

Teacher-Team Development in a School-Based Professional Development Program

Lu Pien Cheng
Ho-Kyoung Ko

This paper documents how a team progressed through the five stages of team development as a result of a school-based professional development program using a laboratory class cycle. Six Grade two teachers and their administrator in a primary school in the south eastern United States participated in the study. All the teachers were interviewed at the end of each laboratory class cycle. Their administrator was interviewed after the program ended. A grounded theory approach and constant comparative method were used. The study revealed how the teachers' participation in the program progressed according to Tuckman and Jenson's (1997) model of team development in the laboratory class cycle. Establishment of trust among teachers and team support over an extended time were identified as important factors in shaping the team development.

Background of Study

A substantial amount of literature has been published on the topic of team development. Among these, in the annual series *Advances in Interdisciplinary Studies of Team Works* (Beyerlein, Johnson, & Beyerlein, 1995), theory and practice are related to stages and processes of development. According to Beyerlein, Johnson, and Beyerlein, models of team learning and factors that interfered or aided the team's growth in petrochemical companies, manufacturing companies, and Naval Training Systems have been published in journals and books. The researchers at the Naval Air Warfare Centre Training Systems Division in Florida Centre studied work teams extensively in the past 15 years, and refined and expanded on studies using rigorous methodologies. This enabled them to examine some team issues that most researchers have neglected. In education, Kruse and Louis's study (1997) suggested that teams can be vehicles for building professional community and school improvement. Dechant, Marsick and Kasl

(2000) claim there are barriers to effective teams; teams need to deal with conflicts before they can function effectively. In order to examine how team members resolve conflicts at different points in time, we use a stage model of development. This model has yet to be applied to mathematics teachers working in a school-based professional development experience.

Professional development based on a training paradigm that implied teachers were deficit in skills and knowledge (Guskey, 1986) became a major enterprise in education during the Post-Depression era. This paradigm aimed at teachers' mastery of prescribed skills and knowledge and resulted in one-time workshops. Several studies found this approach to be ineffective (Fullan, 1991; Guskey, 1986; Howey & Joyce, 1978; Johnson, 1989; Lovitt & Clarke, 1988; McLaughlin & Marsh, 1978; Wood & Thompson, 1980). The ineffective attempts to motivate teacher change based on the training-mastery model of professional development programs triggered research in professional development and teacher change. A significant outcome of this research has been the shift in focus "from programs that change teachers to teachers as active learners shaping their professional growth through reflective participation in professional development program and in practice" (Clarke & Hollingsworth, 2002, p. 948). Johnson (1996) presented a case for reconceptualizing teacher professional development as "opportunities for learning" to enable it to be "embedded into the ongoing work of the school" (p. 12). School-based professional development became a trend with a focus on school-based management: "Both trends are based

Lu Pien Cheng is an assistant professor with the Mathematics and Mathematics Education Academic Group at the National Institute of Education (NIE), Nanyang Technological University, Singapore. She has specific research interest in teacher education.

Ho-Kyoung Ko is currently a professor in the department of Mathematics Education at Wonkwang University in South Korea. She is researching and developing "Silver Math," which provides math education for the elderly. Also, she research "Factors of Difficulty of Mathematics items" and "Programme of professional development for teachers."

on the increasingly accepted belief that the school, rather than the district (too large a unit) or the individual (too small a unit), is the most appropriate unit of change” (Gordon, 2004, p. 10). This indicates that school-based professional development can focus on specific students’ needs and immediate classroom application more than professional development conducted outside of school (Truscott & Truscott, 2004). Demulder and Rigsby (2003) provided evidence that a school-based program affected teachers’ personal and professional growth, transforming their classroom practice. They argued that the program worked well for these teachers, and attributed both the personal and professional transformation of the teachers to their experiences in the program. Truscott and Truscott added that educators have found “opportunities to shift the emphasis of school-based consultation from addressing problems toward developing consultee skills, knowledge, and confidence toward a more positive and preventive model” (p. 51).

In recent years, the focus of professional development has been subject matter and teaching and learning (Cohen, 2004, p. 3). This new genre of professional development gives rise to questions concerning the culture of teaching and learning. It also provides the impetus to build intellectual community among teacher communities during professional development. Critique and disagreement are welcome in this new genre of professional development as teachers redefine teaching practice and engage in learning. Using the group as the unit of analysis, research provides evidence that “strong professional learning communities can foster teacher learning and instructional improvement” (Little, 2002, p. 936). The Community of Teacher Learners project (Grossman, Wineburg, & Woolworth, 2001) and the QUASAR (Quantitative Understanding: Amplifying Student Achievement and Reasoning) project (Lane & Silver, 1994; Smith, 1997; Stein, Silver, & Smith, 1998; Stein, Smith, & Silver, 1999) illustrate this finding. However, these two projects revealed that the development of teacher communities is difficult and time-consuming (Grossman et al.; Stein et al., 1999). One of the most important features of a successful learning community is the establishment of norms that promote supportive yet challenging conversations in the community about teaching. Although teachers generally welcome the opportunity to discuss ideas and materials related to their work, discussions that support a critical examination of teaching are relatively rare (Ball, 1994; McLaughlin & Talbert, 2001; Putnam & Borko, 1997;

Wilson & Berne, 1999). Professional developers must foster such discussions by helping the teachers establish trust among members of the team, develop communication norms that enable critical dialogue, and maintain a balance between respecting individual community members and critically analysing issues in their teaching (Frykholm, 1998; Seago, 2004).

With more professional development becoming school-based, and greater emphasis on the learning community, this study hopes to shed greater light on factors that promote team learning and growth to increase the effectiveness of school-based professional development effort. This article documents how a team of six primary school mathematics teachers developed through the five stages of team development by Tuckman and Jenson (1977) as a result of a school-based professional development program that used a teaching cycle. Using qualitative research methodology within an interpretive theoretical frame, we interviewed six second-grade primary school teachers at different points of the study regarding their conceptions of team development. We also interviewed their administrator at the end of the program to provide another perspective of how the team had developed. The research questions that guided this study were as follows:

1. What are the teachers’ and school administrator’s conceptions of change as a team as a result of this school-based professional development experience?
2. What are the factors that the teachers and school administrator attributed to the change as a team?

Conceptual Framework

Framework for Professional Development

We employed teaching cycles in the study, where teaching cycles in a real school setting are “centered in the critical activities of the profession, that is, in and about the practices of teaching and learning” (Ball & Cohen, 1999, p. 13). The teaching cycle consisted of three consecutive phases: preparation, observation, and analysis. The professional developer’s role is to facilitate and support the teachers’ learning during each phase of the cycle. In all the three phases, team members work together to plan, observe, and critique mathematics lessons. This study included six teaching cycles over the course of one academic year. The teaching cycle used in this professional development was a type of reform activity that “situates the professional education of teachers in practice” (Smith, 2000, p. 2) and aims at providing a connected

contextualized set of experiences on which teachers can reflect more critically about their beliefs and practices. According to Smith, the work of teaching should be used to create opportunities to critique, inquire, and investigate; the materials for the teaching cycle aimed to achieve that purpose.

The professional development program in this study was designed around the three core features and the three structural features identified by Garet, Porter, Desimone, Birman, & Yoon (2001). The three core features are content focus, active learning, and coherence. The three structural features are activity type, duration, and collective participation. The teaching cycle was conducted for teachers in the same school during the teachers' common planning time in the regular school day. They shared the same curriculum that offered a common platform for the group to discuss concepts, skills, and problems that arose during their professional development experiences. By the nature of this particular professional development experience, the teachers were actively engaged in meaningful, planning, practice, and reflective discussion throughout the study. The content and pedagogy of activities were aligned with national, state, and local frameworks, standards, and assessments.

Stages of Team Development

We viewed the team development process in this study through the lens provided by Tuckman's (1965) model of the developmental sequence in small groups. Tuckman maintained that the way teams develop has a direct impact on both their task and social outcomes. Tuckman synthesized 55 studies of groups to produce a generalizable model of the development of groups. Participants in the studies were therapy groups, human relations training or T-groups, and natural and laboratory-task groups. His original findings uncovered four developmental stages: forming, storming, norming, performing. In 1977, Tuckman and Jenson expanded the earlier group development model to include a fifth stage, adjourning, based on additional studies of group behavior. Stage I (forming) involves testing what roles and interpersonal behaviors within the group are acceptable and how team members will relate to one another. Stage II (storming) is characterized by conflict, as team members assert their individuality and debate over the team's goals, norms, and decision-making process. Stage III (norming) includes the emergence of group cohesion and harmony. The group begins to develop into a functioning unit as members agree on rules, roles, relationships, responsibilities, processes, and tasks to

be accomplished. Stage IV (performing) shows the team fully functioning as members actively involved in roles, leading to problem solving. At this stage, members identify with the team and commit to the team's mission. Stage V (adjourning) brings closure to the process and determines that team's mission is complete. The group either disbands or renews itself by establishing a new mission (Gordon, 2004). Tuckman and Jensen's model is used in this study because it serves as a helpful starting point to think about the groups the researcher participated in and encountered.

Research Design and Data Collection

This study drew on an interpretative, qualitative case study design to investigate team learning and development. To obtain detail and rich descriptions of the learning and development processes, we conducted multiple sequential interviews with the teacher participants at the end of each cycle of preparation, observation, and analysis. Field notes were taken for each session with the teachers.

Research Site

Dayspring Primary School is a public school in the southeastern United States. At the time of the study, the primary school had about 400 students and 24 teachers, and the majority of the students were from low-income families. Teachers at each grade level had the same time during the afternoon to meet together to plan lessons and activities and to compare their students' work. This common planning time was a regular occurrence for the teachers across the grade levels in the school. There were six classes of second graders with an average of 19 students in each class during the study.

Participant Selection and Participants

The team in this study was the only second grade team at Dayspring. Group members included individuals of different ethnicities, years of experience, and perspectives on teaching and learning mathematics. The professional development program lasted two years, and research data was collected during the second year of the program. At the end of the first year, one of the six teachers became a part-time third-grade teacher, and another teacher, Linda, was promoted to school vice-principal. We included Linda as a participant in the study as an administrator because her role provided a wider lens on the team's growth. Two teachers, Ivy and Mary, joined the second grade team in the second year. Kay, Macy, Anna, and Lana were the other teachers on the second grade team during the second year of the program. All

six of the grade two teachers and the vice-principal participated in the study. See Table 1 for more

information about the participants in the study.

Table 1

Descriptions of the Teachers in the Study

Teacher	Mary	Ivy	Kay	Lana	Anna	Macy	Linda
Ethnicity	White	African American	White	White	White	African American	White
Years taught	8	9	9	3	18	27	
Identification of students taught	Gifted	Mixed ability	Mixed ability	Gifted		Mixed ability	N/A
Additional characteristics of the teacher	First time teaching 2 nd grade.	New to school. Trained to use mastery learning.	Only taught 2 nd graders. Believed in direct instruction.	Considers herself a novice. Believed in direct instruction.	Team leader. Believed in direct instruction.	Worked with Anna for nine years. Believed in mastery learning, direct instruction.	Believed in developing students' mathematical thinking through using questioning, manipulatives, and activities.
Teacher's Education	Enrolled in master's of education program.	Completing a specialist's degree.	Master's degree in early childhood education.	Bachelor's degree	Bachelor's degree in early childhood education	Bachelor's degree in science	

Data Sources

The sources of data were interviews and field notes to capture participants' perceptions of the team's development over time. An interview guide listing the questions or issues to be explored in the course of an interview was prepared to "ensure that the same basic lines of inquiry are pursued with each participant interviewed" in the early part of the interview (Patton, 2002, p. 344). The participant is free to pursue any subjects of interest that arise in latter parts of the interview (Patton, 2002). Each teacher participated in eight interviews. All the interviews were usually conducted in the participants' classrooms at the end of a school day and audio-taped then transcribed by the researchers. We conducted the first interview before the program began to elicit the teachers' beliefs about teaching and learning mathematics. The next six interviews occurred almost immediately after each laboratory class cycle to trace the team's development, growth, or progress. We conducted the final interview with the teachers three months after the program ended to summarize their professional development experiences. The administrator only took part in the final interview. All the individual interviews with the participants were face-to-face interviews that lasted approximately 40 minutes each. Taken together, the interview data allowed us to investigate team development over time.

Data Analysis

Charmaz (2000) suggested five techniques for using the constant comparative method: (a) comparing aspects of different people (such as their views, situations, actions, accounts, and experiences), (b) comparing data from individuals with data from themselves at different times, (c) comparing an incident with another incident, (d) comparing data with a category, and (e) comparing a category with other categories. In this study, we compared incident with incident to analyze teachers' perceptions of team development in the professional development program. Each cycle of preparation, observation, and analysis is defined as an incident. There are four stages in the constant comparative method (Glaser & Strauss, 1967). In Stage 1 of the constant comparative method, the teachers' reactions to their team learning and development were coded to identify key elements of each learning episode. Using those codes, many categories of analysis were formed. Some of the categories were as follows: persons involved in the nature of activity, setting and timing of the episode, and participants' immediate responses. In Stage 2 of the constant comparative method, more interview data were included to connect each team development experience to the created categories. In Stage 3, using theoretical criteria described by Glaser and Strauss, the list of categories for collecting and coding data was cut

down to focus on applicable incidents. In Stage 4, the theoretical framework was written to provide the content behind the categories and their properties. A hypothesis was developed as a result of the framework to explain certain social processes and their relationships.

Findings

We describe how the team developed according to five stages of team development (Tuckman & Jenson, 1977): forming, storming, norming, performing, and adjourning. The model, however, did not completely fit the six teachers' behavior. This team was started at the second stage of Tuckman's model, storming, before experiencing the other stages.

Storming

The storming stage was characterized by conflict. According to Ivy, tension resulted from cliques forming within the team of teachers. Mary and Kay were sensitive to criticism leveled at them by Macy and this created an atmosphere of uneasiness. In response, Mary was reluctant to share what she considered effective teaching practices. Kay, being new to the team, was overwhelmed by the team's dynamics thus contributing to her discomfort.

Anna and Macy, team members for more than a decade, were good friends and went through the mastery program together. They were not satisfied with the composition of the current team and had difficulty accepting new teachers to this team. Part of the conflict that arose can be explained by the differences in Anna and Macy's preferred methods of mathematics instruction with respect to other team members. Before the program, they had mostly used what they called the show-and-tell method, along with drill-and-practice. They had been unable to accept other ways of teaching because they believed that the newer methods of teaching were a threat to their confidence and authority as teachers. As the novice teachers tended to advocate more innovative teaching styles Anna felt that her teaching methods were becoming obsolete. Linda also observed that "there was very little collaboration, more hostile feeling...in the sense that there was inferiority in that team". Rather than dealing with the conflicts, Mary, Anna, and Kay withdrew from the team. Initially, I (Cheng), as the professional developer, did not help the team resolve the conflicts. Instead, I focused on the teaching cycle and how it could be refined to meet the teachers' expectations. The teachers were more willing to participate in the research study once they realized I was there in a supportive and non-judgmental capacity.

Transition from Storming to Forming

The team began to form after receiving direction from the administration. This occurred during the first three laboratory class cycles. In this stage, members determined how they would relate to other team members, and it was a period of anxiety for them.

There were also moments when Mary, Kay, Anna, and Macy were in different stages at the same time. For example, Mary and Kay continued to receive harsh critiques from Macy, an issue still unresolved by the third laboratory class cycle. Mary, still affected by the tensions in the team, coped by not sharing her ideas during team meetings. Instead, during the interviews, she suggested many ideas to help the team grow and bond. Kay managed the situation by concentrating on the support she received from some of the team members. She was also unsure of herself as a teacher in the school and preferred to focus on her teaching rather than activities of the team.

During the first three laboratory class cycles, Macy could not fully form with all members of the team. She was disconnected from the new team members because of a perceived lack of acceptance of her teaching style. Macy also said that some teachers needed to be more accepting of their team members and other teachers were open to suggestions, but only from certain team members. Because the current team was not united, she thought her former team, having the same members for many years, was much closer. Linda said Anna coped with the tension by isolating her teaching practice from colleagues and playing a passive role as the team leader during the first year of the program.

At the beginning of the second year of the professional development, Anna started to assume her role as a team leader by having an agenda for each meeting to help the team focus on the issues to be addressed. She requested each team member submit announcements in advance of meetings and prepared a copy of the compiled announcements for each member at meetings. During the third laboratory class cycle, Anna said she started to allocate time for each announcement so that more time could be devoted to the professional development program. Ivy said that the agenda helped the team to stay focused. When Lana and Ivy were in the forming stage, they believed in teamwork and looked to the team for support. They recognized the conflict and tensions among the team members and were hopeful that the team would learn to cooperate.

Norming

According to the teachers, the transition from the forming to the norming stage was influenced by the administrator's insistence on the teachers setting norms during the two years of the program. Talking about the norms during the meeting allowed the teachers to set expectations for the team, such as maintaining productive dialogue, and to set the team's mission. Everyone felt uneasy with the norms at first because according to Kay "if we put [the norms] on paper we felt like we have to do it."

In the norming stage, the team developed trust and began collaborating. This stage occurred during the fourth laboratory class cycle and continued throughout the rest of the research study. As the professional developer, I was leading the teachers less; the teachers appeared to be leading and charting what they wanted to plan for their lessons. Collaboration and trust could be seen when the teachers worked in pairs to plan demonstration lessons and critique each other's implementation of those lessons. The team was now comfortable sharing their ideas around the table, potentially improving the quality of the meetings.

As the teachers assumed a greater role in the team leadership, they agreed on their roles and responsibilities. Mary and Ivy assumed special roles on the team. Because the school used different textbook series for first and second grade, Mary's experiences teaching the first grade the previous year helped the team to fill in some gaps in the second grade curriculum. Teaching in the higher grades in the same school system helped Ivy contribute to the team in planning lessons that prepared students for the next grade level. Her specialist degree program exposed her to new ideas about teaching. She was doing an internship with her mentor as they conducted different workshops for teachers, and she enjoyed bringing information back to the team from the workshops she was assisting with as part of her internship. Ivy believed the program enabled her to find another role on the team as she realized she could also be a bridge between education policy makers and the teachers, giving her more confidence to share her ideas with the team. Like Mary, having a specific role on the team with something to contribute made Ivy feel that she was a part of the team.

The program was a growing experience for Anna because it had helped her to "step out of the box, try something new, and try to get along with other people" (Anna interview). Anna came to agree on the relationship with the new members in the team in this stage, finally accepting that there would always be new

members of the team. Also, she had learned to accept the differences among her team members, a significant change in her perspective. She no longer felt inferior to other team members and was able to acknowledge the strengths of other members and how they complimented one another. The change in how Anna perceived her role on the team had brought about a change in the entire team.

Performing

In the performing stage, the team was fully functioning, and members identified with the team. This stage occurred during the fifth and sixth laboratory class cycles, while the team was still norming. Mary said that in comparison to the beginning of the year, the team was more open to suggestions during the fifth laboratory class cycle. She felt encouraged by teachers responding positively to the program. She observed that the teachers who were not receptive to the program previously were now more open to change and more willing to try new ideas in their classrooms during the sixth teaching cycle. Mary shared more in the meeting now that she felt part of the team and had received more constructive feedback, support, and encouragement from the team members.

Lana also felt more comfortable sharing because everyone was sharing ideas and critiquing teaching practices, without taking the critiques personally. Kay described the change in the team as from being unreceptive to new ideas to anticipating the sharing of new ideas in every meeting. Linda's observation was consistent with the teachers' perceptions of team growth. She noticed "teachers who were quieter during the first year were now sharing a lot more and were more involved with conversations during the team time" (Linda interview). Those teachers "had grown stronger with a more positive attitude" and she believed that those teachers changed because "they felt safe" to share (Linda interview). The school held a monthly faculty meeting so that teachers could share their ideas about their teaching, assessment, and curriculum. Linda observed that before the professional development program, the second-grade team "would not [necessarily] pipe up or add to conversations [during the school meetings], whereas now they have started talking about assessment" (Linda interview).

Team members acknowledged the roles within the team; they observed that Anna became more proactive in her team leader role. With the meetings becoming more efficient, she was able to reduce the total number of meetings with her team and not overburden them with meetings, the program, or the research study.

According to Linda, Macy had been the teacher most resistant to any form of change at the beginning of the first year of the program. Linda said she was very impressed with Macy's change in her mathematics instruction and Anna's change in assuming a stronger leadership role at the end of the study. She thought their changes directly influenced the rest of the teachers on the team, along with other members of the school faculty.

In this stage, the team members continuously engaged in reflective dialogue, consensus building, and self-assessment. These activities were evident in Anna's and Macy's behavior during the sixth teaching cycle. Macy suggested more ideas for the planning of the demonstration lessons and made kinder remarks during the critique sessions. Anna acknowledged her own weaknesses and reflected on how those weaknesses had restricted the way she viewed others. She was now ready to accept the new team and felt that having the team members share their ideas was helpful in promoting understanding among the teachers.

The team was now performing with a common goal of incorporating the new state standards into their curriculum. Lana thought that planning the demonstration lessons as a team helped the team members understand each other's teaching styles and personalities. Team planning gave the teachers opportunities to share, justify, and clarify the presentation of a lesson. This planning of lessons as a team created opportunities for the teachers to clarify misunderstandings and to appreciate the strengths of every teacher. The opportunity to work with colleagues in the laboratory class format fostered growth in the team. The teachers learned to put their personal differences aside to focus on the learning of the children. Lana believed the program especially boosted the confidence of the more experienced teachers because their ideas and strengths were recognized and respected, and they were accepted as part of the team.

This person might not have felt like their ideas were valid because they have been teaching for a while, and a lot of their ideas might be older and outdated. Really, they were very good ideas, and I think that kind of gave them more self-worth and made them feel like, Oh well, I have been doing all this all along, and my ideas are still valid; I am doing the right thing. I think that was the best thing for them. (Lana interview)

Kay said that the weekly meetings conducted over an extended period of time allowed the new and the more experienced members of the team to communicate with one another, promoting growth and

understanding among the team members. Anna felt that respect for one another was a key factor in promoting the team's growth and effective functioning. According to Anna, the newer team members' increased respect for the more experienced teachers reduced the tensions between them. Linda made the same observations, noting that by the end of the program, the teachers believed that "they are equals and that they are on the same playing grounds as the rest of the teachers on the team" (Linda interview).

Adjourning

Linda felt that the adjourning stage began at the end of the sixth laboratory class cycle, and continued after the program ended. The team witnessed Macy turn from a drill-and-practice mathematics teacher to one who was open to trying different techniques in her classroom. For example, she began to incorporate the use of manipulatives in her teaching. Ivy said that Macy changed because of the new state standards and because the program had goals that aligned with those standards. Furthermore, Macy's positive change improved her relationship with the rest of the team members and their participation in the program.

All of the teachers continued to teach second grade the following academic year and, three months after the program ended, the team made plans for their own professional development. They believed that the program was helpful and they developed their own teaching cycle by scheduling teachers to lead their own weekly professional development meetings. Anna assumed a greater leadership role in the team and ensured the program ran smoothly. According to Linda, the team was regarded as a model for the other teams in the school in terms of collaboration in teaching mathematics. This recognition by other teachers in the school district further enhanced the second grade teachers' motivation to continue to support each other in their teaching practices and continue their own professional development the following academic year.

Summary and Discussion

This study employed the laboratory class cycle in a school-based professional development to improve and support teachers' learning and teaching. We showed that the team stormed before they formed, reversing the order of the first two stages in Tuckman and Jenson's (1977) model. The team developed into an effective team towards the end of the professional development program. There was a high level of collaboration among the teachers as they worked towards a common goal of improving their teaching practices and

students' learning. After the project ended, the teachers sustained the professional development by creating an experience similar to the laboratory class cycle.

Team Growth through Teaching Cycle

The data showed that teacher change can trigger team growth and vice versa. This supports Putnam and Borko's (2000) claim of two directions learning: the role of the individual in the development of the team and the role of team in the development of the teacher. Specifically, individual teachers enriched the discussions of the team through their ideas and ways of thinking, while the way the team viewed and modified mathematics instruction affected individual teachers. This suggests that school-based professional development programs need to afford opportunities for individual teacher development and team development in order to be effective. The teaching cycle can be a viable model to promote individual teacher development and team development because it provides a formalized structure for collegial coaching. The shared experiences and the type of interactions afforded by the teaching cycle reduce isolation and strengthen professional and personal relationships among teachers. Through such interactions, teachers begin to acknowledge others' strengths and to value the distributed expertise provided by various members of the team. This supports Truscott and Truscott's (2004) finding that "acknowledging teacher strengths as internal resources fostered positive social climate overall and reinforced new learning for the teachers" (p. 62).

The teaching cycle created a culture in which the teachers were more willing to exercise the traits of critical collegiality, as seen in the final stages the team members experienced (Lord, 1994). Teachers who initially viewed disagreement as personal insults learned to view disagreement as opportunities to consider different perspectives and clarify their beliefs. Turning teachers' attention away from animosity towards a focus on helping children learn through observing and critiquing lessons enhanced critical collegiality. As in Gordon (2004), and in the programs of Frykholm (1998) and Seago (2004), this professional development program helped establish trust, model communication norms that enabled critical dialogue, and maintain a balance between respecting individual team members and critically analyzing their teaching.

Team Growth through the Cooperative Work of Experienced and Novice Teachers

The blending of these two groups proved to be essential to the effectiveness of this team. Established members may take for granted the assumptions behind the school's rules and procedures, preventing them from completely understanding the experience of a newcomer. This finding is consistent with Kardos, Johnson, Peske, Kauffman, and Liu's (2001) observation that teachers who have taught for many years may not realize the difficulty for a newcomer to enter, explore, and understand her place among the more experienced teachers. In accordance with Hughes (1958), this study shows that the newcomer, faced with an uncertain situation, lacks reference points for appropriate behavior and experiences a surprise upon entering the new situation, as was seen in the storming stage by Mary and Kay. As illustrated in the norming stage for Mary and Ivy, their anxiety decreased after they identified their specific roles on the team (Berlew & Hall, 1966; Feldman, 1976; Louis, 1980).

Experienced teachers may have established systems for running their classrooms that dissuade and constrain them from trying new approaches that might threaten those systems. This was evident in Anna and Macy's experiences during the forming and storming stages. Experienced teachers should not be neglected because they also need guidance and support to cope with changes. Our findings contribute to research on developing effective teams by recognizing the different needs of team members, based on their level of teaching experience.

The teaching cycle can be a model that offers intellectual nourishment and renewal to teachers. In this study, the teaching cycle helped the more experienced teachers cope with changes around them and ushered new teachers into the team by helping them find their roles. We see in the final stages that it is possible to bring about an effective team invested in an environment of continuous inquiry and improvement when the team's focus is redirected toward students' mathematical learning and achievement.

Conclusion and Future Research

One limitation of the study is the required participation of the team members. Future research on school-based professional development should focus on factors of team building with teachers who volunteer for a similar program. If participation is not mandatory, teachers might progress through the stages differently than described here.

This study showed that trust needs to be established before teachers can experience personal and professional growth. Team development is an uphill task, particularly when team members are resistant to change. To build collegial relationships among team members, both team members and professional developers must make a commitment over an extended period of time. When teachers are provided with the support they need for professional development, they begin to place a significant value on continuous learning.

References

- Ball, D. L. (1994, November). *Developing mathematics reform: What don't we know about teacher learning but would make good working hypotheses?* Paper presented at Conference on Teacher Enhancement in Mathematics K6, Arlington, VA.
- Ball, D. L., & Cohen, D. K. (1999). Developing practice, developing practitioners: Towards a practice-based theory of professional education. In L. Darling-Hammond & G. Skyes (Eds.), *Teaching as the learning profession* (pp. 3–31). San Francisco: Jossey-Bass.
- Beyerlein M. M, Johnson, D.A., & Beyerlein, S. T. (1995). *Advances in interdisciplinary studies of work teams*. Greenwich, CT : JAI Press.
- Berlew, D. E., & Hall, D. T. (1966). The socialization of managers: Effects of expectations on performance. *Administrative Science Quarterly, 11*, 207–223.
- Charmaz, K. (2000). Grounded theory: Objectivist and constructivist methods. In N. K. Denzin & Y. K. Lincoln (Eds.), *Handbook of qualitative research* (2nd ed., pp. 509–535). Thousand Oaks, CA: Sage.
- Clarke, D., & Hollingsworth, H. (2002). Elaborating a model of teacher professional growth. *Teaching and Teacher Education, 18*, 947–967.
- Cohen, S. (2004). *Teachers' professional development and the elementary mathematics classroom: Bringing understandings to light*. Mahwah, New Jersey: Lawrence Erlbaum.
- Dechant, K., Marsick, V. J., & Kasl, E. (2000). Team learning: A model for effectiveness in high performing teams. In: M. Beyerlein, D. Johnson, & S. Beyerlein (Eds.), *Advances in interdisciplinary studies of work teams*, Vol. 7 (pp. 1–19). Greenwich, CT : JAI Press.
- Demulder, E. K. & Rigsby, L. C. (2003). Teachers' voices on reflective practice. *Reflective Practice, 4* (3), 267–290.
- Donovan, M., Bransford, J., & Pellegrino, J. (2000). *How people learn*. Washington, DC: National Academies Press.
- Feldman, D. C. (1976). A contingency theory of socialization. *Administrative Science Quarterly, 21*, 433–452.
- Frykholm, J. A. (1998). Beyond supervision: Learning to teach mathematics in community. *Teaching and Teacher Education, 14*, 305–322.
- Fullan, M. G. (1991). *The new meaning of educational change* (2nd ed.). New York: Teachers College Press.
- Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal, 38*, 915–945.
- Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Chicago: Aldine.
- Gordon, S. P. (2004). *Professional development for school improvement: Empowering learning communities*. Boston: Pearson Education.
- Grossman, P., Wineburg, S., & Woolworth, S. (2001). Toward a theory of teacher community. *Teachers College Record, 103*, 942–1012.
- Guskey, T. R. (1986). Staff development and the process of teacher change. *Educational Researcher, 15*(5), 5–12.
- Howey, K. R., & Joyce, B. R. (1978). A database for future directions in in-service education. *Theory Into Practice, 27*, 206–211.
- Hughes, E. C. (1958). *Men and their work*. Glencoe, IL: Free Press.
- Johnson, N. (1989). *Teachers and change: A literature review*. Unpublished manuscript, Melbourne University, Melbourne, Australia.
- Johnson, N. (1996, July). School leadership and the management of change. *IARTV Seminar Series*, No. 55, p. 12.
- Kardos, S. M., Johnson, S. M., Peske, H. G., Kauffman, D., & Liu, E. (2001). Counting on colleagues: New teachers encounter the professional cultures of their schools. *Educational Administration Quarterly, 37*, 250–290.
- Kruse, S., & Louis, K. S. (1997). *Teacher teaming: Opportunities and dilemmas*. (ERIC ED 383 082).
- Lane, S., & Silver, E. (1994, April). *Examining students' capacities for mathematical thinking and reasoning in the QUASAR project*. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.
- Little, J. W. (2002). Locating learning in teachers' communities of practice: Opening up problems of analysis in records of everyday practice. *Teaching and Teacher Education, 18*, 917–946.
- Lord, B. (1994). Teachers' professional development: Critical collegiality and the role of professional communities. In N. Cobb (Ed.), *The future of education: Perspectives on national standards in education* (pp. 175–204). New York: College Entrance Examination Board.
- Louis, M. R. (1980). Surprise and sense-making: What newcomers experience in entering unfamiliar organizational settings. *Administrative Science Quarterly, 25*, 226–251.
- Lovitt, C., & Clarke, D. M. (1988). *Mathematics curriculum and teaching program*. Carlton, Victoria, Australia: Curriculum Corporation.
- McLaughlin, M. W., & Marsh, D. D. (1978). Staff development and school change. *Teachers College Record, 80*, 69–94.
- McLaughlin, M. W., & Talbert, J. E. (2001). *Professional communities and the work of high school teaching*. Chicago: University of Chicago Press.
- Patton, M. (2002). *Qualitative research and evaluation methods*. 3rd ed. Thousand Oaks, CA: Sage

- Putnam, R., & Borko, H. (1997). Teacher learning: Implications of new views of cognition. In B. J. Biddle, T. L. Good, & I. F. Goodson (Eds.), *The international handbook of teachers and teaching* (pp. 1223-1296). Dordrecht, The Netherlands: Kluwer.
- Putnam, R., & Borko, H. (2000). What do new views of knowledge and thinking have to say about research on teacher learning? *Educational Researcher*, 29(1), 4-15.
- Seago, N. (2004). Using videos as an object of inquiry for mathematics teaching and learning. In J. Brophy (Ed.), *Using video in teacher education* (Advances in Research on Teaching, Vol. 10, pp. 259-289). Orlando, FL: Elsevier.
- Smith, M. S. (1997, April). *Riverside Middle School: School reform supported by an innovative curriculum*. Paper presented at the annual meeting of the American Educational Research Association, Chicago.
- Smith, M. G. (2000). *Practice-based professional development for teachers of mathematics*. Reston, VA: National Council of Teachers of Mathematics.
- Stein, M. K., Silver, E., & Smith, M. S. (1998). Mathematics reform and teacher development: A community of practice perspective. In J. G. Greeno & S. Goldman (Eds.), *Thinking practices in mathematics and science learning* (pp. 17-52). Mahwah, NJ: Lawrence Erlbaum.
- Stein, M. K., Smith, M. S., & Silver, E. A. (1999). The development of professional developers: Learning to assist teachers in new settings in new ways. *Harvard Educational Review*, 69(3), 237-269.
- Truscott, D. M., & Truscott, S. D. (2004). A professional development model for the positive practice of school-based reading consultation. *Psychology in the Schools*, 41(1), 51-65.
- Tuckman, B. W. (1965). Developmental sequence in small groups. *Psychological Bulletin*, 63, 384-399.
- Tuckman, B. W., & Jenson, M. A. (1977). Stages of small group development revisited. *Group and Organizational Studies*, 2(4), 419-427.
- Wilson, S. M., & Berne, J. (1999). Teacher learning and the acquisition of professional knowledge: An examination of research on contemporary professional development. In A. Iran-Nejad & P. D. Pearson (Eds.), *Review of research in education* (pp. 173-209). Washington, DC: American Educational Research Association.
- Wood, F. H., & Thompson, S. R. (1980). Guidelines for better staff development. *Educational Leadership*, 37, 374-378.