i.e., setting, participants, facilitator) in which materials are used” (Seago, 2007). Adaptation is not synonymous with unproductive professional development and, given attention to the goals and intent of materials, adaptations can lead to worthwhile experiences for teachers. Indeed, professional development takes place in complex situations and should be shaped to address the needs of the teacher group involved. However, regardless of contextual needs, some facilitators of professional development may not feel they “own” published materials and see the need to make adaptations to the materials, either to personalize them or fit them to their specific contextual requirements. In addition, some “professional developers may be more likely to place a premium on creativity and attention to context that is only possible with adaptation” (Seago, 2007).

In her 2007 article Seago outlines and describes categories of adaptation—ranging from those that are productive, to those that produce no impact, to those considered fatal. With this work in mind, we interviewed and observed several facilitators, many using one of two sets of professional development materials. We report on what we found so that we can expand on Seago’s ideas to provide further insights into how facilitators might effectively adapt and use professional development materials. Our purpose in observing professional development sessions was to further understand the types of adaptations that facilitators make in using professional development materials and to examine the relationship between adaptations and fidelity to the intent of those materials.

### Professional Development Materials Considered in the Study

Our primary observations involved facilitators using one of two published PD materials—*Fostering Geometric Thinking Toolkit* (Driscoll, et. al., 2008) and *Learning and Teaching Linear Functions* (Seago, Mumme, & Branca, 2004). We chose these materials for two reasons: 1) the authors of this article are also the developers and authors of these materials and therefore intimately familiar with the goals

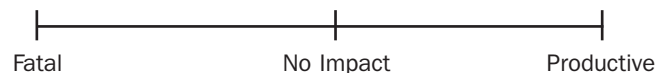
and intent; and 2) each of these materials represent a genre of PD materials that are well specified, i.e., each carefully specifies learning goals, makes explicit its design characteristics and provides extensive supports for facilitators.

The *Fostering Geometric Thinking Toolkit* (FGTT) is a comprehensive professional development program involving 20 two-hour sessions designed for middle school and high school mathematics teachers. (There is the option of pairing sessions such that groups would meet for 10 four-hour workshops instead of 20 two-hour sessions.) The materials focus on the key topics addressing geometric properties, transformations, and measurement, with the following overall goals: strengthening teachers' understanding of geometry; enhancing teachers' capacity to recognize and describe geometric thinking; increasing teachers' attention to students' thinking; enhancing teachers' understanding of students' geometric thinking; and preparing teachers to advance students' geometric thinking. The materials contain two guiding structures designed to address the goals of FGTT. The first guiding structure is a cycle of activities that, over the course of a pair of sessions, takes teachers through the exploration of mathematics activity that teachers do together, reflecting on their own learning as a result of the activity, and then considering student work related to the mathematics of the activity. The second structure is the Geometric Habits of Mind (GHOMs) framework that provides a lens for teachers to use when analyzing their own geometric thinking, colleagues' geometric thinking, and students' geometric thinking. The facilitator materials provide clear instructions for use including agendas, facilitator notes and tips, and other helpful resources. Its accompanying DVD contains an array of tools, including video clips for use in particular sessions, PowerPoint® slideshows that summarize existing research on students' geometric thinking, printer-ready participant handouts and geometry applets for use by both participating teachers and their students.

*Learning and Teaching Linear Functions* (LTLF) consists of five modules designed to help teachers deepen their understanding of mathematics content, students' mathematical thinking, and instructional strategies as well as develop norms and practices for learning about teaching. The first of five modules, *Conceptualizing and Representing Linear Relationships*, is a sequential set of eight 3-hour sessions

designed to enrich teachers' ability to teach linear relationships including the various representations that capture these linear relationships and connections among them. Each session has at its core one of two video clips that

#### Categories of Adaptation



capture students doing important mathematics. These video clips reflect a range of grade levels, different geographic locations, and a diverse student population. The agenda for each session addresses four basic components: framing the goals of the session, exploring a mathematics activity related to the mathematics of the video clip, viewing and discussing the video clip, and making connections to practice. The facilitation guide for these materials offers explicit and well-specified support including a complete overview of the materials, explanations and rationale of the underlying principles and specific goals, sample agendas and guidelines for sessions, lists of references and useful resources, tips for facilitation including caution points, mathematics commentaries, and excerpts from a composite facilitator's journal chronicling the experiences of others having used these materials.

In addition to the two sets of materials described above, we draw upon data and observations from two professional development leadership projects—*Learning to Lead Mathematics Professional Development* (Carroll & Mumme, 2007) and *Researching Mathematics Leader Learning*.<sup>3</sup> The *Learning to Lead Mathematics Professional Development* collected data from a number of practice-based professional development programs. Facilitators were observed, videotaped and interviewed. The materials developed in this project have been published and are being used to support K-12 mathematics education leaders, whether novice or experienced. Data was also gathered from *Researching Mathematics Leader Learning* where we engaged approximately 70 mathematics education leaders in a series of leadership seminars that were videotaped. We interviewed and observed several leaders as they conducted professional development, mostly in school-based settings.

#### Professional Development Leaders Involved

<sup>3</sup> An NSF project (ESI-0554186) directed by Mumme investigating how professional development leaders create mathematically rich environments in professional development.

## in the Study

Six facilitators were interviewed, observed, and videotaped using the *LTLF* and *FGTT* materials. We also drew on hundreds of hours of video of professional development sessions and interviews we gathered from the *Learning to Lead Mathematics Professional Development* project and data from the *Researching Mathematics Leader Learning Project*. Facilitators in these projects represented a broad range of levels of experience in teaching and in facilitating professional development. In the *LTLF* and *FGTT* sessions, four of the facilitators had participated in facilitator institutes to learn about the materials and two were “off-the-shelf” users. Three of the facilitators were new to this role but had taught for at least five years as secondary mathematics classroom teachers, one was a secondary mathematics teacher with over 30 years of teaching experience and 8 years of facilitating professional development, and one was an elementary teacher of 10 years of teaching experience and five years of experience facilitating professional development. In most settings, sessions were cofacilitated, and all of the facilitators always planned ahead of time—doing the mathematics beforehand, previewing videos if applicable and, when cofacilitating, dividing the session work amongst each facilitator.

## Findings

As a result of our observations and interviews we have identified a number of reasons why facilitators make adaptations to materials, the types of adaptations they make, and the impact of those adaptations. As we saw in the opening scenarios, Sara’s situation was externally imposed. She was required to constrict the time allocation for her sessions. Frank, on the other hand, saw an opportunity to pursue his goals through a situation that arose during a session. We decided to chunk the adaptations into three types: those due to contextual or external constraints; those that facilitators chose based on their knowledge, assumptions, and beliefs; and those that were the result of situations that arose during a session.

### ADAPTATIONS RESULTING FROM CONTEXTUAL OR EXTERNAL CONSTRAINTS

Adaptations resulting from contextual or external constraints included situations where there were time constraints, where participants were absent from sessions, and where participants didn’t complete homework assignments. Each is discussed below.

**Time Constraints.** In one *LTLF* professional development offering, the district was only able to provide time for six 3-hour sessions, rather than the eight sessions prescribed in the materials. The facilitators were faced with the decision as to what to cut. Since the *LTLF* materials are carefully sequenced, the facilitators chose to keep the first five sessions intact, and then bring things together with *linking to practice* activities in session six. The facilitators explained, “I guess we are trying to make the most of it. We know that mathematically, and probably in other ways too, they obviously aren’t getting what you would get from a complete eight session PD.” The facilitators reasoned that it was better to keep the integrity of the first five sessions, rather than trying to squeeze everything into the shortened schedule. Given the time constraints imposed, the facilitators appear to have made a productive adaptation, especially considering the fact that additional *LTLF* sessions were scheduled for the following school year.

In another example from a professional development session videotaped for LLMPD during which novice facilitators were using *FGTT* materials designed to help teachers examine student thinking, the facilitators only had an hour for what was designed as a two-hour session. They chose to engage teachers in working on some math tasks, which didn’t leave time for watching and discussing the video clip of students discussing their thinking about these tasks, clearly missing the point of the activity and limiting what teachers were able to learn from the session.

Time constraints were the most frequent cause of adaptations. Most professional development materials suggest optimal timing per session and are organized to address specified content over a specified timeframe. Not every professional development contexts fit neatly into these schedules and often facilitators are required to make adjustments to fit their circumstances. Most often this involves a shorter time than desired. The *FGTT* facilitators indicated they would have appreciated guidance on what to do, explaining, “the reality of it is, we have had to shorten something almost every time... Because we’re making that decision but we’re not, we didn’t write this, so how would you know...how does that affect what’s to come?” This presents a dilemma for developers of professional development materials. If facilitators are offered suggestions for cutting, the fear is that facilitators will be more apt to do so, and participants might miss out on what the full program has to offer. However, by failing to offer these suggestions, facilitators who need to make cuts

are left to decide what to omit or shorten on their own. Although the facilitator materials describe the purposes of each session, without a clear understanding of the goals and purposes of the professional development program, it can be difficult to make productive adaptations in relationship to time constraints.

**Participant Absenteeism.** In professional development programs where ideas are designed to build from one session to the next it can be problematic if people miss a session. In the *Learning to Lead Mathematics Professional Development* project we observed a facilitator taking some extra time at the beginning of a session to have the group bring returning absentees up to date. The facilitator asked participants to reflect on key ideas from the last session in small groups, then in the whole group, with some prompts to hone in on key points. This served to bring absentees up to speed, give other participants an opportunity to reflect on their own learning and to provide valuable information to the facilitator on where people were with their thinking. When this wasn't a built-in feature of the professional development agenda, this added discussion took away from time in the regular agenda, but was made up for in the benefits of the time to reflect. When these reflection times didn't consume too much of the planned agenda, they were often very productive adaptations.

It is rare that PD materials explicitly mention the issue of absenteeism, yet most facilitators recognize this as an issue they often face. While some facilitators may choose to begin the session with a small group reflection time, others may choose to begin with a whole group review of the previous session, while still others may choose to send out an email summarizing the previous session for absentees. The important point is that facilitators plan for the possibility of absenteeism.

**Participants Failing to Complete Homework.** Many professional development programs ask teachers to complete assignments in advance of a session, like trying out a mathematics task with their students and bringing back student work, or reading a case ahead of time as a way to prepare for discussion. FGTT follows this practice in many of its sessions, where teachers are asked to try a task with their students, and then submit student work to facilitators in advance of the session itself so facilitators can pre-select student work that will best advance the key ideas of the session. In one FGTT session we observed, most teachers didn't try the task with their students, and no one sub-

mitted student work to the facilitators as requested. This forced facilitators to make some adaptations to their plans for the session. While they had collected some student work that they could have shared, they decided it would be more valuable if the discussion focused on work that participants brought, even though none of it had been submitted in time for them to review it ahead of time, and asked one participant to share what she had brought. The quality of the discussion about these pieces of work was less than what the facilitators had hoped. They wondered if they had made the best choice about how best to proceed. They had been hoping for a greater variety of student work, to discuss and also felt handicapped by the fact that they had not seen the student work ahead of time. This adaptation was, in a sense, forced upon the facilitators and was not particularly productive. In this case, the facilitators had samples of student work available but chose to use some a teacher supplied. Where this may have added credibility to the student work itself, some key points of the session were missed because of this choice, and using the student work previously collected by the facilitators might have better served the session goals. Given that homework tasks are an important component in many professional development programs, facilitators would be wise to talk explicitly with participants about the role of homework tasks and the importance of homework deadlines. They would also be wise to consider contingency plans for how to proceed if homework is not submitted.

### **ADAPTATIONS BASED ON FACILITATORS' KNOWLEDGE, ASSUMPTIONS, AND BELIEFS**

Decisions based on facilitators' knowledge, assumptions, and beliefs was also an important category of adaptations. This includes facilitator knowledge of the materials, their perceptions of the needs of participants, and their own additional goals for the professional development sessions themselves. Each of these is discussed below.

**Knowledge of the Materials.** Facilitators need to understand how all of the design elements that support the use of a set of professional development materials are important. For instance, during an LTLF discussion of a video clip, the facilitators needed to be able to go back into specific footage because participants had different perceptions as to what had happened in the segment. The materials are set up to allow facilitators to use links from the on-line transcript to go to specific portion of the video clip, but the facilitator didn't know how to do this, and precious time was wasted while she attempted to find that portion

of the video clip. This is a crucial feature in the design of the materials, as it allows the facilitator to bring different perspectives out on the table, using evidence from the video clips. While this may not be clearly an adaptation, it had an impact on how the materials were used in the sense that it didn't allow for full use of what the materials were intended to offer, and is an example of unproductive use of the materials. How the technological aspects of professional development materials can hinder or support opportunities for teacher learning.

Even when sessions involve two or more facilitators, it is important for each facilitator to fully know the materials and understand the goals of each session. In the FGTT sessions we observed, we found that the facilitators seemed to have specific roles. One FGTT facilitator, Alice, explained, "I'm the Do Math girl." Another facilitator, Phyllis, added, "I'm the time keeper." One of them added, "Fred is the GHOMy (Geometric Habits of Mind) . . . that's what we call him." As she gestured to another one of the facilitators, she explained, "You're really the 'analyze the student work' person . . . so we've kind of broken it into those three sections [based on] our strengths." One of the facilitators added, "And our personalities." This might be viewed as resulting in stronger learning experiences for teachers, and in some cases this might be true. But Alice also said, "It's hard to answer on the Geometric Habits of Mind part because that was Fred's. Fred's baby I guess, is what we were calling it . . . he leads that discussion." Since the Geometric Habits of Mind are such an integral part of the FGTT materials, it raises questions as to how well the facilitators other than Fred were equipped to make decisions as to what to take up in discussions during their turn at leading.

Another example highlighting the importance of each facilitator fully understanding the materials and the goals for each session appeared during an observation of an LTLF session. During her time to lead, one facilitator asked a question that was aimed at the purpose outlined in the materials. When there was prolonged silence the other facilitator jumped in with a different, unrelated question, taking the group off target. Silence can be difficult to accept, and what one does as a result needs to be tied to purpose.

Each of these examples points to the fact that facilitators need to have deep knowledge of the materials, including the technology associated with the materials, as well as the learning goals for participants—whether they are facilitating alone or cofacilitating with partners. Knowing the pur-

poses of each element of the materials individually and collectively allows for a more coherent well-orchestrated learning experience

***Perceptions of the Needs of Participants.*** Another important issue that influences the adaptations of professional development materials has to do with how facilitators respond to what participants believe about whether the professional development program is meeting their needs. In one LTLF series, participants complained that things were moving too slowly. They had seen enough tasks and video involving linear functions and wanted to move on. In response, the facilitator modified sessions to omit the video so she could add in mathematical tasks that addressed quadratics and other more complex functions, thus changing the focus of the professional development program which centered on the teaching of linear relationships — including the use of mathematics tasks and video clips addressing this content. These participants spent the remainder of their sessions doing and discussing mathematics tasks that addressed other kinds of mathematics functions, one after another, and did not have opportunities to continue to deepen their understanding of linear relationships, examine and compare representations for linear relationships, and consider the implications for teaching—a fatal adaptation. An interview with this facilitator, an "off-the-shelf" user of the materials, revealed that she apparently didn't understand the storyline that LTLF was developing and didn't communicate its value to the participants.

A similar situation was observed in FGTT. A facilitator determined that participants were getting "restless" looking at student work, so she omitted this aspect of the professional development in favor of simply "doing the math"—another fatal adaptation. Whereas facilitators need to be responsive to the needs of participants, they also have to know the value of each of the design elements of a particular professional development program, and determine ways to build and communicate the value of each of these components to participants.

In the *Learning to Lead Mathematics Professional Development Facilitators* we observed several facilitators weighing teachers' mathematical strengths. We saw serious attempts to slow down the mathematics to insure that teachers developed a deep fundamental understanding. We observed facilitators adding in content, believing that this would help teachers' fragile knowledge. We also observed facilitators making decisions to skip over activi-



ties assuming that the teachers already knew the content.

Evidence should guide perceptions of teacher knowledge, needs, and contentment. Assumptions should be checked. Facilitators need a repertoire of strategies for gathering evidence of what teachers bring to the professional development. Facilitators can use teacher reflections, surveys, and their work on mathematical problems to gain insights into how and what teachers are thinking. In addition, they can use probing questions to gain more information about teacher reasoning. This evidence then needs to be weighed against how the program materials were designed to address these issues. Many of the practice-based professional development materials referenced earlier are the result of years of development and field-testing across multiple contexts. Making adaptations should be considered in this light. On the other hand, being responsive to genuine teacher needs is important. Adhering rigidly to an agenda and ignoring teacher needs can be fatal. Facilitators need to know the value of a professional development program and determine ways to build and communicate its value to teachers.

**Identifying Additional Goals.** Adhering to the goals of the professional development program was often mediated by facilitators' attention to cultivating particular orientations toward mathematics. For example, in one professional development session we observed in *Researching Mathematics Leader Learning*, the facilitators were using professional development materials designed to strengthen teachers' mathematical knowledge. The facilitators also decided they wanted to help teachers understand the constructivist learning philosophy and how it was the foundation of their new curriculum adoption. Doing the mathematics in professional development was thus situated within this major aim. One facilitator explained, "what we were looking at with the staircase problem was to engage them in that struggle as well as to provide some modeling about work within the constructivist model." The facilitators wanted the mathematical task to generate willingness to persevere with problem solving in the face of difficulty, to be comfortable sharing vulnerabilities, and to cultivate the curiosity to question each other and engage in the task. Whereas these are laudable goals, this could be done at the expense of what is to be learned mathematically. It must be noted that sometimes additional goals are mandated externally, such as a district requirement that all professional development include a certain goal or address a district priority. Taking up these additional goals must be

balanced with the goals of the program and considered in light of what is feasible within the time available.

### ADAPTIONS RESULTING FROM SITUATIONS THAT ARISE DURING SESSIONS

Often, adaptations result from situations that arise during particular professional development sessions. These include running out of time during a session or having to negotiate an "opening" that arises during a session.

**Running Out of Time in a Session.** When time was a crunch, and it often was in sessions we observed, the final "pulling ideas together" or reflection activity was often omitted. In one LTLF session facilitators ran out of time to finish the activities. Before time was up, however, they made time for teachers to write reflections in their journals. They indicated that without time for reflection teachers would lose an opportunity for making sense of their experience. Interviews with facilitators indicated that they made contingency plans, outlining what they would do if an activity took longer than anticipated. They identified key points not to be missed to help guide decisions about time. In some sessions in FGTT and LTLF sessions we saw student work or video omitted from sessions when time was an issue. In many instances these were the centerpiece of the session. In some professional development sessions when time was limited we saw facilitators omit activities that asked teachers to apply ideas to practice. In general, in carefully constructed professional development programs, selectively leaving out portions of the activities (unless cited as optional) will result in lost learning opportunity and may destroy the integrity of the program. Carefully monitoring time is important, but sometimes adaptations can't be avoided, often for reasons that are about supporting teacher learning. Recognizing that even with the best intent, time can get away from you, facilitators can make contingency plans in advance for how they will "make up" for key lost pieces.

**Navigating through Openings.** "Openings" are created when unanticipated questions, challenges, observations, or actions on the part of participants in professional development require facilitators to make on-the-spot decisions about how to guide the discourse. When these are successfully navigated, openings can provide facilitators with opportunities to foster learning by capitalizing on mathematical or pedagogical issues as they arise and connecting these to the learning goals of the professional development (Remillard & Geist, 2002). During our observations of

LTLF and FGIT sessions we saw numerous openings. For example, during the discussion of a video clip in a LTLF session, one teacher talked about how he noticed that students seemed to be talking about every other odd number—an issue that would come up in the next clip—but the facilitator chose not to highlight this mathematical moment even though doing so might have helped teachers prepare to focus on this important idea in the upcoming discussion. Successful navigation of openings requires a deep understanding of the specific purposes of an activity, the goals of a session, and the overall goals of the program—all of which well-specified professional development materials can provide

## Discussion

In our findings we discuss only a few of the adaptations facilitators make with professional development materials. Reasons for adaptations were many—some were the result of external contextual issues, some were driven by facilitators' knowledge, assumptions and beliefs, while others were the result of issues that arose during a session. Some adaptations, even those that arose during a session, were planned in advance, while others were in-the-moment decisions. Many of the facilitators were aware of the adaptations they were making and could provide a rationale for the modifications, while others appeared to be unaware of any adaptations being made.

In *Fidelity and Adaptation of PD Materials*, Seago (2007) identified “categories of adaptation.” These categories are arranged on a scale that ranges from fatal adaptations at one extreme to productive adaptations at the other, while in the middle lies the types of adaptations that do not impact the design of the materials negatively or positively. She describes these categories as follows:

**Fatal Adaptations.** Adaptations that violate the goals and intent of a program can be considered fatal errors and seriously undermine critical components of the materials. For example, in our data we saw a facilitator choose to omit the video and replace it with more math tasks, a “fatal adaptation.” In this case we believe it revealed misconceptions the facilitator held about the intended use of the professional development materials. Sticking with the program design and communicating its value to participants may have benefitted teachers more by addressing the goals that lead the facilitator to select these materials. We do not want to suggest, however, that fatal adaptations are necessarily unproductive

for participants, even though they violate the goals of the professional development materials.

**No Impact Adaptations.** Some adaptations seem relatively neutral in that they don't have a big impact on use with fidelity. For example, in the situation cited under time constraints where the facilitators had to reduce the number of sessions from eight to six, they chose to keep the first five session intact and use session six to pull ideas together. Whereas this wasn't ideal, their adaptation was neither fatal nor productive given the situation. These “no harm, no foul” adaptations are categorized as no impact because they don't undermine the basic design or values of the materials, nor do they make better use of them.

**Productive Adaptations.** Some adaptations by facilitators are productive in that they make better use of the materials given the circumstances in which they are being used. For example, the strategy used by facilitators to bring absentees up-to-speed, beginning with a discussion of key ideas from the previous session, was an example of a productive adaptation. It not only allowed those who had not been present to gain a sense of what had happened in the last session, but also served to rekindle ideas for those who had been present. Productive adaptations are those that relate to particular participants in particular contexts, while at the same time keep an eye on the learning trajectory of the materials.

An adaptation in itself is neither necessarily productive nor fatal. It all depends on the degree to which the adaptation helps participants achieve the goals addressed in the professional development materials. A thorough understanding of these goals allows facilitators to weigh an adaptation in light of its impact on teacher learning. When you consider the years of development work that go into the design of these materials, and their productive use in a wide range of contexts, facilitators should take time to consider whether adaptations that deviate from the identified agendas are wise.

The extent to which professional development materials contain supports for facilitator of the professional development can influence the kinds of adaptations facilitators are inclined to make as they plan and facilitate sessions, as they are then better equipped to make adaptations that do not compromise the integrity of the learning goals. Seago

(2007), in her earlier paper, suggested, “Well-specified professional development materials make it possible to use materials with fidelity because they explicitly communicate the underlying principles.”

In 2008, Horizon Research convened a meeting of several invited mathematics educators to examine issues in the design, development, and use of practice-based mathematics teacher professional development materials. A draft report issued from this meeting outlined several components that should be included in published professional development materials in order to support effective use by facilitators of the professional development (Heck, Markworth, & Weiss, 2008). The components include the following:

- An *overview* that explicates the pedagogical and mathematical learning goals overall and of each session.
  - *Logistical information* about the program and its implementation, including timing suggestions, participant grouping, recommendations for structuring activities, etc.
  - *Resources* for each session’s implementation such as masters for handouts, PowerPoint slides, transcripts, posters, and prepared student work samples.
  - *Prompts* that provide guidance for starting, continuing, concluding tasks and discussions, and for getting things back on track when necessary.
  - Material-specific *facilitation techniques* and instructions for any relevant features such as setting the desired intellectual and social climate, how to facilitate discussion effectively, how to react to participants’ responses, etc.
  - *Links to practice* that describe how concepts, issues and activities are likely tied to the teachers’ school or classroom contexts and how the facilitator can use state/district standards or instructional materials to create tighter links to the context.
  - A variety of potential *answers* and solution approaches to mathematics tasks, along with commentaries on their uniqueness and connections, common incorrect solutions or interpretations, along with suggestions about how to respond to various solutions.
  - *Samples and examples* to illustrate how a task or session might progress.
- A means for *assessment* of the progress of participants that could include embedded formative assessments, scoring rubrics, exit card questions, what to look for in group work and other evidence to watch for to determine if the pedagogical and mathematical learning goals are being met.
  - *Support notes* that provide guidance for using recommended technology, acknowledgement of issues or concerns that might arise and ways to respectfully deal with them, and commentaries on mathematics content of tasks.
  - Suggestions for *alternatives and extensions* to consider that extend the experiences.

Having these components available in published professional development can also help make it more likely that those responsible for identifying professional development materials can make good choices based on the learning goals they wish to achieve.

## Conclusions

We saw from our observations of professional development sessions and our interviews with facilitators that constraints resulting from the scheduling of professional development or the challenges that arise from unexpected events in the professional development itself often require adaptation in how professional development materials are used with participants. However, the design features of professional development materials identified above are only of use if facilitators thoughtfully attend to what these design features offer as they plan and facilitate their sessions. Thoughtful use of the design features of professional development materials can also be supported by facilitator participation in training on the use of the professional development materials that is often available where a range of constraints and challenges can often be discussed and explored with other facilitators and the authors of the materials themselves.

Our findings suggest that even when using professional development materials that include all the recommended design features, facilitators might be advised to develop contingency plans during their planning sessions, thinking ahead about what issues might arise in each session and what kinds of adaptations might be considered to address those issues—all the while keeping in mind the core principles of the materials. Some contingency plans might include adaptations to address the following:

- Participants have been absent from an earlier session
- Participants haven't done the homework
- A key point doesn't come up in a discussion
- A solution method you want isn't created by someone from the group
- Participants struggle with the mathematics beyond what is planned
- Participants don't seem to see the value in the activities
- Part of a session takes longer than anticipated

We believe that facilitators who prepare for these contingencies are more likely to be prepared to make productive adaptations that address them.

Creators of professional development materials can help support facilitators by purposely designing for adaptations. The Learning and Teaching Geometry Project<sup>4</sup> is designing for potential adaptations as they are developing video case materials for use in professional development. In an effort to create well-specified materials aimed at supporting facilitators to use the materials in accordance with the core principles, they are measuring adaptation and fidelity in their pilot tests to examine adherence to and focus on the mathematical and pedagogical storylines

of the materials. The data collected will be used to inform the content of the facilitation materials—to better design supports for using the materials as they are designed to be used. Developers who take seriously the importance of helping facilitators adapt professional development materials productively can impact the scaling up of high quality professional development learning opportunities for teachers.

We all believe that high-quality professional development is key to improving mathematics teaching and learning. Well-designed professional development materials are crucial to this effort, but how these materials are used to promote teacher learning, including what adaptations are made as they are used, ultimately determines the effectiveness and impact of the professional development. For these reasons, thinking carefully about how to support facilitators of professional development as they use well-designed professional development materials is an important question for our mathematics education leadership community.

---

<sup>4</sup> An NSF-funded professional development materials project (ESI- 0732757) intended to produce video-based professional development materials for grades 6 through 10 due to be published in 2012.

## References

- Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher*, 33(8), 3-15.
- Carroll, C. & Mumme, J. (2007) *Learning to Lead Mathematics Professional Development*. Thousand Oaks, CA: Corwin Press
- Driscoll, M., Wing DiMatteo, R., Nikula, J., Egan, M., Mark, J., Kelemanik, G. (2008) *Fostering Geometric Thinking Toolkit*. Portsmouth, NH: Heinemann.
- Driscoll, M. Zawojewski, J., Humez, A., Nikula, J., Goldsmith, L., & Hammerman, J. (2003) *Fostering Algebraic Thinking Toolkit*. Portsmouth, NH: Heinemann.
- Heck, D. J., Markworth, K., & Weiss, I. R. (2008, April). The future of mathematics teacher professional development materials: Building on what we've learned. [Draft.] Chapel Hill, NC: Horizon Research, Inc.
- Loucks-Horsley, S., Love, N., Stiles, K., Mundry, S.E., & Hewson, P. (2003) *Designing Professional Development for Teachers of Science and Mathematics*. Thousand Oaks, CA: Corwin Press.
- Miles Grant, C., Nelson, B. S., Davidson, E., Sassi, A., Weinberg, A.S., & Bleiman, J. (2003) *Lenses on Learning*. Parsippany, NJ: Dale Seymour Publications.
- Miles Grant, C., Mills, V., Bouck, M. & Davidson, E. (2009) *Secondary Lenses on Learning*. Parsippany, NJ: Dale Seymour Publications.
- Remillard, J. & Geist, P. (2002). Supporting teachers' professional learning through navigating openings in the curriculum. *Journal of Mathematics Teacher Education*, 5, 7-34.
- Schifter, D., Bastable, V. & Russell, S.J. (1999-2008) *Developing Mathematical Ideas*. Lebanon, In: Pearson.
- Seago, N. (2007). Fidelity and adaptation of PD materials: Can they co-exist?, *NCSM Journal Winter 2007*, (9)2,16-25
- Seago, N., Mumme, J., Branca, N. (2004) *Learning and Teaching Linear Functions*. Portsmouth, NH: Heinemann.
- Smith, M., Silver, E., Stein, M.K. (2005) *Improving Instruction in Algebra*. New York. Teachers College Press.
- Smith, M. (2001). *Practice-based Professional development for teachers of mathematics*. Reston, VA: National Council of Teachers of Mathematics.