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Available online: 26 Aug 2008

To cite this article: Nance S. Wilson (2008): Teachers expanding pedagogical content knowledge: learning about formative assessment together, Journal of In-Service Education, 34:3, 283-298

To link to this article: http://dx.doi.org/10.1080/13674580802003540

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Teachers expanding pedagogical content knowledge: learning about formative assessment together

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The present study explores the ways in which participating in a study group helped five US middle school teachers alter their construction of knowledge. The members came together to improve their knowledge on assessment for learning in response to school-level and district-level pressures. The analysis was a recursive review of teacher statements and actions in the study group as well as the classroom through the lens of pedagogical content knowledge. The support and collegiality of the group demonstrates how collaborative groups can develop professional growth. The examination of the data looked at how participation in a study group focused on assessment for learning changed the structure of pedagogical content knowledge for participating teachers and what components of the study group led to those changes.

Introduction

The present article explores the development of teacher knowledge during a teacher learning community. These learning communities have proved effective in helping teachers question routines and examine new ideas while engaging in a collaborative effort to build knowledge (Grossman et al., 2001; Little, 2003; Good & Weaver, 2003). Teacher educators have learned that the benefits of one-day workshops are rarely permanent as the learning is not sustained (Hargreaves, 1995), and they violate the key conditions for teacher learning (Newman et al., 2000). In teacher learning communities, professional development is an ongoing process that meets the teacher’s needs for personal and professional growth that includes reflection and the development of skills and knowledge (Middlewood et al., 2005).

A teacher study group is one example of a teacher learning community. It is created by teachers who are interested in taking charge of their own learning and

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ISSN 1367–4587 (print)/ISSN 1747–5082 (online)/08/030283–16
© 2008 International Professional Development Association (IPDA)
DOI: 10.1080/13674580802003540
transformation. The participants in the study group negotiate a balance between theory and practice while discussing a common goal (Birchak et al., 1998). In this environment, the teachers are safe to try new ideas, reflect on implementation and work with each other to change practice. The teachers meet for a sustained period of time to address a common goal, open-up a dialogue, help build connections between theory and practice, and support each other in making curricular changes (Birchak et al., 1998). The model of teacher study groups as a mode of professional development emphasizes that teachers are professionals involved in complex decision-making (Butler et al., 2004). It is through these professional discussions and ongoing learning that the teachers’ professional knowledge base changes (Borko & Putnam, 1995).

The professional knowledge base refers to the structure of teachers’ knowledge; how knowledge is organized. Shulman (1986) proposed a theoretical model for components of teacher knowledge known as pedagogical content knowledge (PCK). PCK is the construction of interrelated knowledge that includes two or more of a teacher’s knowledge of students, content, curricular goals, instructional techniques and materials, and context (Wilson, 2006).

This study examines teacher knowledge development during a teacher study group. The participating teachers were self-selected to engage in dialogue regarding assessment for learning. The participants were all US urban teachers working with 11–15 year olds in the English/language arts. The lens used to examine the teachers’ knowledge was the structure of their PCK. A core belief of this study was that knowledge is dynamic and changing, and that as teachers learn their knowledge changes.

Purpose/rationale

The topic of professional development is as important as the structure. Assessment for learning, when teachers collect evidence to design instruction that meets the needs of students, was chosen as a topic for this professional development initiative because the volunteering teachers demonstrated an interest in improving classroom assessment systems. Educational initiatives have identified standards for learning that students must meet, and imposed consequences on school districts and schools who do not meet standards (No Child Left Behind Act, 2001); thereby causing teachers, schools and administrators to feel pressure to raise student achievement. Schools are responding by implementing standardized assessments and creating assessment systems to assure students that continually work towards achieving the state standards. In order to become better at targeting instruction to meet students’ needs, teachers have turned toward assessment for learning. The goal of assessment for learning is to improve learning by improving instruction rather than using assessment to reflect on instruction.

Assessment for learning requires teachers to integrate areas of knowledge to make appropriate instructional decisions (Black & Dylan, 1998). Assessment requires that teachers collect evidence to design instruction that meets the needs of students. Torrance and Pryor (2001) conducted a study to investigate the development of
formative assessments in schools, and found that teachers need to examine critically their practice regarding assessment while engaging in discussions around assessment for learning. This supports Black and Dylan’s (1998) conclusions that the development of teacher knowledge regarding assessment for learning is complex and related to both theoretical understanding and practice. Additionally, Hayward et al. (2004) identified professional development focused on assessment for learning as a vehicle for teacher development.

The teachers participating in this study analyzed professional literature, examples of assessment for learning and their own classroom/school practices. They focused on language arts assessments, particularly reading comprehension, writing and poetry performance. The author, a professional development provider, designed the study group as a vehicle for analyzing teacher knowledge.

**Theoretical assumptions**

The evaluation of the professional development initiative in this study was based on three theoretical assumptions. The first assumption was that the professional development of teachers is a lifelong ongoing process (Cole & Knowles, 1998) that is most meaningful when it is closely connected to teachers’ work in classrooms (Wilcoxon, 1998). Professional development helps teachers identify significant issues of practice, encouraging teachers to study their students and classrooms and giving teachers the opportunities to construct and reconstruct curriculum (Cochran-Smith & Lytle, 1999), thus challenging their past assumptions. The teachers engage in the professional development because areas of interest are addressed and the learning links theory and practice, two key conditions of professional development (Fraser et al., 2007).

The second assumption was that learning takes place within contexts of meaningful interactions with others, in line with socio-constructivist notions (Vygotsky, 1978). Teachers learn as they interact with new knowledge as individuals and through the discussions they have with others (Wertsch, 1985). Teachers have the opportunity, as a learning community, to explore how their understanding impacts their students. The study group met the social conditions deemed important for effective professional development.

The third assumption was that the study of assessment for learning would change the PCK of participating teachers. This assumption is based on research showing that the study of formative assessment in professional development generates new knowledge (Black et al., 2003; Hayward et al., 2004). This study examines whether a professional development initiative, connected to teachers’ work in classrooms, taking place in the context of encouraging dialogue and focused on assessment for learning, would affect the structure of the teachers’ professional knowledge base.

**Methodology**

The present study used a qualitative orientation with a case-study design to study the teachers’ PCK during the professional development. The researcher was the facilitator
and principal investigator whose role was to collect all data and provide professional readings and assessment models. The analysis was focused on what the teachers did in the meetings as well as in their classrooms in relation to assessment for learning. The teachers’ study group interactions and responses to interview questions were analyzed for expressions of PCK and changes in the structure of those expressions as well as the factors within the design and implementation of the study group that contributed to those changes.

Structure of the professional development initiative

The design of the study group met the first two assumptions of the study, giving the teachers time to analyze their classrooms and construct/reconstruct knowledge as they interacted in a teacher study group. The participating teachers interacted through professional conversations over a 15-week period. Each meeting began with informal conversations during which teachers discussed individual students, school concerns and personal issues. The official meeting discussions began with professional readings, chosen by the author, and focused on assessment for learning. Topics included an overview of assessment for learning (Black & William, 1998; Carmelich, 2002), information on scoring rubrics (Moskal, 2000; Mertler, 2001), defining classroom goals (Stiggins, 2001), and literacy assessment techniques (Afflerbach, 1993). As the group discussed the readings, they shared personal experiences, lessons learned and other reflective thoughts.

Following this discussion, the author modeled the use of assessment for learning techniques. The modeling served two purposes: it allowed the author to demonstrate the use of professional knowledge; and it gave the teachers an opportunity to talk about how knowledge was integrated. The modeling included think alouds regarding the use of student data to plan instruction, the creation of clear achievement targets, using those clear achievement targets to create rubrics, using rubrics to plan instruction, creating and using anecdotal records, and miscue analysis. The participants developed their own assessments and discussed how they would apply what they were learning.

Participants

The five sixth-grade through eighth-grade teachers who participated in this study were volunteers interested in learning more about the topic of assessment for learning. At some point during the study, they each expressed concern about meeting their schools’ goals of developing and implementing assessment systems. It is significant that the participants were volunteers because teacher choice was found to be an important factor in determining engagement (Dillion et al., 2000).

The participants had a range of experience extending from 0 to 22 years in the classroom. Within the range of experience, the participating teachers (pseudonyms are used in place of participants’ names) had different levels of education. Two of the teachers taught seventh and eighth grades: Tammy was Nationally Board Certified in language arts with 13 years of experience, and joined to improve her use of rubrics to inform
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Data sources

Multiple data collection techniques were employed for this study. There were study group fieldnotes, classroom observations and two kinds of structured open-ended interviews. The author completed all data collection and transcription.

The two structured interviews were used as evaluations of teachers’ expressions of PCK. To ensure that the participants’ responses were captured accurately, the interviews were audio-taped and transcribed. The interviews served two different purposes. The first was a pre–post interview was developed using questions concerning each area of PCK within and across the areas of knowledge. The second interview was used to identify expressions of PCK in relation to an individual incident of classroom instruction. The questions were developed using Content Representation developed by Loughran et al. (2004). This interview took place before each of the five classroom observations. Although the participants were not given the questions beforehand, it can be assumed that participants learned the questions after the second interview.

Five classroom observations were conducted for each participant. The goal of the observations was to gather data about how teachers enact their knowledge of PCK. Prior to each observation, the structured interview discussed above was administered to ascertain the teacher’s goal, knowledge of students, content area, assessment and instructional techniques pertaining to the observed lesson. The participating teachers’ actions were aligned with responses from this interview by analyzing the classroom environment, teacher actions and student actions as exemplars of knowledge shared in the interview. Two of the observations were designed to capture pre and post practices. Three occurred during the study group time.

The final data source, study group fieldnotes, was created using transcripts of audio-recordings and reflective comments from the participants and the author. The reflective comments of the author included impressions gathered during the course of the study group meeting, whereas the comments of participants were those expressed before taping began or after it was completed. The author transcribed the audio recordings. The fieldnotes documented the comments and interactions of the participants capturing expressions of PCK. The transcriptions of the study group meetings were shared with the participants, however the reflective comments were not.
In sum, the data that were collected included pre and post interviews, classroom observations preceded by interviews and transcriptions of study group interactions over a 15-week period. Each data source sought to capture how PCK changed while teachers participating in a study group focused on assessment for learning. This study used three types of data-gathering techniques: observation, interviewing, and document collection to achieve triangulation.

Data analysis

Tool for analysis

The tool used to examine the data was the areas of knowledge that make up PCK: knowledge of students, content, instructional strategies and curricular goals. The readings were selected from peer-reviewed sources on formative assessment and literacy instruction; therefore, it was assumed that the sources of knowledge were valid. The professional readings and the modeling sessions were designed to purposefully encourage discussion regarding each area of knowledge and to encourage integration among areas of knowledge. For instance, ‘Stances and Dances: The Negotiation of Subjectivities in a Reading/Language Arts Classroom’ (Broughton & Fairbanks, 2002) and ‘Anecdotal Records: A Powerful Tool for Ongoing Literacy Assessment’ (Rhodes & Nathenson-Mejia, 1992) led to discussions about students’ motivation, their differences in talents, and how students learn and understand content. Teachers’ content knowledge referred to knowing ‘that’ about the concept they are teaching (Rovegno, 1994) was addressed in numerous readings including, but not limited to, ‘Responing to Audience: Using Rubrics to Teach and Assess Writing’ (Wyngaard & Gehrke, 1996). Another component of a teachers’ knowledge base is the knowledge of the curricular goals for students in the subject they are teaching as well as the articulation of those goals across grade levels (Magnusson et al., 1999). The participants learned about creating clear achievement targets in readings such as ‘Finding the Right Words’ (Babb, 2002) and ‘Defining Clear Achievement Targets’ (Stiggins, 2001). Other readings addressed knowledge of instructional techniques such as ‘Using Data to Differentiate Instruction’ (Brimijoin et al., 2003) and ‘STAIR: A System for Recording and Using What We Observe and Know about Our Students’ (Afflerbach, 1993). A teachers’ knowledge of instructional techniques and materials includes general pedagogical and subject-specific instructional techniques (Morine-Dershimer & Kent, 1999). The modeling sessions were opportunities for the teachers to see assessment for learning in action. The author developed the modeling sessions based on the professional readings for the week. Each session focused on assessment for learning and was aligned to the areas of PCK. Thus, the tool for analysis was also a tool for the design of the learning community.

Although in the above discussion of PCK the individual areas of knowledge are defined separately, in practice the constructs are interrelated. In this analysis, the components of PCK were analyzed to determine the degree to which the teachers integrated knowledge. Teachers’ comments and actions were examined for representations
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The present study sought to examine how participation in a study group focused on assessment for learning changed the nature of PCK and what components of the study group led to those changes.

**Analysis technique**

The analysis of the data using PCK was a recursive process to determine the frequency of comments in which the participants used more than one area of PCK in a unit of analysis. The unit of analysis was defined as a response to a specific question or prompt during interviews and study group meetings as well as turns taken during study group interactions.

The areas of PCK included knowledge of students, content, instructional strategies and curricular goals. Items that coded knowledge of content or subject matter exhibited the teacher’s knowledge of the language arts, including, but not limited to, knowledge of reading, writing, vocabulary, grammar, comprehension and fluency. The knowledge of students’ code included items that exhibited teachers’ knowledge of students, including, but not limited to, knowledge of students’ achievement and...
typical problems students have in the language arts. Items given the code of knowledge of instructional techniques and materials exhibited the teachers’ knowledge of strategies and materials. The knowledge of curricular goals category included items that demonstrated teachers’ knowledge of state, school and classroom goals for the language arts. In addition to the areas of PCK, a category for assessment was added to the analysis, as this was the topic of the study group and believed to be key in changing teachers’ knowledge.

Initially, the individual instances, meetings, interviews and observations were reviewed for exhibitions of PCK, including assessment. Later the data were reviewed for an aggregation of instances (Stake, 1995), in which the data were analyzed for changes in teachers’ PCK. Data were also coded by their placement in the study. Data collected during the first four weeks of the study were coded as beginning. Data collected in the middle seven weeks of the study were coded as middle, and data collected in the last four weeks of the study were coded as end. The periods were delineated as such because during the first and last four weeks of the study benchmark interviews and observations occurred, marking these periods as pre and post measures. The middle period was labeled as such because it was when much of the learning and discussion about evidence-based instruction occurred. Coding the data by time permitted the analysis to determine how PCK was expressed differently throughout the study.

The data analysis included coding discussions with a person outside the study. This process involved coding discussions to assure reliability in the coding process. The code map was reviewed with this person and she received training in the terms and determination of the unit of analysis. After training, the researcher and the outside coder agreed on assigned codes 90% of the time.

Findings

Throughout the study, the teachers engaged in discussions regarding assessment for learning during the study group meetings. These discussions were influenced by their impressions of the professional literature and the introduction to formative assessment techniques. The comments of the teachers were used as examples of their PCK as they negotiated between new and existing knowledge. The discussions led to changes in the ways that the group as a whole related the areas of knowledge that comprise PCK.

Figure 1 illustrates the frequencies, determined by the percentage of overall comments, in which the teachers used two areas of knowledge within one unit of analysis. The percentages in represent the percentage of times the group integrated two areas of knowledge during the beginning, middle and end of the study.

Initially the group was more likely to relate instructional strategies to students (37% of the time). One way this was demonstrated was when they chose instructional strategies based on students needs. ‘When we are talking about nouns or verbs, I try to get around while they [students] are doing independent practice because some don’t get it’ (Michael, interview, 3 February 2005). Michael’s comment illustrates
how he uses his knowledge of students to choose the instructional strategies of working with students one-on-one.

The teachers integrated knowledge in different ways after interacting with each other and professional literature about assessment for learning. At the end of the study, as shown in Figure 1, the participants related assessment to curricular goals (11% of the time), assessment to instructional strategies (14% of the time), curricular goals to instructional strategies (12% of the time), and instructional strategies to students (12% of the time) (Wilson, 2006). An example of how participants related curricular goals to instruction strategies is ‘[I think about] the goals that I want to students to achieve then I have to decide what to best use in order [to help them] achieve it’ (Jeremy, meeting, 14 April 2005).

Additionally, Ilene illustrates a typical comment in which the participants related assessment to instructional strategies: ‘We did the interview … before we did it we set up the rubric for it … They knew what it [the interview] should look like’ (Ilene, meeting, 28 April 2005).

The finding—that the teachers integrated more areas of knowledge at the end of the study group than at the beginning—led to an examination of the themes that may have caused these changes. The specific factors that appear to have had an effect on PCK include discussions guided by professional literature, and discussions guided by implementation of assessment for learning.

**Discussion**

*Discussion and analysis of professional literature*

Each study group meeting began with a discussion of professional literature read by the teachers. The literature focused on topics related to assessment for learning. The
discussion often began with an open-ended question such as ‘What did you think about the reading?’ During these discussions, it was common for teachers to talk about how they should apply the technique in their classroom.

An example of such a conversation came in response to a reading about setting clear achievement targets (Stiggins, 2004). Setting clear achievement targets is key to assessment for learning because it is the first step in determining curricular needs, assessment needs and instructional needs. Additionally, a teachers’ ability to set clear achievement targets informed the researcher as to his/her integrated PCK of curricular goals and content. In addition, the article (Stiggins, 2004) used to stimulate discussion illustrated the need to link achievement targets to instruction and students. Michael shared how the article demonstrated instructional practices that differed from his:

They made some valid points. They talked about a lot of things I don’t do right now. In regards to starting out with clear expectations about what you want the students to get out of what you are teaching. (Meeting, 10 February 2005)

Michael’s recognition that he did not consider either his curricular goals or students’ needs in planning instruction led to a change in practice. He moved from enacting a lesson because it was next in the book to considering his curricular goals and analyzing student needs in choosing an instructional strategy.

For contractions, I didn’t even use book … because the kids the way that they were talking … I realized that they don’t know how to write because they think the way that they talk is the way they write. So I went through the book and asked myself—What do they need to know to write properly based on the way they talk. (Michael, interview, 21 April 2005)

The changes Michael made were similar to those made by the other participants. His teaching and his knowledge changed.

In response to another reading on student-generated rubrics (Skillings & Ferrell, 2000), Jeremy, Janice, Ilene and Tammy implemented the strategy in their classrooms. Student-generated rubrics involve key factors of assessment for learning. When engaging in this task, teachers must share clear achievement targets with students, provide students with explicit content knowledge, understand their students’ knowledge, and implement assessment as an instructional strategy, thus using assessment to improve instruction.

In response to this reading, Jeremy and Janice identified the instructional strategy they believed would be good for students.

Jeremy: I liked how they allowed children the opportunity to help create the rubric and let children go through the process with the restaurant and what makes a good restaurant, and then, after teaching a particular skill, asking the students what they think would be the best paper and then coming up with student ideas for a really good paper.

Janice: Can I interrupt you? I thought it was a good idea because it, you get the students involved in developing those criteria for what you want to see. Then they know exactly, there is no mistake, they know exactly what is there. They are going to remember it. They are going to internalize it because they were part of the process. (Meeting, 24 February 2005)
These comments were part of the discussion that led four of the teachers to implement the technique. In doing so, the structure of their PCK included the integration of knowledge of curricular goals, instructional strategies, students and assessment—areas of knowledge required to use this technique.

The two examples above illustrate how reading and discussing professional literature had an effect on the teachers’ PCK. As they read, discussed and implemented, the teachers changed the ways the integrated knowledge.

Discussions on assessment—modeling and creating

Throughout the study group, the teachers learned about assessment for learning by examining models and creating their own instruments to use in their classroom. At the beginning of the study, Tammy and Jeremy described their use of assessment:

Tammy: I am giving them a grade.
Jeremy: To get them a grade on their comprehension and writing skills. (Meeting, 20 January 2005)

Their knowledge of assessment was isolated from other areas of knowledge.

During a modeling activity in which the group used a rubric to analyze student work and make instructional decisions, Janice stated: ‘It [students’ success on assessment] depends upon the person or achievement target’ (meeting, 17 February 2005). This comment illustrates a connection between the assessment, students and the curricular goals, demonstrating a change in her PCK resulting from the modeling activity.

When the teachers spent time revising their rubrics, they also engaged in dialogue that led to changes in their PCK. The revision of rubrics took place during the last 30 minutes of each study group meeting. During this time, the participants were encouraged to bring existing literacy assessment tools. Janice and Ilene worked on a writing rubric; Jeremy worked on a rubric to evaluate students’ use of a story map; and Tammy worked on a rubric used to evaluate group poetry performance.

Tammy came to the study group with a rubric she had used to assess her students. The rubric included some curricular goals regarding a group poetry performance, but included no details explaining what achievement of those goals looked like.

During the course of the study, Tammy created a new rubric that clarified her curricular goals while using her knowledge of students to develop levels of expectations. The highest level of the rubric represents her knowledge of curricular goals whereas the other levels were based on her knowledge of students and how they tend to perform relative to the goal (see Table 2).

As Tammy revised her rubric she talked about how it ‘[told the students] what to expect. I gave the students a target … and I got better results than I did before’ (Tammy, meeting, 3 March 2005). She provided the students with a rubric as they worked on the recitation of poetry. Tammy’s use of the rubric demonstrated an integration of assessment, curricular goals, students and instructional strategies. Tammy’s experience details how discussing, viewing and creating tools for assessment for learning led to changes in the structure of her PCK. The other participants
<table>
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<th>Performance</th>
<th>5</th>
<th>4</th>
<th>3</th>
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<tbody>
<tr>
<td>Visual</td>
<td>Group begins in a group pose in a frozen picture suggesting the theme of the poem. Each member (1) gestures when each of his/her lines is spoken, (2) has memorized the poem, and (3) has eye contact with the audience. The group has a movement that is synchronized.</td>
<td>Group begins in a group pose in a frozen picture suggesting the theme of the poem. Some members (1) gesture when each of his/her lines is spoken, (2) have memorized the poem, and (3) have eye contact with the audience. The group has a movement within the performance.</td>
<td>Group stand in a pose. A few members (1) gesture when each of his/her lines is spoken, (2) have memorized the poem, and (3) have eye contact with the audience. Some members have movement within the performance.</td>
<td>Group stands in a straight line. A member gestures when some of his/her lines are spoken. A member of the group has memorized the poem. Some members use eye contact. A few members have movement within the performance.</td>
<td>Group stands as a group. No one gestures. There is no eye contact with the audience. Everyone is reading from the paper. There is no movement within the performance.</td>
</tr>
<tr>
<td>Vocal</td>
<td>Every member has two or more lines to recite. Each line is spoken loudly and clearly enough to be heard. Many times the members will speak a word or phrase in unison. The performance will included three or more styles of poetry.</td>
<td>Every member has one line to recite. Most lines are spoken loudly and clearly enough to be heard. The members will speak a line in unison only a few times. The performance will include two styles of poetry.</td>
<td>Most members have one line to recite. Some lines are spoken softly or are mumbled and are unable to be heard. The members spoke in unison only twice. The performance will include only one style of poetry.</td>
<td>Some members have only one line to recite. Most lines are spoken too softly or are mumbled and are unable to be heard. The members spoke in unison only once. The performance included a poetry style that was unable to be identified.</td>
<td>Few members recite the poem. The lines are spoken too softly or are mumbled making the poem unable to be heard. The members do not speak in unison throughout the performance. The performance does not include a style of poetry.</td>
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experienced similar changes as they discussed the models and created their own rubrics.

Summary

The integration of knowledge appears to have been influenced by the discussions and analysis of professional literature as well as by the modeling and creation of assessment for learning tools. Thus, the findings indicate that interaction in a study group focused on assessment for learning, where discussions played a key role, was an effective tool in changing the PCK of the participating teachers.

The group as a whole experienced a shift in knowledge. The teachers learned about techniques for implementing assessment for learning. A key feature of assessment for learning is the establishment of clear curricular goals. The group as a whole experienced changes in how they related curricular goals to other areas of knowledge. Additionally, there were changes in the teachers’ view of assessment, from assessment to give a grade to assessment that measures curricular goals and influences instructional strategies. These changes in PCK were observed during classroom instruction as well as in interviews and study group meetings.

The teachers recognized the changes they made in their teaching and related these changes to the study group.

I think it was beneficial talking with teachers who teach in the same context. (Jeremy, meeting, 28 April 2005)

I learned this from the discussion. (Janice, meeting, 28 April 2005)

I don't think I would have made these changes on my own … being in the group helped. (Michael, interview, 21 April 2005)

It was good [to share]. (Ilene, meeting, 19 April 2005)

I made changes in my teaching because I was with the group. I was listening to the experiences of the others. (Tammy, interview, 19 April 2005)

As is evident in the above comments, the study group discussions were considered key in changing instructional practice.

Implications

The presented research supports the belief that sustained professional development connected to classroom practice changes the structure of teachers’ PCK. Through this study, the aspects of the professional development that may have led to these changes were uncovered.

The data suggest that discussions, modeling and application exercises led to changes in the structure of teachers’ knowledge. The data suggest teachers recognized these changes as a result of the interaction with their peers. The discussions appeared to be a more powerful source of learning than the readings of professional literature because the teachers did not always read the literature with a critical eye, and in some cases
did not read at all. Consequently their learning, at times, was dependent on others’ understandings of the readings, the modeling sessions and application exercises. The application exercises were also highly dependent on discussion. Teachers created literacy-based formative assessments and implemented them in their classrooms. They discussed the assessments with the group as they created them and after implementing them. In developing professional development where the participants had extended time for discussion and relevant classroom artifact development, the results of previous research was confirmed because planned learning opportunities were combined with informal learning (Fraser et al., 2007).

The research in this study extends previous research on professional learning within professional development. As the teachers learned about formative assessment, they experienced development of their PCK regarding language arts instruction. Some previous research that demonstrated similar findings include areas such as infant education (Torrance & Pryor, 2001), science education (Loughran et al., 2004), and language education (Meijer et al., 1999). In the area of language arts education, this study extended previous research by Hodgen and Marshall (2005) by demonstrating that a group of teachers experienced changes in their knowledge as they learned about formative assessment.

Although not generalizable due to the small number of participants, this study informs researchers about the design of professional development. First, in planning professional development, teachers need time for discussing, viewing and creating artifacts related to the topic. Secondly, assessment for learning is an effective topic of professional development when the goal is to help teachers develop a richer, more integrated PCK.

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