THE INFLUENCE OF COGNITIVE COACHING ON THE PLANNING AND USE OF INSTRUCTIONAL CONVERSATIONS, WITH A FOCUS ON MATHEMATICS INSTRUCTION

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ABSTRACT

Instructional conversations are a teaching method in which teacher and students discuss academic topics with students’ previous experience or knowledge (Tharp & Gallimore, 1988). In order to improve student learning, providing students more opportunities to engage in instructional conversations is often recommended. As research indicates that teachers need external support to promote student talk in such classroom conversations, this study investigated the influence of cognitive coaching on teachers’ planning and use of instructional conversations. Participants included 28 K-12 public school teachers who received a year of professional development to learn instructional conversations. This study included two stages of the investigation. In Stage 1, 28 teachers’ lesson plans submitted over time were analyzed by using multilevel modeling. In Stage 2, a multi-case study was used to examine 8 of the 28 teachers’ growth in instructional conversations by analyzing teachers’ assignment, coach’s feedback on the assignment, and coaching notes. The eight teachers all taught mathematics. The results of the study were consistent with literature on cognitive coaching, instructional conversations, and mathematical discourse. The quantitative and qualitative results suggested that before teachers received their first coaching assistance, their instructional conversation planning scores were low. Once they started receiving coaching, their scores went up with fluctuation in later coaching sessions. Furthermore, three covariates (teaching experience, teaching subjects, and grade levels the teachers taught) were not statistically significant. Qualitative results indicated that teaching experience and the grade level taught did influence teachers’ planning and use of instructional conversations.
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Chapter 1

Introduction

opportunities to verbally express their views provide students with multiple benefits, including increased understandings of complex concepts and academic achievement (Institute of Educational Sciences, 2006; Mercer & Howe, 2012). While research is clear that these instructional opportunities are beneficial to students, teachers appear to lack confidence in their ability to plan for academic conversations, as well as to provide activities that afford such opportunities in class (Nathan & Knuth, 2003; Silver & Smith, 1996). Through external and continuous support in creating this type of learning environment, teacher’s practice and understanding of academic conversations can significantly improve (Saunders, Goldenberg, & Hamann, 1992; Teemant, Wink, & Tyra, 2011).

This study investigated teachers’ change in planning and use of instructional conversations after they received a year of cognitive coaching support. More specifically, this support was designed to help teachers change their classroom organization from whole-class instruction to small-group discussion, as a way to include more opportunities for students to engage in meaningful dialogues. This study was designed in two stages. Stage 1 used multilevel modeling to examine the quality of the written lesson plans from 28 teachers who were involved in a professional development program from the Center for Research on Education, Diversity, and Excellence (CREDE) Hawai‘i Project in 2009-2011. Compared to other subjects, implementation of instructional conversations in mathematics tends to be more challenging (Nathan & Knuth, 2003). Therefore, in order to understand this situation more deeply, Stage 2 involved a multi-case study of eight
teachers. These eight teachers taught mathematics in the elementary and secondary schools. The results from the two stages provided evidence of whether, how, and why cognitive coaching influenced teachers’ professional growth in planning and use of instructional conversations.

**Statement of the Problem**

Encouraging students to actively participate in their learning processes through communicating their thoughts with one another has been promoted in education. For example, the National Council of Teachers of Mathematics [NCTM] developed professional standards for teaching and learning mathematics (NCTM, 1989, 1991, 2000) to address the importance of discourse in mathematics education. Following the trend, the Common Core State Standards Initiative (CCSSI, 2010) published the *Common Core State Standards for Mathematics* (CCSSM). Consistent with this vision, Tharp, Estrada, Dalton, and Yamauchi (2000) further promote that discourse should happen in all K-12 classrooms.

Nevertheless, many teachers still feel challenged, especially in mathematics teaching. Studies on the process of building a discourse environment indicate that it is not easy for teachers to implement the instructional strategy (Goldenberg, 1992/1993; Hufferd-Ackles, Fuson, & Sherin, 2004; Stein, Engle, Smith, & Hughes, 2008), especially when attempting to conduct higher levels of enactment of instructional conversations (Teemant et al., 2011). This is due to teachers’ need to help students stay on the academic topic and respond to students’ unexpected comments or thoughts. One study explained that teachers did not feel well equipped to develop interactive communities with their students, even though they recognized this as being important...
In addition to changing their practice, teachers also need to help students feel comfortable participating in instructional conversations and must be explicit about teaching students how to express themselves in front of their peers (Baxter & Williams, 2010). In addition, fruitful instructional conversations require teachers to have sufficient knowledge of what they are teaching, especially in science and mathematics classes where special forms of language are used and may be different from students’ informal language (National Research Council, 2007). Another challenge is that under test pressure, teachers often reduce the practice that advances students’ higher-level thinking; instead, they focused on drill-like test preparation (Knight & Smith, 2004). Combined, these challenges indicate that many teachers need assistance to enact instructional conversations in their classrooms.

**Purpose of the Study**

The purpose of this study was to analyze how cognitive coaching, a type of professional development, influenced teachers’ professional growth in planning and use of instructional conversations across the academic year. Attending one year of professional development program from CREDE Hawai‘i Project, teachers learned how to plan and use instructional conversations in their practices. The professional development program provided each teacher with cognitive coaching assistance embedded in workshops, classroom observations, and planning and reflection meetings.

This study collected intensive data of teachers’ planning and use of instructional conversations, such as coaching observation notes, teachers’ lesson plans, teachers’ coaching reflection journals, and coach’s feedback on teachers’ lesson plans and
coaching reflection journals. Data analysis of this study focused on the factors that contributed to the development of instructional conversation skills and the role cognitive coaching played in this process. This study included 28 teachers from various grade levels and subjects, so differences and similarities among each of them were also investigated.

Review of the literature found that there is little research on how to measure the effects of professional development on the improvement of teachers’ lesson plans. Furthermore, studies that examined changes in lesson plans after teachers received various types of assistance from other experts tended to only be concerned with the beginning and/or the end results (e.g. Byrum, Jarrell, & Muñoz, 2002; Jacobs, Martin, & Otieno, 2008). Without systematic and longitudinal analysis, it is not clear how teachers changed across time. Instead of only examining the differences between before and after the teachers attended professional development programs, this study aspired to investigate teachers’ change in planning across time. It focused on using a rubric to examine teachers’ written lesson plans and use of instructional conversations and how cognitive coaching helped teachers deal with various challenges in the planning processes.

Assumptions and Research Questions

In this study, I identified four critical assumptions in the design and construction of this research study. First, I assumed that teachers wanted to plan and use instructional conversations, but their classroom environments did not support them to do so or their abilities to plan and use of instructional conversations were underdeveloped. Second, I assumed that after receiving cognitive coaching assistance, teachers’ problematic
personal or classroom environmental factors would be overcome or avoided by teachers.

Third, I assumed that when I compared and contrasted teachers’ planning and use of instructional conversations, I would see a positive connection between teachers’ planning and use of instructional conversations in the collected data. Fourth, I assumed that the progress of planning and use of instructional conversations would be shown in teachers’ lesson plans, teachers’ coaching reflection journals, coach’s feedback on teachers’ lesson plans and coaching reflection journals, and coaching observation notes.

Given these four assumptions, four Research Questions focusing on the interactions between cognitive coaching and teachers’ growth in planning and use of instructional conversations were proposed. They were:

1. To what extent did cognitive coaching influence teachers’ planning of instructional conversations?

2. What factors influenced teachers’ planning and use of instructional conversations in mathematics teaching?

3. What characterized teachers’ development in planning and use of instructional conversations in mathematics teaching, both individually and as a group?

4. How did cognitive coaching influence teachers’ planning and use of instructional conversations in mathematics teaching?

**Overview of the Study**

The rest of the dissertation is organized in the following way. In Chapter 2, I begin by discussing the theoretical framework, where I describe how sociocultural theory is related to this study. I also describe why using instructional conversations in practice is important and why teachers need support in developing their instructional conversation
skills. Furthermore, I compare and contrast how CREDE, NCTM, and CCSSM researchers conceptualize implementation of instructional conversations. This chapter will end by presenting the influence of cognitive coaching on teachers’ learning and the connection between cognitive coaching and the professional development provided by the CREDE Hawai‘i Project.

In Chapter 3, I begin with a rationale for my study. I also explain this mixed-method study by describing the participants, data sources, and data analysis for the quantitative and qualitative studies separately. Finally, I describe my role as a researcher and the procedures I used to increase trustworthiness of my analysis.

In Chapter 4, I describe the results from the quantitative analysis of the 28 K-12 teachers’ lesson plans collected from their six to eight coaching sessions. I also present data from the qualitative analysis of eight teachers’ planning and use of instructional conversations in their mathematics teaching. The qualitative data included the teachers’ lesson plans, coaching reflection journals, coach’s feedback on the plans and journals, and coaching observation notes.

In Chapter 5, I begin with a comparison and contrast between quantitative and qualitative results. I present how these findings are related to previous studies on cognitive coaching, instructional conversations in general, and mathematical discourse in particular. Based on the connections between my study and prior research, I propose potential implications. Finally, due to limitation caused by the design of my study, I suggest what future inquiries can be done to increase the generalizability of the findings to other educational contexts.
Chapter 2

Literature Review

Theoretical Framework

Vygotsky’s (1978) sociocultural theory emphasizes that social interactions between adults and children play an important role in children’s learning. Through interactions, capable others can assist children in learning new concepts and skills. Many times, children’s peers can be capable others who provide assistance. Vygotsky also thought that through social interactions, children can observe and participate in cultural forms of behavior and thinking. Eventually, children internalize these external rules and behaviors. For example, social interactions help children with language development. It may start from social conversations with adults until children gradually internalize the “communicative speech” as thoughts or “inner speech” (Vygotsky, 1986). These shared experiences, in turn, develop children’s cognitive competencies. Among these experiences, language is a mediating tool (Vygotsky, 1978, 1986).

From a Vygotskian perspective, children need assistance from capable adults or peers in their environment (Vygotsky, 1978). Instead of only lecturing, teachers are encouraged to collaborate with their students, so students can observe how teachers conceptualize different concepts and participate in the activity (Jung & Reifel, 2011). This type of collaborative learning environment involves instructional conversations. For example, in mathematics class, students need to learn mathematical language. Although mathematics uses common words that students might see or hear in daily lives, meanings and usage of these words are different in mathematical contexts. Through talking with
and listening to teachers, students can understand mathematical language, and learn how to use it in a formal way.

Vygotsky (1978) proposed that teaching occurs when teachers’ assistance is provided based on students’ zone of proximal development (ZPD), the distance between what students can do on their own and what students can do with others’ assistance. Tharp and Gallimore (1988) further developed the concept of the ZPD. They proposed four stages of the ZPD. At the earlier stages, learners need assistance in order to perform a skill. Gradually, the assistance decreases until the skill is fully developed. At the fourth stage, the learner might lose the capacity to perform the skill due to the changes in the external environment. Through various internal assistance (e.g., self-regulation) or external assistance (e.g., asking teachers), the capacity might be restored.

In a professional development context, teachers, like their students, consult with experts who teach them new skills (Tharp & Gallimore, 1988). The experts provide responsive assistance based on the individual teacher’s ZPD. Gradually, teachers can efficiently adopt more new skills from their professional development programs than in the situation where they have no one to consult with about how to use the new skills in their own classrooms (Tharp & Gallimore, 1988).

In the current study, teachers learned to use instructional conversations in their classrooms. Their coaches were experts who provided assistance in teachers’ learning processes. According to Teemant et al.’s (2011) study, teachers’ prior experience in the use of instructional conversations was limited, and they needed coaching assistance to improve their use of the strategy. Therefore, I assumed that early in the process, the teachers were new to instructional conversations, so they received a lot of assistance from
their coaches in order to plan a lesson, and implement instructional conversations in their classrooms. Through continuous practice, the teachers would need less assistance from their coaches in order to do well in planning and enacting instructional conversations, and their skills would become more fully developed.

**Definitions of Instructional Conversations**

In general, instructional conversations and discourse are interchangeable, and they are used to describe a teaching method in which teachers and students discuss academic topics (NCTM, 1991; Tharp et. al, 2000). I considered there were similarities and differences between instructional conversation developed by Tharp et al. (2000) and discourse promoted by the NCTM (1991).

**CREDE Standards.** In their previous research work, Tharp and Gallimore (1988) came up with the phrase, *instructional conversation*, to describe teaching “in which teacher and students weave together spoken and written language with previous understanding” (p. 111). Later, instructional conversation was included as one of the CREDE Standards by Tharp and other CREDE researchers (Tharp et al., 2000).

Through intensive fieldwork and review of literature in educational research, Tharp et al. (2000) identified five effective teaching principles and named them as CREDE Standards. Standard 1, Joint Productive Activity, encourages teachers to closely work with their students, and students to work with others. This experience to work with teachers in a small group provides chances for students to learn how formal language and academic concepts are expressed, and for teachers to assist students based on individual needs (Dalton, 2008). Standard 2, Language and Literacy Development, emphasizes the importance of developing students’ language and literacy in learning processes. Standard
Contextualization, highlights the importance of integrating students’ prior or personal experiences from school, home, and community with academic concepts. Standard 4, Complex Thinking, asks teachers to advance all students’ thinking to higher levels. Standard 5, Instructional Conversation, means teaching through dialogue. Teachers who use instructional conversations often carefully listen to students’ ideas and guide them to talk to or question each other. Based on their input, teachers provide responsive assistance and contextualize their teaching to students’ lives (Hilberg, Doherty, Dalton, Youpa, & Tharp, 2002). Although this study mainly focused on teachers’ growth in planning and use of instructional conversations, theoretically, when teachers do well on instructional conversations, they simultaneously incorporate the other four Standards in their instruction (Tharp et al., 2000).

**NCTM Standards.** The NCTM also promoted instructional conversation but they used “discourse” to name this teaching method (1989). As articulated by the organization:

Discourse refers to the ways of representing, thinking, talking, and agreeing, and disagreeing that teachers and students use to engage in those tasks. The discourse embeds fundamental values about knowledge and authority. Its nature is reflected in what makes an answer right and what counts as legitimate mathematical activity, argue, and thinking. Teachers, through the ways in which they orchestrate discourse, convey messages about whose knowledge and ways of thinking and knowing are valued, who is considered able to contribute and who has status in the group. (NCTM, 1991, pp. 20)

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1 Mathematics teachers’ learning process of instructional conversation will be the main focus at Stage 2, so the definition of mathematical discourse is included in addition to Tharp and Gallimore’s (1988) for all subjects.
The NCTM (1991) described the roles teachers and students should play in classroom discourse. These descriptions imply that teachers need to invite students to talk because students are often used to passively listening to teachers and many of them feel uncomfortable talking in front of others. At the same time, teachers should connect academic concepts with students’ personal experiences from home, community, or cultures. These familiar experiences motivate students, so they will want to engage in the conversations and apply what they learned from schools to their life situations.

**CCSSM Standards.** Consistent with the focus of the NCTM, in 2010, the Common Core State Standards Initiative (CCSSI) published the *Common Core State Standards for Mathematics* (CCSSM), which includes a set of Standards for mathematical practices and content. Three of the Standards for mathematical practices in the CCSSM are connected to the communication Standard in the *Principles and Standards for School Mathematics* (NCTM, 2010). The first one is *Make sense of problems and persevere in solving them.* Students are expected to understand how other people solve problems by identifying the approaches they use. The next one is *Construct viable arguments and critique the reasoning of others.* In class, students often communicate how they generate ideas with one another and justify the validity of their arguments. The last one is *Attend to precision.* Students who are good at mathematics will be able to clearly express their ideas or reason for the comments made in the conversations by using different mathematical symbols or concepts.

In summary, the CREDE Standards emphasize a similar vision to the NCTM Standards (Hilberg et al., 2002) and this vision applies to the CCSSM as well. They all encourage students to work with their peers on tasks that require students to use higher-
level thinking. They also emphasize the importance of developing students’ language and literacy in learning processes through connecting students’ prior, cultural knowledge or experiences to academic concepts. The teaching and learning processes often happen through dialogues between teachers and students.

On the other hand, there are some differences among the three sets of Standards. The CREDE Standards encourage teachers to closely work with their students in a small group setting because this experience provides chances for students to learn how formal language and academic concepts are expressed and for teachers to assist students based on individual needs (Dalton, 2008). This close interaction between teachers and students is not clearly addressed by the NCTM Standards and CCSSM which focus on how students have opportunities to express their thinking with teachers and students.

**Importance of Instructional Conversations**

Instructional conversations bridge daily conversations with more planned instruction (Tharp & Gallimore, 1988). It has been touted as an ideal instructional strategy because it promotes participation of all students, focuses on conceptual and linguistic development, and places the role of the teacher as a facilitator rather than the dominant voice (Tharp et al., 2000). Saunders and Goldenberg (1999) reported that students in classrooms with instructional conversations showed greater understanding of a story than their peers in non-instructional conversation classrooms did. Instructional conversations can also motivate students’ learning (Wells & Haneda, 2005).

Additionally, instructional conversations can be an intervention for lower achievers who may require more opportunities for interaction to learn and develop new concepts, compared to their peers who may understand such concepts without teachers’
assistance (Murphy, Wilkinson, & Soter, 2010). Children from low-income families and minority groups who often receive drill-like instruction may also benefit from instructional conversations because this type of instruction requires teachers to design various opportunities to help students engage in complex thinking (Goldenberg, 1992/1993).

The importance of discourse-based instruction toward increasing students’ mathematics learning has been emphasized in the reform movement, as exemplified by the Curriculum and Evaluation Standards for School Mathematics (NCTM, 1989), the Professional Standards for Teaching Mathematics (NCTM, 1991), and the Principles and Standards for School Mathematics (NCTM, 2000). Students are encouraged to “communicate and reason mathematically” in order to become “mathematically literate” (NCTM, 1989), and develop their “mathematical power” (NCTM, 1991). When students have mathematical power, they construct their thinking logically, are able to solve more challenging problems on their own, and develop their self-confidence. These positive influences are also related to research findings that students who were provided opportunities to actively engage in academic conversations showed more achievement gains than those students with fewer chances (Bradford, 2007; Fennema, Carpenter, Franke, Levi, Jacobs, & Empson, 1996).

Conversations in mathematics learning are especially important because usage of mathematical language differs from the ordinary use of language (Schleppegrell, 2007). For example, mathematics has multiple semiotic systems (e.g., the use of symbols, graphs, and diagrams). There is vocabulary with particular meanings (e.g., product or fraction). Mathematics uses different grammatical structures focusing on long and dense
noun phrases (e.g., the volume of a rectangular prism with sides 8, 10, and 12 cm).

Through dialogic teaching, educators can help students correctly use mathematical language by assisting students to explore their mathematical thinking, justify their answers, and listen to the explanations of their teachers and peers (Herbel-Eisenmann, Cirillo, & Skowronski, 2009; Khisty & Chval, 2002; Russell & Corwin, 1993; Schleppegrell, 2007; Wood, Cobb, & Yackel, 1991).

**Implementation of Instructional Conversations**

Being able to have productive instructional conversations in class takes time. CREDE, NCTM, and CCSSM researchers have different views on helping teachers develop this competency. Since the focus of the current study was on teachers’ development in planning and use of instructional conversations, I will discuss more details on how CREDE researchers describe the process of implementing instructional conversations in class, from a large group to a small group. After this, I introduce how NCTM and CCSSM researchers view the development of a classroom full of mathematical discussion. This section will end with a comparison and contrast among the processes proposed by the three groups of researchers.

**CREDE process.** Tharp et al. (2000) proposed five phases to help teachers have instructional conversations with their students. During the first phase, teachers use CREDE Standards 1-3 (Joint Productive Activity, Language and Literacy Development, and Contextualization) and early content themes to work with students as a whole class. The early content themes are related to students’ personal experiences, so students can feel comfortable sharing their views with teachers and peers. Teachers also help students become familiar with the CREDE instructional frame which involves teachers presenting
the day’s agenda and expectations, implementing activities, and debriefing about what happened in class. The instructional frame prepares students to know what will happen in class and provides a regular opportunity for students to express their opinions in front of the whole class. Teachers and students also agree on classroom values that will be used to remind students of appropriate learning behaviors. The importance of classroom values and the instructional frame were not clearly discussed in the NCTM Standards and CCSSM.

In Phase 2, teachers and students still do what they did in Phase 1, but the teachers start to work with half of the class at one time. In addition, the teachers design different activities so that their students can successfully work with their peers or independently without teachers’ direct assistance. The teachers also group students by ability levels, gender, or students’ personal interests. Different activities are set up to help students practice rotating from group to group. Moving to Phase 3, teachers float around to check if students in small groups can work together, have opportunities to work with different students, and rotate to next activity in less than one minute. These techniques are useful in preparing students to work with one another independently from their teachers, so the teachers can concentrate on having instructional conversations with the students in their small groups.

During Phase 4, teachers use one more CREDE Standard, Complex Thinking, in their instruction and work with one small group of students while other students work effectively in other activities. Teachers start to teach academic content through conversing with students at the teacher center and assist students with concept development. In the last Phase, teachers continue Phase 4 strategies, but they use one
more CREDE Standard, Instructional Conversation. At the teacher center, the conversation has an academic goal preplanned by teachers, and teachers use these conversations to assist students with evaluating and justifying the ideas posted by group members. Ideally, students should talk more or as much as their teachers. Having a teacher center where teachers and a small group of students have instructional conversations was not emphasized in the NCTM Standards or CCSSM.

**NCTM process.** Although the NCTM Standards did not provide clear guidance on how to implement instructional conversations in mathematics classes, the results of previous studies can fill in the missing parts. In their study, Brendefur and Frykholm (2000) developed four constructs to describe how teachers’ instructions changed when they worked on building classroom discourse as proposed by the NCTM Standards. Initially, teachers used “uni-direction communication” in which they dominated the whole class communication and played the only authority of mathematical knowledge. When they started to allow “contributed communication” to take place in classrooms, their students had more chances to share their thinking. At the third stage, they used “reflective communication” to ask questions to help students think deeply. Their students often justified or rationalized their mathematical thinking in the learning process. Finally, when teachers used “instructive communication”, they built the learning environment for which the NCTM Standards aimed. They not only provided chances for students to express their thinking but also used their comments to modify the directions of instruction.
Hufferd-Ackles et al.’s (2004) study further examined what an elementary teacher and her students did when they were in the process of building a classroom full of discussion. Initially, the teacher was the only questioner and source of mathematical ideas. Later, she started to encourage her students to ask questions because she noticed that these questions were beneficial for mathematical learning. Instead of only asking what the correct answers were, she cared more about her students’ understanding behind the answers. At the beginning, the students’ answers were brief. However, when she started to guide them to explain or explore their thinking behind the provided answers, they felt comfortable and confident explaining their answers more thoroughly, and taking the initiative to ask questions.

**CCSSM process.** CCSSM did not clearly describe how to implement instructional conversations in classrooms (CCSSI, 2010). They only mentioned that teachers should integrate all of the CCSSM into their instruction and what “mathematically proficient students” will do in these Standards. However, they did not provide further guidance for teachers to execute instructional conversations. Because the CCSSM is new to the field, not many studies of the CCSSM have been published. At the same time, many resources about implementing the CCSSM can be found on websites or articles, but their usefulness might need further examination. These resources did not provide information about step-by-step processes. Usually, they only show how a class full of mathematical language looks like.

For example, *the Illustrative Mathematics Project* and *Inside Mathematics* provide useful resources for teachers. Based on content Standards for grades K-12, the former provides ideas about how teachers can teach standards to students by conversing
with them (“The Illustrative Mathematics Project,” n.d.). The latter also collected many video clips to show what a classroom full of discourse looks like at different grade levels (“Inside Mathematics,” n.d.). For each clip, the teachers shared why they designed the lessons and how they planned to provide opportunities for students to justify their thinking.

White and Dauksas (2012) suggested that teachers write the Standards for mathematical practices in a language that students can relate to and post them in the classroom. When students work on mathematical problems, they can use these Standards to process their thinking. This will help the students become familiar with the Standards, so they can refer to them easily when they need to. Teachers at lower grades can also create a “culture of mathematics learning and doing in a classroom” (p. 443) by posting mathematical terms as word walls, providing books with mathematical concepts, and placing manipulatives with toys and games (White & Dauksas, 2012).

These resources are helpful because they provide ideas about what teachers can do to encourage classroom discourse. On the other hand, teachers might need external support to apply these ideas to their classrooms. These resources only show what classroom discourse looks like but they do not show teachers how to start or get there based on their classroom situations. For example, in the video clips, many teachers demonstrated how to lead students to look again at the worksheets they finished earlier. When I was watching them, I wondered what it would look like if teachers taught a new concept to their students who had no vocabulary to communicate. Hufferd-Ackles et al. (2004) found that when teachers were teaching new concepts, the students needed to
learn vocabulary, so they could not talk as much as they were talking about a learned topic.

Meanwhile, the teachers on the video clips had several years of teaching experience. I wondered how novice teachers might use the strategies. These teachers often struggle not only to choose teaching methods, but also with classroom management. If they looked at the suggestions from *The Illuminative Mathematics Project*, I am not sure whether novices would feel confident about deciding what ideas they should adopt first. Brendefur and Frykholm (2000) stated that these struggles often discourage teachers from trying classroom discourse. In order to make these ideas more helpful, external support is necessary.

**Comparison and contrast of the three Standards.** All CREDE, NCTM, and CCSSM researchers addressed the importance of having instructional conversations or discourse in class, but CREDE researchers provided more guidance on how to implement instructional conversations for a teacher who was new to the teaching strategy. The NCTM Standards (2000) and CCSSM (CCSSI, 2010) emphasized that students should have chances to communicate their thoughts either with teachers or their peers, but they did not emphasize the importance of small-group learning. On the other hand, in order to maximize effects of teaching and learning, CREDE researchers suggest that teachers regularly work with a small group of three to seven students for sustained time instead of floating around to check students’ understanding (Dalton, 2008; Tharp et al. 2000). In a whole-class setting, it is hard for every student to express their thinking and for teachers to assess and assist each student (Doherty, Hilberg, Epaloose, & Tharp, 2002).
In addition, the CREDE teachers design various small-group activities for other students to work on while the teachers have instructional conversations with a small group of students (Dalton, 2008; Tharp et al., 2000). The activities can be skill support or language practice that is designed to prepare students to participate in instructional conversations (Dalton, 2008). The NCTM Standards and CCSSM did not address this. For example, the students in the clips that Inside Mathematics posted to help teachers implement discourse usually did the same activity. Because the students often did the same activity and the instruction happened in a whole class, the NCTM and CCSSM researchers did not focus on their attention preparing students to work independently from teachers as much as CREDE researchers.

Furthermore, CREDE researchers differentiated teachers’ use of instructional conversations, but the quality of using discourse was not discussed in the NCTM Standards and CCSSM. Doherty et al. (2002) developed Standards Performance Continuum, a validated tool to measure the extent to which teachers used the CREDE Standards. When teachers have nonacademic discussion in a whole-class setting, their use of instructional conversation is rated at an emerging level. When the teachers have academic goals for instructional conversations, provide opportunities for students to justify their thoughts or discuss with one another, and elicit more student talk than teacher talk, their use of instructional conversations is rated at the enacting level. This tool can help a teacher who is new to instructional conversations to self-examine where their use of instructional conversation is and what else they need to improve, so their instructional conversations can benefit student learning.
The NCTM (2000) Standards described what teachers could do to develop classroom discourse based on students’ grade levels. Although CCSSM did not provide concrete suggestions for teachers, they did encourage teachers to refer to the NCTM Standards (CCSSI, 2010). Compared to the NCTM Standards, CREDE researchers did not base on students’ developmental needs to provide many suggestions about what concept at each grade level educators should teach (Tharp & Gallimore, 1988). This might be because the CREDE Standards are designed to be used in all subjects and all grade levels, but the NCTM Standards and CCSSM are discipline-based. However, CREDE researchers definitely considered how students’ abilities and ages would influence the implementation of instructional conversations (Tharp & Gallimore, 1988). For example, based on students’ achievement levels, Tharp and Gallimore suggested that teachers use homogeneous or heterogeneous grouping to achieve teaching objectives.

Although the typical duration of an instructional conversation is around 20 minutes, shorter instructional conversations might be developmentally appropriate for younger students.

Furthermore, instructional conversations usually mean that teachers and a group of students converse about their ideas in learning processes. For students ages two or three who might not speak or write yet, Yamacuhi, Im, and Schonleber (2012) argued that teachers could still have instructional conversations with them because the younger students might express their thoughts in a nonverbal way. At the same time, instead of working with a group of students, Yamauchi et al. advocate that teachers with students ages two or three are doing instructional conversations when they work with at least two students at the same time.
Overall, the NCTM Standards, CCSSM, and the CREDE Standards have a very similar vision for how instructional conversations or discourse should be used in teaching and learning. They all recognize the importance of discourse on learning and the influence of discourse on teaching, and emphasize that discourse should be used in all grade levels and teachers need to help students feel comfortable conversing with others. Because the CREDE Standards aim for teachers to work with their students for extended time in a small group, the teachers will need to make more effort to help students to be able to work independently from teachers. When teachers want to use discourse suggested in all of the Standards, they might need external support in applying those general ideas to their instruction.

**Challenges of Implementation of Instructional Conversations**

In the previous sections, I already discussed the ways in which teachers can implement instructional conversations as well as the importance of this teaching strategy in influencing student learning. Unfortunately, many classrooms do not typically afford opportunities for extended student talk (Goldenberg, 1992/1993; Hilberg, Tharp, & DeGeest, 2000; Jacobs, Hiebert, Givvin, Hollingsworth, Garnier, & Wearne, 2006; NCTM, 1991; Rittenhouse, 1998), especially in mathematics (Draper, 2002). There are several reasons why this may occur. First, it is not easy for teachers to implement the instructional strategy (Goldenberg, 1992/1993; Imm & Stylianou, 2012; Rittenhouse, 1998; Teemant, et al., 2011; Walshaw & Anthony, 2007). Teachers need to help students stay on the academic topic, and feel comfortable participating in the discussion. Before having an academic conversation, teachers often need to teach students how to express themselves clearly in front of peers and teachers (Baxter & Williams, 2010; Rittenhouse,
1998), and to work collaboratively and productively in small groups with or without the teacher’s presence (Wood et al., 1991). Although teachers may want to encourage students to share their ideas, the teachers may also feel challenged to positively respond to students’ off-topic comments or underdeveloped concepts. Finally, fruitful instructional conversations require teachers to have sufficient knowledge of what they are teaching, especially in mathematics classes where special forms of language are used and may be different from students’ informal language (Herbel-Eisenmann, et al., 2009; Schleppegrell, 2007).

Compared to teachers in other subject areas, mathematics teachers seem to have more challenges to create a discourse-based learning environment. Many mathematics teachers’ instruction still emphasizes the mechanics of symbol manipulation rather than advancement of student thinking about those symbols at higher levels (Nathan & Knuth, 2003). These teachers may not prioritize the communication of mathematical thinking (NCTM, 2000). This might be due to the teachers’ underdeveloped understanding of how to enact instructional conversations in their classrooms (Staples, 2007), and personal experiences as many teachers were likely taught to master in mechanics of symbol manipulation when they were students (NCTM, 1991). Nevertheless, Rubenstein and Thompson (2002) pointed out that in order to learn mathematics well, students need their teachers to create opportunities for them to use mathematical language. Students tend to use the mathematical language only in mathematics class. This is unlike other new English words that are also used in daily conversation (Rubenstein & Thompson, 2002). Without support, hearing mathematical language is like “hearing a foreign language” for students (Kotsopoulos, 2007).
Professional Development

From the challenges mentioned above, it is clear that in order to have fruitful instructional conversations, teachers need external support. Research also indicates that professional development supports teachers’ abilities to build a discourse-based learning environment (e.g., Russell & Corwin, 1993; Saunders et al., 1992; Simon & Schifter, 1991; Teemant et al., 2011; Tharp & Gallimore, 1988; Wood et al., 1991). In the following paragraphs, I will discuss six studies about how professional development helped teachers to overcome their challenges when the teachers tried to use instructional conversations in their instruction.

Teemant et al. (2011) examined the effectiveness of a performance-based instructional coaching model on improving teachers’ learning of instructional conversations. Twenty-one elementary language arts teachers from two schools participated in the study and received seven coaching sessions. Data sources included seven observations in each teacher’s classroom, and field notes about the interactions between teacher and students gathered across a year. Results indicated significant teachers’ growth in use of instructional conversations, even if most of the teachers showed difficulty in learning instructional conversation initially.

Saunders et al. (1992) found that weekly meetings conducted by a professional development consultant successfully helped four K-2 language arts teachers conceptualize and enact instructional conversations. Initially, the discussions in the meetings focused on how to listen to and sustain conversations so that every student was on topic. As this professional development progressed across the year, teachers began to
think about how to promote students’ academic growth in the conversation beyond simply sustaining the conversations.

In Simon and Schifter’s (1991) study, 39 K-12 mathematics teachers received a two-year professional development program, an intensive summer course and ongoing classroom support. The learning focus of the professional development was to teach mathematics from a constructivist perspective, such that students actively communicated with peers or the teacher about their mathematical thinking. Two types of data were collected across the time: teachers’ written reflections and interviews of teachers. Written reflections revealed that teachers changed their role from a controller to a facilitator, and students were encouraged to actively participate in the learning process. Interviews indicated that more than half of the teachers could use the new skill to meet each student’s learning needs. After one-year participation in the professional development program, many teachers started to feel that these new strategies “came together and became more fully operational” (p. 21).

Wood et al. (1991) examined change in a second-grade mathematics teacher’s interactions with her students before and after she received professional development support. During the one-year professional development program, the researchers took field notes during each mathematics lesson, and notes from each of the weekly project meetings, and they also videotaped classroom discussion. The data indicated positive changes. For example, the teacher respected and valued students’ answers without having to be the sole source of information in class. Furthermore, the teacher constructed the mathematical discourse by negotiating the solutions with her students, and
encouraging them to find possible solutions, instead of telling them directly what method they should use to solve problems.

For three years, Russell and Corwin (1993) worked with 12 elementary master teachers who taught grades K-7 to develop mathematical discourse in their classrooms. Data sources included teacher interviews, teachers’ journals, semimonthly seminar sessions, field notes, and videotapes of classroom observations. Their analysis revealed five major changes in teachers’ beliefs and practice. First, more time was used for mathematics because the new teaching method interested students. Second, these teachers asked different kinds of questions that could open up conversations. They slowed down their teaching in order to allow students to use their own words to explore their thinking. Instead of asking questions that requested only one-word answers, the teachers looked for more answers even if one of the students already answered correctly. Third, they encouraged students to share their answers. Fourth, instead of telling or showing mathematical rules to students directly, they let students find, describe, analyze, and generate patterns of different concepts. Fifth, because they recognized the importance of allowing more time for students to explore or express their thinking, they gradually felt comfortable letting go of the idea that they had to go through all of their preplanned goals.

Tharp and Gallimore (1988) observed how eight consultation meetings helped a first-grade teacher change in her use of instructional conversation with students. During each meeting, the teacher shared a video clip of her recent reading lesson, and decided which part of the clip she wanted to discuss. The meetings were audiotaped and transcribed. These data indicated that initially, the teacher could elicit student talk, but
she did not help them to make connections between their thoughts and the goal of instructional conversations. The educator did not understand the discussed text well in advance so that she could not tell which students’ points needed follow up. She often ended up dominating the conversation instead of facilitating the discussion. The consultation meetings helped her to recognize that her questions should require students to think deeply before answering. In addition, she also learned that by being aware of what questions she asked, she could avoid dominating the conversation. At the last consultant sessions, the teacher started to be aware of what she should do in order to have a good conversation without reminders from her consultant.

Overall, these studies indicate the positive influences professional development programs can have on teachers’ learning of instructional conversations (Russell & Corwin, 1993; Saunders et al., 1992; Simon & Schifter, 1991; Teemant et al., 2011; Tharp & Gallimore, 1988; Wood et al., 1991). More significant changes happened when teachers received intensive classroom support along with their application of the new skills in their classrooms (Simon & Schifter, 1991; Teemant et al., 2011; Tharp & Gallimore, 1988; Wood et al., 1991). Due to the importance of intensive classroom support, coaching has been identified as an effective way to develop teachers’ professional growth (Garet, Porter, Desimone, Birman, & Yoon, 2001; Matsumura, Garnier, Correnti, Junker, DiPrima Bickel, 2010; Neuman & Wright, 2010; Showers, 1984; U. S. Department of Education, 2002). In the next section, I will discuss why coaching, especially cognitive coaching, can have this great influence on teacher learning.
Cognitive Coaching

Coaching. Based on each of their unique foci and theories, educational researchers developed various coaching methods, such as peer coaching, literacy coaching, instructional coaching, and cognitive coaching (Cornett & Knight, 2008; Knight, 2009). Out of the various coaching methods, the CREDE Hawai‘i Project uses cognitive coaching to provide assistance for their teachers. Among these approaches, Knight (2009) commented that in general, coaches provide ongoing support for teachers to apply what they learn from the professional development to their own classrooms. When this support through coaching takes place systematically, teachers develop higher efficacy for adopting new instructional strategies (Showers, 1984). Furthermore, the relationship in the coaching process is confidential. Coach and teachers are partners, and the coach’s role is to facilitate teachers’ learning processes, instead of evaluating teachers’ learning results.

Cognitive coaching. Cognitive coaching, developed by Costa and Garmston (2002), has a great effect on improving teacher practice (Batt, 2010; Beltman, 2009; Cochran & DeChesere, 1995; Cornett & Knight, 2008; Moche, 2010; Ray, 1998). Cognitive coaches plan lessons with teachers, observe teachers’ implementation of the planned lessons, and facilitate teachers’ reflection after the observation. When working with teachers, cognitive coaches use several techniques (e.g. emphasizing positive relationships or questioning skills) to help teachers be aware of their thinking and reflect their practices from a deeper or different perspective. Previous studies have identified the importance of these techniques in helping teachers grow professionally. What skills the cognitive coaches used and how they influenced teaching practices will be discussed
Cognitive coaching skills. Coaches use verbal and nonverbal tools to maintain trust and help teachers be open to reflections. The tools include paralanguage, response behaviors, structuring, and meditative questioning (Costa & Garmston, 2002). Paralanguage refers to “vocal qualities, body gestures, and other verbal and nonverbal behaviors that exist alongside the words” people speak (Costa & Garmston, 2002, p. 73). When coaches’ vocal cues signal safety and inquiry, or their nonverbal behaviors are congruent with teachers’ feelings and thoughts, teachers often feel comfortable sharing more with the coaches.

Meanwhile, response behaviors include silence, acknowledging, paraphrasing, clarifying, and providing data and resources (Costa & Garmston, 2002). When coaches patiently wait for teachers to answer their questions, this silence indicates their respect for teachers’ reflections and the faith that teachers are able to answer the questions. Acknowledging and paraphrasing also help teachers feel that their thoughts are valued and respected, so they are willing to share more insights instead of giving one-word responses. Clarifying helps teachers to provide more details about their thoughts. For example, during the planning conference, coaches can ask teachers what data they want to collect during the observation (e.g., number of students on-task while the teacher is conducting the lesson).

Coaches also communicate with teachers their expectations and the purposes of cognitive coaching (Costa & Garmston, 2002). For example, coaches may inform teachers that during the planning conference, the teachers need to share their objectives for the lesson, and how they want to achieve those objectives. This clear communication
prepares the teachers to know what will happen in the planning conference, so they can prepare in advance.

According to Costa and Garmston (2002), coaches often use meditative questions as a tool to help teachers think of their practices more deeply and differently. They can invite teachers to describe their lesson plans more thoroughly (e.g., “What are your goals for this lesson?”). In addition, the questions can encourage teachers to reflect on their practices from different perspectives. For instance, the coach might ask the teacher, “As you reflect on your lesson, how do you know that you achieved your objectives?” The coach can also ask a follow-up question to help teachers apply what they learned from the reflection to their next lesson plan. That question might be, “So, what will you do differently to help your students stay on task?” Other meditative questions can help teachers to connect what happened in their classrooms with what was on their mind during the reflection meeting. The coach might ask, “You planned to finish that activity in 10 minutes, but you ended up using 20 minutes. What reasons can you think of?”

Many of these elements mentioned in the previous paragraphs are identified as the keys to improve teachers’ practices from the previous research on cognitive coaching (e.g. Batt, 2010; Cochran & DeChesere, 1995; Moche, 2000; Ray, 1998). These skills were used in the CREDE professional development program, too. They can be categorized in two parts: positive relationships between coaches and teachers, and coaching conversations in the reflection meetings. The next sections will review several studies that examined the influences of cognitive coaching on teachers’ practices.
**Positive relationships.** Reed’s (2006) research found that cognitive coaching positively influenced teachers’ practices. Interview data confirmed that the trust between the coach and the teachers helped teachers change practices. The teachers described their coach as “approachable, knowledgeable, respectful, and non-judgmental” (p. 188). They felt comfortable reflecting on their practices in front of their coach, and going to their coach to ask for help because they knew she would be willing to help and support them. The coach made the teachers feel “they were on the same level” (p. 195), and “she (the coach) really listened to them” (p. 196). They mentioned that they were open to their coach because the coach was open to them first.

**Coaching conversations in coaching debriefing meetings.** In Garmston, Linder, and Whitaker’s study (1993), two middle school English teachers receiving cognitive coaching reported that reflections in the coaching process were helpful. Coaching allowed them to explore their thinking behind their practices and be aware of how their thinking influenced students’ learning. Many alternatives in their thoughts and actions were generated during the reflection meetings.

In another study, six teachers received seven months of cognitive coaching assistance (Krpan, 1997). In their open-ended written journals, portfolios, and exit interviews, all of them mentioned that in the reflection meetings, the discussion of the data that coaches gathered in the classroom observation contributed to their professional growth. The teachers often used what they discussed to revise their future lessons. Consistent with Krpan’s study, Smith (1997) reported similar results. The coach’s feedback in the reflection meetings enabled the teachers to see multiple perspectives in examining their practices and to be more “observant” in their classrooms.
Five first-grade teachers in Slinger’s (2004) study indicated that being involved in conversations with their cognitive coach for nine weeks improved their practices. For example, one teacher wrote, “The coach is able to deconstruct what I am processing or reflecting upon and reconstruct it with more depth and breadth” (p. 149). Their written reflection logs collected throughout the study showed that these conversations helped them to (a) think more clearly and differently, (b) become accountable, (c) be able to think through difficult or challenging situations they encountered in their instruction, and (d) generate alternative thinking. Consistent with the findings of the three studies mentioned above, Moche’s (2000) study comparing the growth of teachers’ reflective practice demonstrated that teachers who received cognitive coaching showed more growth than the other teachers who received no cognitive coaching.

These studies mentioned above showed the influence of cognitive coaching on teacher learning. What is yet unknown are the challenges that coached teachers deal with in the learning processes and the strategies the coaches employ to address the challenges teachers had. After examining 123 published studies and presentations discussing cognitive coaching, Cornett and Knight (2008) suggested that there is a need for more systematic investigation of the influence of cognitive coaching on teacher’s knowledge and practice. Meanwhile, research using more objective data sources can also expand educators’ understanding of cognitive coaching. The data used to study cognitive coaching are typically collected retrospectively. In order to address this limitation, the current study examined how coaching assisted teachers with use of instructional conversations by analyzing objective and subjective data collected while teachers were being coached from the first to the last coaching session. Objective data were the scores
that coders provided using the Lesson Plan Rubric to rate teachers’ lesson plans. Subjective data included coaching observation notes, teachers’ coaching reflection journals, and coach’s feedback on lesson plans and coaching reflection journals. Researchers also suggest that these subjective data are useful in demonstrating teacher competencies (Ruys, Keer, & Aelterman, 2012).

Another limitation of previous research on cognitive coaching is that studies focused on how coach’s assistance in coaching debriefing meetings or classroom observation influenced teachers’ professional growth. Few studies examined how coach’s assistance in lesson planning contributed to teachers’ implementation of new skills. Research on lesson planning has shown that teaching effectiveness is related to teachers’ preparation in planning. Therefore, the focus of the current study was on teachers’ growth in planning and use of instructional conversations. In the next section, I will provide more details about the importance of lesson planning in improving teaching competency.

**Importance of Lesson Planning**

The connection between the quality of lesson planning and teaching effectiveness is emphasized in literature. When teachers planned a lesson in advance, they can present the lesson more clearly, and provide more assistance to their students for that lesson (Byra & Coulon, 1992; Meyen & Greer, 2009; Panasuk, Stone, & Todd, 2002). In-depth planning also helps teachers feel more confident during instruction (Johnson, 2000). This may be especially true when teachers want to implement instructional conversations in their classrooms. To implement successful instructional conversations, teachers often report that they have to spend a lot of time in planning (Goldenberg, 1992/1993). For
example, they have to consider how they can respond to students’ thoughts or comments effectively, and incorporate their input into academic topics. In addition, having read a detailed instructional plan in advance, coaches are better prepared to target their observation than if they were to only come to observe without knowing what to expect (Watanabe, 2002). These lesson plans can also be used as a guide for coaches to facilitate teachers’ reflections after implementing a lesson (Costa & Garmston, 2002).

Strengthening teachers’ lesson planning ability is important because many teachers tend to rely on “ready-to-go” lesson plans (Liyanage & Bartlett, 2010). Liyanage and Bartlett (2010) warned that these ready-to-go lesson plans are not tailored to individual students and teachers, and these plans often limit teachers’ application of what they learned from professional development programs to their own classrooms. When working with their teachers, Liyanage and Bartlett (2010) noticed that teachers tried to closely follow these lesson plans without being aware of whether the plans were appropriate for their teaching practices. They were not able to modify the ready-to-go plans in order to meet students’ learning needs in class. One of the teachers made the following comment, “I had to do X because I needed to cover my third objective quickly” (p. 1).

Since teachers’ practice is related to the quality of their planning, I assumed that improvements in lesson plans might reflect teachers’ growth in practice. However, there is little research on how to measure the effects of professional development support on the improvement of teachers’ lesson plans. For example, in Teemant et al.’s study (2011) and Byrum, Jarrell, and Muñoz’s study (2002), teachers received intensive support on designing lesson plans. However, neither Teemant et al. (2011) nor Byrum et al. (2002)
studied teachers’ growth in lesson planning. Although Byrum et al. (2002) discussed some about how the professional development support influenced teachers’ planning, their results seemed too general to clearly describe how that growth occurred. For example, one teacher reported,

I now routinely begin any unit planning with an overarching theme and goal, then, compose the assessment. Then I plan the lesson or lessons. It now seems to be the obvious, natural way to approach teaching. This represents a paradigm shift for me. (p. 13)

In the current study, I examined change in teachers’ written lesson plans and use of instructional conversations across time. I further investigated how cognitive coaching helped teachers deal with various challenges when they tried to plan and use of instructional conversations in their classrooms. In the following section, I will discuss how the professional development program provided by CREDE Hawai‘i Project integrated cognitive coaching in its support for teachers, especially assistance in planning and coaching debriefing meetings.

Professional Development Offered by the CREDE Hawai‘i Project

The CREDE Hawai‘i Project is located at the University of Hawai‘i at Mānoa. It has provided professional development support for in-service K-12 teachers in Hawai‘i since 1997. The professional development is designed as a graduate-level course, in which teachers learn how to use the CREDE Standards in their classrooms. From July to May, the teachers need to submit assignments, attend four workshops, and receive cognitive coaching support 6-8 times.

Coaching support and assignment. Cognitive coaching (Costa & Garmston, 2002) is used in the CREDE professional development program. The role of the coaches is to help teachers implement the CREDE Standards in their classrooms. As mentioned earlier, every
coaching session includes three parts: assistance in lesson planning, observation of the lesson, and reflection on lesson implementation. Every teacher experiences 6-8 coaching sessions throughout an academic year. The CREDE coaches usually observe each of their teachers once a month. The coaches and the teachers discuss when the teachers are available to be observed. The teachers decide what they are going to teach and how they are going to use the CREDE Standards in their instruction.

Before observing teachers, coaches receive teachers’ lesson plans (see Appendix A for the lesson plan template). After reading them, the coaches provide feedback on the plans to help teachers be clearer about what they want to do (see Appendix B for the rubric the coaches use to assess the lesson plans). Usually, the teachers ask the coaches to provide more feedback on certain challenges. For example, the teacher might say, “Coach A, I want to do instructional conversations with this group of students, but I don’t know how to do it. I came up with this idea. Could you let me know if there is anything else I can do to help students feel comfortable talking in front of their peers?”

After working with teachers on the lesson plans, coaches observe how teachers conduct the lessons. During the observation, coaches take notes about how the lessons went regarding teaching and learning in class. These notes will be used to facilitate teachers’ reflections in the coaching debriefing meetings. Each teacher meets with his or her coach individually. During the meetings, the coach helps her teacher to reflect on his or her instruction by looking through the observation notes and discussing how the teacher can improve his or her future lessons based on the reflections.
In addition, the role of the coach is as a facilitator who helps teachers appropriately examine their practices. When the teacher and the coach discuss how the teacher used the CREDE Standards, they refer to the Classroom Observation Rubric, a tool to rate teacher’s use of the CREDE Standards in classroom. Teachers rather than the coach rate themselves. Teacher A might say, “I gave myself 2 on using instructional conversations.” Then, the coach will ask her, “What indicators did you see that match the level 2?” or “Could you tell me why you did not give yourself 3?” These discussions help teachers to think of their practices deeply and write their coaching reflection journals (see Appendix C for the coaching reflection journal template). After receiving the journals, the coaches provide feedback and comments on the assignment to help teachers plan their next lessons (see Appendix D for the rubric the coaches use to assess the coaching reflection journal).

Teachers also complete video reflection. The CREDE Project staff scheduled teachers’ videotaping after they receive two sessions of coaching assistance so every teacher had four video recordings during an academic year. The purpose of the videotaping is to see how teachers implement the CREDE Standards in a regular class period. After watching the video recordings, teachers write video reflections journals discussing how they used the CREDE Standards, how they judged if they achieved their objectives, and their future plans of using the CREDE Standards. Then, the coaches provide feedback on their reflections. Teachers also need to do another assignment, a final project. I will discuss it more under the section of workshop.

These assignments aim to help teachers reflect on their implementations of the CREDE Standards and be accountable for what they planned to do for future lessons.
When the coaches assess the quality of these assignments, they focus on how teachers reflected their lessons instead of focusing on how good their implementation of each of the CREDE Standard. For example, Teacher A might reflect that she only did instructional conversations at level 1 describing why she gave herself that score or why she only could accomplish a level 1. Consistent with previous studies on coaching (Garmston et al., 1993; Krpan, 1997; Slinger, 2004; Smith, 1997) that emphasize connection between coaching support in reflections and teachers’ professional growth, the coaches’ feedback on the assignments helped the teachers to reflect on their practice and come up with action plans for future lessons.

**Workshops.** The CREDE Hawai‘i Project provides four workshops for teachers and the purposes of the workshops are different. During the first workshop, teachers learn the CREDE Standards by watching video clips that show previous CREDE teachers’ uses of the CREDE Standards in class. They also learn how to use the Classroom Observation Rubric to assess the quality of teachers’ uses of the CREDE Standards. These learning experiences help them apply the CREDE Standards to their classrooms. The CREDE Project staff also schedules some time to build trust and rapport between teachers and coaches because a trusting relationship helps teachers feel comfortable working with their coaches (Reed, 2006). For example, one activity is to discuss the situations that help teachers with their learning and to develop an agreement on how to structure the ideal coaching session. Another activity is to discuss anxiety about being videotaped. The Project coaches who used to be videotaped share how they went through the anxiety of being videorecorded and how this experience contributed to their professional growth. This sharing often makes teachers feel more comfortable being videotaped. The Project also uses some time to model how to do assignments. For example, a CREDE coach models how to
plan a lesson that applies the CREDE Standards to the instruction. After this demonstration, the teachers work with their coaches to practice planning a CREDE lesson. At the end of each workshop, the teachers will evaluate the quality of the workshop and provide suggestions how future workshops can better support their learning of the CREDE Standards. The Project staff modifies the design for the next workshop based on teachers’ suggestions, such as watching more video clips or having more time to work one-on-one with their coaches.

The second and third workshops are designed to help teachers deal with the challenges they encounter when they try to implement the CREDE Standards in their classrooms. For example, the coaches might find out that many of their teachers have a hard time engaging students in the academic conversations. The workshop focuses on this topic by watching different clips in which previous CREDE teachers successfully had instructional conversations with their students and discussing how these examples can be applied to the current teachers’ situations. In addition, during the workshops, each of the teachers will choose one 10-minute clip from his or her video recording to share with other teachers and reflect on their uses of the CREDE Standards. Teachers often mention that watching each other’s clips inspire them a lot. Usually, at the third workshop, the CREDE staff also shows examples of final projects done by previous CREDE teachers to help current teachers prepare their final projects.

Different from the first three workshops, the fourth one is for teachers to share their final projects with one another. Each teacher has approximately 15 minutes to present their final project, which reveals how they have progressed from the beginning to the end in using the CREDE Standards. They can also report the influence of the CREDE Standards on student learning and their next step after leaving the CREDE
professional development program.

In summary, the CREDE professional development program emphasizes the use of coaching to support teachers to grow professionally. Before working closely with teachers, the coaches try to build rapport with their teachers. When assisting teachers, the coaches aim to facilitate teachers’ reflection in coaching debriefing meetings or in their assignments. The data sources of this current study included lesson plans, coaching reflection journals, the coach’s feedback on plans and journals, and coaching observation notes because these data showed how teachers developed in their planning of instructional conversations and how they used the preplanned ideas in practice. Teachers’ video reflection and presentations in the workshops were not included because they only showed how teachers used instructional conversations but they did not indicate how their practice was related to their growth in planning of instructional conversations.
Chapter 3

Method

Teachers are encouraged to involve students in instruction by having academic conversations with students or promoting the academic conversations among peers. However, this type of practice is often not popular in K-12 classrooms, especially when students are learning mathematics. Cognitive coaching has been identified as an effective professional development method to help with teachers’ professional growth (Batt, 2010; Beltman, 2009; Garmston et al., 1993; Krpan, 1997; Moche, 2000; Reed, 2006; Slinger, 2004; Smith, 1997). Cognitive coaches often visit teachers’ classrooms and assist teachers with their lesson planning and reflecting on their practices. To understand how cognitive coaching influenced teachers’ planning and use of instructional conversations, a mixed-method study was conducted to identify the influences of cognitive coaching on the teachers’ growth in their one-year participation of the CREDE professional development program, especially the evolution of mathematics teaching in this process.

This section describes the research rationales and methodology that was used to answer the following Research Questions:

1. To what extent did cognitive coaching influence teachers’ planning of instructional conversations?

2. What factors influenced teachers’ planning and use of instructional conversations in mathematics teaching?

3. What characterized teachers’ development in planning and use of instructional conversations in mathematics teaching, both individually and as a group?
4. How did cognitive coaching influence teachers’ planning and use of instructional conversations in mathematics teaching?

Research Design and Approaches

This study employed both quantitative (multilevel modeling) and qualitative (multi-case study) methods. Multilevel modeling was used to address the first Research Question, and the multi-case study was used for the other questions. Multilevel modeling was adopted to evaluate the effects of cognitive coaching on teachers’ planning of instructional conversations across time. With regard to the qualitative method, an in-depth analysis of use and planning of instructional conversations in mathematics teaching was implemented. Furthermore, the qualitative method was used to compare and contrast how a cognitive coach worked with the teachers from different school levels. The goal to use a mixed-method study was to accommodate the weaknesses of using only either quantitative or qualitative method. More specifically, the results from the qualitative method were used to support and explain the findings from the quantitative method.

Stage One: Quantitative Method

Participants. Twenty-eight teachers attending the professional development program offered by the CREDE Hawai‘i Project in 2009-2011 were included. Ten were from 2009-2010 cohort, and eighteen were from 2010-2011. The CREDE Project in 2009-2011 included two types of professional development programs: one with six coaching sessions and the other one with eight coaching sessions. Eight of the teachers attended the six coaching sessions while the rest of them received eight. One of the teachers who attended the eight-session professional development decided to drop out after the fourth coaching session, so her data only included four lesson plans. Because
multilevel modeling can deal with missing data, I still kept her in the study (Heck, Thomas, & Tabata, 2010).

In the school year before they enrolled in this PD program, 76% of the teachers’ schools did not meet the Adequate Yearly Progress provision of the national legislation known as the No Child Left Behind Act. Other teachers’ demographic data were shown in Table 1.

Table 1

*Teachers’ (N=28) Demographic Information*

<table>
<thead>
<tr>
<th>Teacher gender</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>17</td>
</tr>
<tr>
<td>Male</td>
<td>11</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teacher ethnicity</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian</td>
<td>2</td>
</tr>
<tr>
<td>Hawaiian/ Part Hawaiian</td>
<td>5</td>
</tr>
<tr>
<td>European</td>
<td>17</td>
</tr>
<tr>
<td>Mixed</td>
<td>3</td>
</tr>
<tr>
<td>Did not report</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade levels</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>K-5</td>
<td>11</td>
</tr>
<tr>
<td>6-8</td>
<td>6</td>
</tr>
<tr>
<td>9-12</td>
<td>11</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teaching subject*</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Language Arts</td>
<td>8</td>
</tr>
<tr>
<td>Mathematics</td>
<td>10</td>
</tr>
<tr>
<td>Science</td>
<td>2</td>
</tr>
<tr>
<td>Social Studies</td>
<td>2</td>
</tr>
<tr>
<td>All subjects</td>
<td>3</td>
</tr>
<tr>
<td>Others</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Years of teaching experience</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>9.54</td>
</tr>
<tr>
<td>SD</td>
<td>7.58</td>
</tr>
<tr>
<td>Range</td>
<td>1-28</td>
</tr>
</tbody>
</table>

*When there were fewer than two teachers teaching a particular subject, the teachers’ subject was categorized as “others”. Although elementary school teachers teach all subjects, only those who submitted lesson plans that included different subjects were placed in the “all subjects” category.
The teachers each chose a “study class” who were also participants in the study. Though all participants joined the study voluntarily, the teachers and their students could not be considered a random sample. The teachers self-selected to participate in the professional development program. The teachers, their students, and the parents of their students all signed the consent to indicate whether they wanted to participate in this study. Only those with permission were included.

It is important to determine the minimum sample size to achieve a desired level of statistical power prior to data collection. Hedeker, Gibbons, and Waternaux’s (1999) formula was used to calculate sample size in a longitudinal design. They proposed that when a study has a sample size of 25, and six to eight times of repeated observations, it will have a statistical power of .80 on a two-tailed $t$ test at $\alpha=.05$, a medium effect size of .50, and correlation of .30 among the repeated measures. Therefore, for this study, 28 participants are assumed to achieve a desired statistical power.

**Data sources and instrument.** For each coaching observation, teachers submitted the written lesson plans of the instruction that would be observed by their coaches. Two trained coders rated the quality of teachers’ planning of instructional conversations using the Lesson Plan Rubric, a tool designed to measure planning of the CREDE Standards. Table 2 provides a description of six levels of teachers’ planning of instructional conversations, as measured by the Lesson Plan Rubric, a modification tool of Standards Performance Continuum. They rated teachers’ lesson plans individually, and then met to discuss the discrepancies between their scores until they reached consensus. The reconciled scores were analyzed. In a pilot study, the two trained coders used the Lesson Plan Rubric to rate the first three lesson plans of teachers who attended
the PD from 2009 to 2010. The average of the generalizability coefficients for the first three lesson plans was .80.

Table 2

*Lesson Plan Rubric Scoring Criteria for Instructional Conversations*

<table>
<thead>
<tr>
<th>Score</th>
<th>Characteristic of Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Not planned.</td>
</tr>
<tr>
<td>1</td>
<td>The teacher planned to converse with a large group of students on an academic topic for an extended amount of time AND elicit student talk with questioning, listening, rephrasing, or modeling.</td>
</tr>
<tr>
<td>2</td>
<td>The teacher planned to converse with a small group of students on an academic topic for an extended amount of time AND elicit student talk with questioning, listening, rephrasing, or modeling.</td>
</tr>
<tr>
<td>3</td>
<td>The teacher planned an instructional conversation with a small group of students with a clear academic goal AND planned to assess and assist student understanding.</td>
</tr>
<tr>
<td>4</td>
<td>The teacher planned an instructional conversation with a small group of students with a clear academic goal. The teacher planned to assess and assist student understanding AND question students on their views, judgments or rationales in reaching the academic goal.</td>
</tr>
<tr>
<td>5</td>
<td>The teacher planned an instructional conversation with a small group of students with a clear academic goal. The teacher planned to assess and assist student understanding AND question students on their views, judgments or rationales in reaching the academic goal. The teacher planned to facilitate the conversation so that student talk occurs at a higher rate than teacher talk.</td>
</tr>
</tbody>
</table>

**Data analysis.** I used a multilevel model (Heck et al., 2010) using SPSS MIXED version 18 for two-level models (observations within teachers) to estimate 28 teachers’ growth trajectories for planning of instructional conversations over the course of the school year. I analyzed different covariates, including teaching experience, the grade levels taught, and the subjects (teaching mathematics or other subjects), to examine how much of the variance regarding the growth trajectories of instructional conversations was accounted for by each covariate. Therefore, it was assumed that $i^{th}$ teacher’s instructional conversation score at $j^{th}$ lesson plan is $Y_{ij}$, and $Y_{ij}$ is modeled as follows:
Stage Two: Qualitative Method

Participants. In Stage 1, ten teachers whose study classes were related to mathematical instruction but only eight of them were included in Stage 2. Coaching notes were part of the data source for Stage 2. I found that the coaching notes for only eight teachers were complete and described what happened in the observation and coaching debriefing meetings. Therefore, the two teachers with incomplete coaching notes were not included. Table 3 provided more details of the teachers’ demographic information.
Table 3

*Overview of Eight Participating Teachers*

<table>
<thead>
<tr>
<th>Teacher</th>
<th>School location</th>
<th>Number of years teaching</th>
<th>Grade</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kelly</td>
<td>Urban area of Oahu</td>
<td>28</td>
<td>2</td>
<td>17</td>
</tr>
<tr>
<td>Belinda</td>
<td>Rural area of Oahu</td>
<td>11</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Betty</td>
<td>Rural area of Oahu</td>
<td>11</td>
<td>3</td>
<td>19</td>
</tr>
<tr>
<td>Chad</td>
<td>Rural area of Oahu</td>
<td>1</td>
<td>7</td>
<td>21</td>
</tr>
<tr>
<td>Nancy</td>
<td>Urban area of Oahu</td>
<td>6</td>
<td>7</td>
<td>24</td>
</tr>
<tr>
<td>Cindy</td>
<td>Rural area of Oahu</td>
<td>1</td>
<td>7</td>
<td>24</td>
</tr>
<tr>
<td>Gary</td>
<td>Rural area of Oahu</td>
<td>1</td>
<td>9-12</td>
<td>12</td>
</tr>
<tr>
<td>Jordan</td>
<td>Rural area of Oahu</td>
<td>1</td>
<td>9-12</td>
<td>17</td>
</tr>
</tbody>
</table>

**Data sources and analysis.** Teachers’ written lesson plans, coaching reflection journals, coaches’ feedback on the plans and journals, and coaches’ observation notes were included. After finishing the data analysis, I also interviewed the coach to clarify the questions I had during data analysis. I used multiple and relevant sources of evidence (lesson plans, reflection journals, feedback, notes, and interview) over an extended period of data collection (one year) to provide a broad understanding of the proposed study (Yin, 2009). A multiple-case study with different strategies was conducted, including data coding (Miles & Huberman, 1994), explanation building (Yin, 2009), pattern matching (Yin, 2009), time-series analysis (Yin, 2009), and cross-case analysis (Yin, 2009). In Table 4, I briefly describe each strategy.
Table 4

**Coding Strategies**

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data coding</td>
<td>Label the data collected for a study while reviewing them for data analysis.</td>
</tr>
<tr>
<td>Explanation building</td>
<td>Examine whether general explanation(s) emerge while going through the data.</td>
</tr>
<tr>
<td>Pattern matching</td>
<td>Compare and contrast the patterns of teacher change from previous studies and the current study.</td>
</tr>
<tr>
<td>Time-series analysis</td>
<td>Investigate the changing pattern(s) of each teacher about their use and planning of instructional conversations across time.</td>
</tr>
<tr>
<td>Cross-case analysis</td>
<td>Study the similarities and differences of teacher change across teachers.</td>
</tr>
</tbody>
</table>

**Coding of Instructional Conversations**

*Instructional conversation categories.* The coding categories were initially developed based on a review of the literature on the CREDE Standards (Goldenberg, 1992/1993; Teemant et al, 2011; Tharp & Gallimore, 1988; Tharp et al, 2000), cognitive coaching (Batt, 2010; Beltman, 2009; Costa & Garmston, 2002; Garmston et al., 1993; Krpan, 1997; Moche, 2000; Reed, 2006; Slinger, 2004; Smith, 1997), the literature on development of classroom discourse (Herbel-Eisenmann, et al., 2009; Rubenstein & Thompson, 2002; Schleppegrell, 2007), and mathematics reform documents (CCSSM, 2010; NCTM, 1989, 1991, 2000) as well as on my knowledge of the CREDE professional development Project and its goals. Two categories, student readiness and instructional conversation skills were from literature on mathematical discourse. The other three categories: contextualization, activity design, and grouping methods, were from literature on discourse in non-mathematical instruction. The categories were modified through the process of actually attempting to code the collected data. Hence, the final coding categories reflected important features of discourse in classrooms as
suggested by theory and prior research and also salient characteristics of the Project and
the data set.

As mentioned earlier, I identified five categories and labeled them as follows:
student readiness, contextualization, activity design, questioning skills, and grouping
methods. These categories are in Table 5. I derived the categories from either the
teachers’ ideas or the coach’s suggestions.

Table 5

*Coding Categories for Instructional Conversations*

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student readiness</td>
<td>Teachers used or were suggested by Tina to use various strategies to prepare students to work independently from the teachers.</td>
<td>“I need to implement an instructional frame with times and activities listed on the board so that students can keep track of their independent work time better (Cindy’s first coaching reflection)*.”</td>
</tr>
<tr>
<td>Contextualization</td>
<td>Teachers integrated or were suggested by Tina to integrate students’ prior knowledge and experiences into their instruction.</td>
<td>“We brought items or drawings as a homework assignment to find arrays that we will use to create our instructional conversation joint product (Kelly’s fifth lesson plan)*”</td>
</tr>
<tr>
<td>Activity design</td>
<td>Teachers designed or were suggested by Tina to design their classroom activities to provide more opportunities for students to generate mathematical language.</td>
<td>“My biggest suggestion to you is that when you interact with the students and help them see how they can solve the problem, try to get the students to use the vocabulary. This will be a test to see if they are able to make the connection (Tina’s feedback on Nancy’s seventh lesson plan)*.”</td>
</tr>
<tr>
<td>Instructional conversation skills</td>
<td>Teachers used or were suggested by Tina to use questions that helped students learn more in instructional conversations.</td>
<td>“Try to keep the big questions such as the one you used today, “What is a grid used for (greater purpose kind of question)?” in the instructional conversation (Tina’s feedback for Belinda from the fifth coaching observation notes).”</td>
</tr>
</tbody>
</table>
Grouping methods

Teachers grouped or were suggested by Tina to group students in a way to help students learn more when they had instructional conversations with their students.

“A possible solution could be to break up the class into 2 groups instead of 4 for the Instructional Conversation. I think the class is small enough where this slight increase in group size wouldn’t negatively influence the effectiveness of the instructional conversation (Jordan’s third coaching reflection journal).”

*Cindy, Kelly, Nancy, Belinda, and Jordan are the pseudonyms for teachers and Tina is for the coach.

Coding procedures. I analyzed each teacher’s data chronologically (Miles & Huberman, 1994) because these data were collected by following each coaching cycle, from the first to the last coaching session. I did a pilot study by analyzing one teacher’s data because his coach told me that his planning and use of instructional conversations greatly improved over time. When I planned to continue analyzing other participants’ data, I wondered if other middle school teachers’ data would show a similar development of planning and use of instructional conversations. Therefore, I started by analyzing the other two middle school teachers’ data. I assumed that secondary teachers’ data might have a similar pattern so I decided to analyze the three elementary school teachers’ data. Finally, I analyzed the two high school teachers’ data. When the words or phrases in the data were related to the five categories, I marked them down as they appeared. The analysis process followed the order of Research Questions because the results of Research Question 2 were used to analyze Research Question 3, and so on. Different coding strategies mentioned above were used to answer the questions.
Once the data were coded, I applied explanation building to answer Question 2 by examining how these factors affected teachers’ change in planning and use of instructional conversations. Meanwhile, pattern matching was used to compare the findings to the previous studies on instructional conversations.

With the findings from Question 2, cross-case analysis was used to answer Question 3 by comparing and contrasting the differences and similarities across teachers. In addition, I used time-series analysis to see if these results were the same when comparing the results from the first to the last coaching session. After using time-series method, I used pattern matching to see if the findings matched those of previous studies, and if the findings supported the results of Question 1. When the results were different from the first Research Question, I re-examined the findings from Questions 2 and 3. After indentifying why there were differences, I moved to answering Question 4.

When answering Question 4, I carefully investigated how the findings from Questions 2 and 3 were caused by coaching support. More specifically, time-series analysis and cross-case analysis were used to examine how the coach helped each teacher change across time, and if the assistance that the coach provided were different for each teacher. Pattern matching was also used to compare the findings with previous studies on the effects of cognitive coaching. I would examine if the findings of Question 4 matched with each other. If not, I would examine findings from Questions 2 and 3 to see why the discrepancies happened. Finally, based on the second examination, I reported the findings of Questions 1 to 4 in the result section.
In summary, this investigation on coaching influence on teachers’ planning and use of instructional conversations was done by applying quantitative and qualitative analyses. It started from using quantitative method (multilevel modeling). Based on the quantitative results, I used a qualitative method (multi-case study) to repeatedly examine if there were discrepancies between quantitative and qualitative results.

**Role of the Researcher**

I have worked for the CREDE Hawai‘i Project as a graduate assistant since 2009 and I have direct contact with coaches and Project teachers. During our weekly Project meetings, the coaches often report how their teachers are using the CREDE standards in classrooms. I often contact teachers regarding non-teaching business, such as mailing them the reimbursement paperwork and videotapes. Because I might unconsciously have biases on the teachers based on what I heard from the coaches and how the teachers interacted with me regarding dealing with the non-teaching business, so my interpretation of the data might not be objective.

Furthermore, because of working for this Project, I started to learn how CREDE researchers conceptualized instructional conversations. Through helping other Project staff in the workshops and examining teachers’ data, I understood how teachers applied their learning of instructional conversations in workshops to their practice and how their coaches assisted them during the application processes. In summer 2012, I taught an undergraduate class, EDEP 429: Introductory Statistics so I had a chance to apply what I learned about instructional conversations to my instruction. Most of my experiences of instructional conversations were indirect. With limited experience of using instructional
conversations in K-12 classrooms, I might not be aware of what struggles teachers in this current study would have if they did not explicitly express them in the data.

In addition, I was born and raised in a non-western culture. I was a certified teacher and had taught English as a foreign language in elementary school for half year and three years in a secondary school before I came to Hawai‘i for my Master and Doctoral degrees. My personal background might influence how I thought of mathematics instruction regarding teaching methods and interactions between students and their teachers. Furthermore, I did not go to the teachers’ classrooms to collect data, so I might have misunderstood what the teachers and coaches described in the collected data when I analyzed them.

**Trustworthiness**

In order to decrease or avoid biases caused by my role as a researcher, I used triangulation, member checking, pre-designed coding list, peer examination, and memos for clarification and deeper understanding. Yin (2009) states that data triangulation encourages “you to collect information from multiple sources but is aimed at corroborating the same fact or phenomenon” (p. 116). Based on Yin’s suggestion, I examined if the themes identified in one type of data source appeared in other data sources. Member checking required that I took my interpretations back to the participants (coach and the eight teachers) and asked them to confirm those results (Merriam, 1991). In order to help novice researchers feel confident coding data, Miles and Huberman (1994) suggested that they use a start coding list that the researchers summarized from the results of previous studies. Therefore, I started my data coding by following a start coding list and modified it based on the common themes in my data. As
for peer examination, I contacted a colleague familiar with case study methodology and cognitive coaching to comment on the findings as they emerged (Merriam, 1991).

Corbin and Strauss (2008) suggested that during data analysis, writing various memos to help researchers reflect on their analytic thoughts is useful because it helps researchers be objective in data analysis. Every time when I analyzed the data, I wrote down memos. For example, when I analyzed first middle school teacher’s data, I noticed that in his first lesson plan, he did not prepare his students to work independently from him. In my memo, I wrote down the following thoughts,

In Tharp et al.’s (2000) book, they mentioned that in order to have a successful instructional conversation, teachers needed to prepare their students to work independently so they could concentrate on working with a small group of students at teacher center. The teacher also mentioned that his students were not used to CREDE Standards. Then, would he implement instructional conversations successfully in his first coaching observation? How about other middle school teachers? Did they start using instructional conversations in their first lesson plan?

In addition, I reviewed these memos regularly during my data analysis, especially when I needed to compare and contrast my findings of each teacher at each coaching session. These strategies including triangulation, member checking, peer examination, and memo keeping helped make my interpretation of the data trustworthy.
Chapter 4

Results

This chapter is presented in four main sections to answer my four Research Questions. The answers for the first Research Question were from quantitative data analysis. The answers for the second to fourth Research Questions were from qualitative data analysis. The findings of this current study supported my three assumptions toward this study. Teachers’ abilities of planning and use of instructional conversations were low, but through coaching assistance, their abilities in planning and use of instructional conversations increased across time. The following sections will provide more details on (a) teachers’ development on planning and use of instructional conversations and (b) factors influencing the development, such as coaching assistance, teachers’ skills, and student learning habits.

Research Question 1: To What Extent Did Cognitive Coaching Influence Teachers’ Planning of Instructional Conversations?

Table 6 presents means and standard deviations of instructional conversation scores over the eight lesson plans. The scores went up since the teachers started to receive coaching; although the scores decreased at the fifth lesson plan, the scores increased again from the next lesson plan.
Table 6

*Descriptive Statistics of Instructional Conversation Scores Over Eight Lesson Plans*

<table>
<thead>
<tr>
<th>Plans</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M</strong></td>
<td>.93</td>
<td>1.81</td>
<td>2.14</td>
<td>2.18</td>
<td>1.7</td>
<td>2.16</td>
<td>1.95</td>
<td>2.39</td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td>.98</td>
<td>1.44</td>
<td>1.67</td>
<td>1.59</td>
<td>1.38</td>
<td>1.77</td>
<td>1.81</td>
<td>1.85</td>
</tr>
</tbody>
</table>

The examination of 28 teachers’ change in instructional conversation score was represented as a two-level growth model, where successive plans are nested within each teacher. Level 1 is teachers’ successive plans and Level 2 is the teachers whose lesson plans were measured multiple times. Since the current study examined the influence of coaching on the changes of the instructional conversation scores over time, the growth trajectories of 28 teachers’ instructional conversation scores were tested first. Results suggested that the model with quadratic trajectory should be retained in the following analysis (linear effect of coaching, \( t = 3.15, df = 108, p < .00 \); quadratic effect of coaching, \( t = -2.02, df = 94.96, p < .05 \)).

The results of the proposed model are summarized in Tables 7 and 8 and Figure 1. Table 7 suggests that differences in instructional conversation scores varied over time. The teachers’ initial status of instructional conversation planning score was not statistically significant (Wald \( Z = 1.61, p/2 = .06 \)) which means that teachers’ instructional conversation planning scores were similar to one another before they started receiving coaching. The variance for Time 0 (teachers submitted first lesson plan and did not receive any coaching assistance) was the least (.71). Once the teachers received coaching after submitting their first lesson plan, the variance of instructional conversation score increased and showed a lot of fluctuation. The size of variance estimates reduced around
Time 4 (teachers submitted the fourth lesson plan and received four times of coaching assistance) and increased again, indicating a possibility to further develop the model. The linear effect was statistically significant, which means that the growth rate of instructional conversation scores varied across the eight lesson plans (Wald $Z=1.90$, $p/2=.03$).

Table 7

Random Effects on Instructional Conversation Scores

<table>
<thead>
<tr>
<th>Effect</th>
<th>Estimate</th>
<th>SE</th>
<th>Wald Z</th>
<th>$P$ (1-sided)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>Level 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 0</td>
<td>.71</td>
<td>.27</td>
<td>2.64</td>
<td>.01</td>
<td>.34</td>
</tr>
<tr>
<td>Time 1</td>
<td>1.90</td>
<td>.58</td>
<td>3.31</td>
<td>.00</td>
<td>1.05</td>
</tr>
<tr>
<td>Time 2</td>
<td>1.97</td>
<td>.58</td>
<td>3.41</td>
<td>.00</td>
<td>1.11</td>
</tr>
<tr>
<td>Time 3</td>
<td>1.47</td>
<td>.45</td>
<td>3.26</td>
<td>.00</td>
<td>.81</td>
</tr>
<tr>
<td>Time 4</td>
<td>1.42</td>
<td>.48</td>
<td>2.95</td>
<td>.00</td>
<td>.73</td>
</tr>
<tr>
<td>Time 5</td>
<td>1.73</td>
<td>.61</td>
<td>2.86</td>
<td>.00</td>
<td>.87</td>
</tr>
<tr>
<td>Time 6</td>
<td>1.66</td>
<td>.70</td>
<td>2.38</td>
<td>.02</td>
<td>.73</td>
</tr>
<tr>
<td>Time 7</td>
<td>2.16</td>
<td>.98</td>
<td>2.21</td>
<td>.03</td>
<td>.89</td>
</tr>
<tr>
<td>Level 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>.33</td>
<td>.20</td>
<td>1.61</td>
<td>.11</td>
<td>.10</td>
</tr>
<tr>
<td>Linear</td>
<td>.03</td>
<td>.02</td>
<td>1.90</td>
<td>.06</td>
<td>.01</td>
</tr>
</tbody>
</table>

Table 8 shows the fixed effects on instructional conversation scores. The teacher’s initial score of instructional conversation before receiving coaching was 1.59. The teaching subject, grade taught, and teaching experience did not explain teachers’ planning of instructional conversations. The trajectory of teachers’ instructional conversation scores was curvilinear. The fixed linear effect of coaching, .45, was significant ($t=3.61$, $df=77.87$, $p=.00$) and the fixed quadratic effect of coaching, -.05, was also significant ($t=-2.34$, $df=73.28$, $p=.02$). By using the two estimates of the coaching effects, teachers’ instructional conversation scores on average achieved the highest when the teachers received 4.5 coaching sessions ($4.5=3.45/2*(-.05)$), and tended to decrease
after that. In general, teachers’ growth in instructional conversation scores was .35 after the first coaching session; .25 after the second coaching session; .15 after the third coaching session.

Table 8

*Fixed Effects on Instructional Conversation Scores*

<table>
<thead>
<tr>
<th>Effect</th>
<th>Estimate</th>
<th>SE</th>
<th>df</th>
<th>t</th>
<th>P (2-sided)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.59</td>
<td>.40</td>
<td>23.11</td>
<td>3.96</td>
<td>.00</td>
<td>.76 - 2.42</td>
</tr>
<tr>
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<td>.13</td>
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<td>3.61</td>
<td>.00</td>
<td>.20 - .70</td>
</tr>
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<td>.02</td>
<td>73.28</td>
<td>-2.34</td>
<td>.02</td>
<td>-.08 - -.01</td>
</tr>
<tr>
<td>Math=0</td>
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<td>21.06</td>
<td>-1.31</td>
<td>.21</td>
<td>-1.11 - .25</td>
</tr>
<tr>
<td>Grade Level=0</td>
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<td>20.96</td>
<td>.11</td>
<td>.91</td>
<td>-.95 - 1.06</td>
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<tr>
<td>Grade Level=1</td>
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<td>1.12</td>
<td>.28</td>
<td>-.39 - 1.30</td>
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<tr>
<td>Grade Level=2</td>
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<td>Teaching Experience</td>
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<td>21.18</td>
<td>-1.64</td>
<td>.12</td>
<td>-.09 - .01</td>
</tr>
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</table>

Figure 1 provides a picture how the teachers’ growth trajectories developed across time. In general, at Time 0 (receiving no coaching assistance on planning of instructional conversations), most teachers’ scores were low and relatively close to each other, but with the coaching assistance, the scores started to go up at different rates and decreased slightly at the end. At Time 7 (the teachers submit their eighth lesson plan), the gaps between different groups of teachers were smaller than those at Time 0 with an exception of Group 4. In addition, although the two covariates (teaching subjects and grade taught) were not significantly different, Figure 1 shows in general, mathematics teachers (except Group 6- high school mathematics teachers) did better than non-

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2 Mathematics teachers only included eight teachers whose coaching notes were complete so the results shown in Figure 1 could be compared to the qualitative results in Chapter 5.
mathematics teachers; among the eight mathematics teachers, elementary school teachers performed much better than secondary teachers.

Figure 1. Teachers’ trajectories of predicted instructional conversation scores over the eight lesson plans. Group 0 = the non-mathematics teachers from kindergarten. Group 1 = the non-mathematics teachers from elementary. Group 2 = the non-mathematics teachers from middle school. Group 3 = the non-mathematics teachers from high school. Group 4 = the mathematics teachers from elementary. Group 5 = the mathematics teachers from middle school. Group 6 = the mathematics teachers from high school. The lines for Groups 2 and 3 are close and the one slightly higher is for Group 2.
**Research Question 2:** What Factors Influenced Teachers’ Planning and Use of Instructional Conversations in Mathematics Teaching?

Through qualitative analysis in Stage 2, the results indicated that four factors influenced teachers’ planning and use of instructional conversations. After I define and explain each factor, I will provide more details in subsequent sections about how the factors influenced the teachers’ development of instructional conversational skills.

The first factor was *student readiness*: in order to have instructional conversations with a small group of students at the teacher center, the teachers in the current study used different strategies to prepare the other students to work independently at the student centers. When students at student centers were able to stay on task, the teachers could concentrate on having instructional conversations with the students at the teacher center. The second factor was *activity design*. The teachers learned to modify their classroom activities so that the activities could provide more opportunities for their students to be engaged in instructional conversations. The third factor that related to teachers’ development and use of instructional conversations was *instructional conversation skills*. The teachers improved their instructional conversation skills so that their questions could elicit more student talk and helped students to understand academic topics at the teacher center. The last factor was *grouping methods*. The teachers tried different ways to group their students so they could adjust the content of instructional conversations to meet students’ learning needs. In the next sections, I describe each of the factors in more detail.
Student readiness. The data showed that many students were not used to working independently from their teachers. Therefore, before the teachers started to use instructional conversations with one small group of students at a time, they needed to prepare their students to work independently from the teachers. Through analyzing the data, I identified ten methods that the teachers used to prepare their students to work effectively at the student centers. After the teachers used one or more of the methods, they found that their students at the student centers could stay on task. When this happened, the teachers could pay more attention to having instructional conversations with a small group of students at the teacher center.

1. Reminders about the noise level: The teacher reminded students of controlling their volume or spread out each of the center activities more, so the students’ voice would not interfere with one another.

2. Use of task cards: At each student center, the teacher provided task cards in which the teacher writes instructions to guide students to finish the tasks and made sure that every student read the task card before they started working on the assigned tasks.

3. Design of appropriate activities: The teacher designed the activities that the students could do without the teacher’s assistance.

4. Provision of extra work: The teacher prepared extra tasks for students who might finish earlier.

5. Modeling ways of accomplishing activities: The teacher modeled how to accomplish the tasks before sending students to each student center.
6. Posting of the day’s agenda: The teacher posted the day’s agenda on the board, so students knew how much time they had to accomplish each activity.

7. Discussion of class values: The teacher and the class discussed class values before students were sent to the student and teacher centers.

8. Modeling of behavior expectations: The teacher modeled how students should behave at the student centers.

9. Planning of appropriate rotation time: The teacher provided enough time for students to finish activities at the student centers.

10. Development of routines: The teacher provided opportunities for students to practice how to rotate from center to center. Sometimes, the teacher set up a system for students to take out and put away the materials that the students used at the student center without the supervision.

Table 9 showed that the teachers used various methods at the first two coaching sessions to prepare their students to work independently at the student centers. After the second coaching session, the teachers used fewer strategies, and the strategies became routines. For example, Kelly often discussed class values with her students before she sent them to the student centers. Modeling expected behaviors was often used by many of the teachers. The high school teachers (Jordan and Gary) used fewer methods to help students work independently from them than the elementary and middle school teachers. Here, I want to point out that Chad, Cindy, Jordan, and Gary attended the six-coaching sessions CREDE professional development program, so there was no information for the seventh and eighth coaching sessions.
### Table 9

*The Methods of Preparing Student Readiness*

<table>
<thead>
<tr>
<th>Name</th>
<th>1st CS</th>
<th>2nd CS</th>
<th>3rd CS</th>
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<tbody>
<tr>
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<td></td>
<td>H</td>
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<td>E</td>
<td>F, G</td>
<td>H</td>
<td></td>
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<td>Chad</td>
<td>G, H, I, J</td>
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<td>A, H, J</td>
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<td>A, H, J</td>
<td>J</td>
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<td>B</td>
<td>C, D, J</td>
<td></td>
</tr>
<tr>
<td>Cindy</td>
<td></td>
<td>B, F, G, H, J</td>
<td>F, H</td>
<td>E, F, H</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gary</td>
<td>F</td>
<td>C, E, F, G, H, J</td>
<td>D, E</td>
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<td></td>
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</tr>
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<td>Jordan</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* CS = coaching session. Letters A-J were used to indicate the ten methods teachers used to prepare their students for entering the mathematics-talk community. A = decrease the noise level. B = use task cards. C = design appropriate activities. D = provide extra work. E = model how to accomplish the activity. F = post the day’s agenda. G = Discuss class values. H = model behavior expectations. I = allot appropriate rotation time. J = set up routines.

**Activity design.** The results showed that initially, teachers tended to have conversations with the whole class. With coaching assistance, the teachers started to consider how they could change their activity designs to develop instructional conversations at the teacher center. The following quote shows that Gary did not plan to have instructional conversations with his students in his first lesson plan. He modeled how to make a foldable (study guide) in front of the whole class and then every student worked on their own study guide.

Teacher will introduce the goal to students and show example foldable. Students will make foldable and include the examples provided for each benchmark (or suggest their own). Teacher will assist as needed each group. Teacher will summarize lesson looking at foldables and remind students about test on Wed. (Gary’s first lesson plan)
However, in the later coaching sessions, Gary started to consider what else he could do to provide more opportunities for the students to use their mathematical language while he had instructional conversations with a small group of students at the teacher center. The following quote showed that Gary provided opportunities for his students to express themselves by asking the students to explain their thinking.

Students had opportunities during this lesson to build literacy skills including learning new mathematical terminology as they worked out the problems…. [instructional conversations] encouraged by the teacher at the center by questioning students on the process being learned. Again, not accepting yes/no answers without explanations. Rephrasing students’ answers in more mathematically correct language. (Gary’s third coaching reflection journal)

Table 10 summarized how teachers changed or planned to change their activity design across time, so that they could provide more chances for students to orally express their thoughts and use mathematical language in class.

Table 10

<table>
<thead>
<tr>
<th>Name</th>
<th>1st CS</th>
<th>2nd CS</th>
<th>3rd CS</th>
<th>4th CS</th>
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<tr>
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<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
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<tr>
<td>Nancy</td>
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<td>B, C</td>
<td>B, C</td>
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<td>C</td>
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<td>C</td>
</tr>
<tr>
<td>Cindy</td>
<td>B</td>
<td>B, C</td>
<td>B, C</td>
<td>C</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>Gary</td>
<td>B, C</td>
<td>B, C</td>
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<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
</tbody>
</table>

*Note.* Letters A-D were used to indicate the change of activity design when the teachers planned to provide opportunities for students to use more mathematical language. A= encourage students to talk in the whole class. B= encourage students to talk at the student center. C= encourage students to talk at the teacher center. D= encourage students to talk more at the teacher center.
There was also a pattern how the teachers changed by using four methods (A-D). Initially, all of the eight teachers encouraged students to talk in a whole class or at the student centers. Later, the teachers not only provided opportunities for students to talk in a whole class or at the student centers but also at the teacher center. When the students were given chances to discuss their thoughts at the teacher center, five of the eight teachers also hoped that their students could talk more than teachers.

When the teachers provided more opportunities for students to talk at the teacher center, this change also illustrated that the conversations at the teacher center were more like instructional conversations. According to Doherty et al. (2002), a fully enacted instructional conversation happens when the teacher “listens carefully to assess and assist student understanding; and questions students on their views, judgments, or rationales. All students are included in the instructional conversations, and student talk occurs at higher rates than teacher talk.” (p. 5)

**Instructional conversation skills.** While teachers were encouraging more student talk in instructional conversations, they also worked on instructional conversation skills that could help students better understand the purpose of instructional conversations. One skill that many teachers were working on was to provide briefing and debriefing statements at the teacher center. For example, before starting any activity at the teacher center, the teacher explained the academic goal of instructional conversations; before finishing the discussion, the teacher summarized all of the discussed points in instructional conversations to help students examine if they reached the academic goal mentioned at the beginning of the discussion.
Table 11 showed four changes in the teachers’ development of instructional conversation skills. The first change was that the teachers started to explicitly tell students what the goal of instructional conversations was before starting activities at the teacher center. The second change was that the teachers noticed that they needed to have a briefing statement about the goal of instructional conversations and a debriefing statement that summarized all discussed points at the teacher center. The debriefing statement also helped students and teachers to check if the academic goal was achieved. The third change was that the teachers preplanned what questions they would ask in the instructional conversations, so they could elicit more student talk and advance students’ thinking to higher levels. The fourth change was that the teachers who preplanned the questions also individualized their questions to match students’ varied ability levels.

Table 11

The Development of Instructional Conversation Skills

<table>
<thead>
<tr>
<th>Name</th>
<th>1st CS</th>
<th>2nd CS</th>
<th>3rd CS</th>
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<td></td>
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<td>B</td>
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<td>Chad</td>
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</table>

Note. Letters A-D were used to indicate the development of instructional conversation skills that the teachers planned, used, or learned to provide opportunities for students to maximize their learning during the instructional conversations. A= having the goal of instructional conversations. B= thinking of questions that advanced student thinking to higher levels. C= having questions for different groups of students. D= having a briefing and debriefing statement.
Table 11 shows that there was not a clear pattern regarding how the eight teachers changed their activity design. From their data, I assumed that this might be due to differences in class contexts. For example, Belinda had a smaller class than the other two elementary school teachers (Kelly and Betty), and her reflection seemed to show that her students’ learning needs were similar. “The majority are at a low second grade level, but a few are still at 1st grade level (first coaching reflection journal).” Therefore, I assumed that might explain why Kelly and Betty designed different questions to match students’ needs, but Belinda did not.

In addition, Table 11 shows that most of the teachers paid attention to developing their instructional conversation skills from the second or third coaching sessions. This pattern was consistent with the findings mentioned above that the teachers needed to prepare students for working independently at the student centers first before the teachers could concentrate on having instructional conversations at the teacher center.

Compared to the other six teachers, Belinda and Cindy focused on refining their instructional conversation skills at later coaching sessions. From Belinda’s and Cindy’s reports quoted below, I assumed that this delay might have been related to their students’ learning behaviors. Belinda’s students did not talk to each other appropriately, so Belinda focused more on helping them to talk nicely by modeling how to talk at the teacher center.

Most students in my class are eager to be first and often do not communicate kindly to one another when determining who will be representing their team. I am trying to promote fairness, respect, and equity with sharing. Students were instructed in groups to determine a way to find out who would be sharing for their group. (Belinda’s first coaching reflection journal)
Cindy had been concerned about student behaviors at the student centers, so she often chose to design her class as a Phase 1 or 2 classroom where the teacher monitors the whole class, does most talk, and works with half of the class. In other words, she did not work much on her instructional conversation skills because a fully enacted instructional conversation requires students to talk more than teachers and the conversation happens when the teacher works with a small group of students (Doherty et al., 2002).

**Grouping methods.** The results indicated that when the teachers started to think about how to plan their instructional conversations, they also considered how to group their students, so that instructional conversations could strengthen student learning. For example, some teachers considered the number of students that should be included at the teacher center and how they should group students, based on student abilities or student interests. Kelly’s reflection below indicated that these considerations helped her to provide appropriate assistance in her instructional conversations.

> I think that the homogenous grouping went well because the group that I thought would need more help understanding perimeter did. I was able to work with that group to review the idea of perimeter. So I do think that in the future I am going to be looking at what grouping would be most appropriate to not only the behavioral issues but also the concept development. (Kelly’s seventh coaching reflection journal)

**Research Question 3:** What Characterized Teachers’ Development in Planning and Use of Instructional Conversations in Mathematics Teaching, Both Individually and as a Group?

The results suggested that two factors characterized teachers’ development in planning and use of instructional conversations. First factor was student readiness. When students were not able to work independently at the student centers, the teachers
did not plan to have instructional conversations because they still needed to float around to assist their students. When students were able to stay on task, the teachers planned to work with a small group of students at the teacher center while the rest of students work independently at the student centers. Student readiness to work independently was related to another factor, activity design. After making sure that students were able to stay on task, teachers started to pay more attention to modifying their activity designs, so they could encourage students to express their thoughts in class, especially at the teacher center. When I examined how the two factors characterized teachers’ development of planning and use of instructional conversations, the data showed that in general, teachers had more similarities with those who taught the same grade levels. The following sections provide more details on how the two factors characterized the development of use and planning of instructional conversations among the eight teachers.

**Student readiness.** All of the teachers needed to prepare their students for working independently from their teachers when the teachers were working with a small group of students at the teacher center. The strategies the teachers used were different across grade levels. Elementary school teachers (Belinda and Kelly) did a lot of preparation at the beginning of each class, such as modeling the expected behaviors and reviewing the class values. At the end of the class, they also asked students for their opinions about the day’s activities. In Belinda’s first lesson plan, she mentioned, “I am focusing on our daily math schedule and student procedures right now as well.” When Tina observed Belinda, she wrote down how Belinda prepared her students to work with
their peers, “We reviewed yesterday what our Pono\textsuperscript{3} class sounds like. Now let’s review what it feels like. Teacher goes through the values (first coaching observation notes).”

In addition to reminding students about the class values, Kelly invited her students to model the class values. When Tina observed Kelly’s class for the first time, she wrote, “Teacher brings up a student and they act out what it looks like when the teacher or the student wants to go first (first coaching observation notes).” The quotes below showed that although Betty seldom reviewed the behavioral expectations at the beginning of the class, she modeled how to accomplish the assigned tasks at the student centers for her students. At the end of the class, she also invited her students to write their feedback about the day’s activities.

I will collect math journals and read their responses to the writing prompt which will be: Tell me 1 thing that was really difficult for you at math centers today, tell me 1 thing that you really enjoyed at math centers today and why, and tell me 1 idea you have for a new math center. I write a response in each journal and return the next school day. (Betty’s third lesson plan)

These intensive reminders helped the students stay on task when they were at the student centers and might explain why the elementary school teachers were able to have instructional conversations after the first or second coaching observation.

The secondary school teachers did not spend time as much as the elementary school teachers did to prepare their students to work independently. In their first lesson plans, they did not mention that they would go over class values or behavioral expectations with their students. They also did not plan to model the expected behaviors before sending students to the student centers. This might explain why Tina’s coaching notes for the earlier coaching observations included more misbehavior at student centers.

\textsuperscript{3} Pono is a Hawaiian word. It means righteous.
for middle school compared to elementary school students. Tina’s coaching observation notes for two high school teachers seldom mentioned student misbehavior. After the first coaching observation, the middle school teachers started to work on preparing their students to work independently from the teachers, so the teachers could concentrate on working with the students at the teacher center.

The following quote showed that Chad’s students were not able to work independently from him, and he planned to use different strategies to prepare his students for working effectively at the student centers. The strategies included modeling of expected behaviors, allotting more time for each center rotation, and designing student-centered activities for students to work on.

On the face, many of the student groups were off-task and some did not complete key components of the lesson as a result. I can trace this back to a number of items that need to be improved. For one, I need to model much better what is expected out of groups when working on their own. Secondly, the logistics of the class need to be adjusted to fit for student needs. This includes lengthening station times, allowing for better materials at stations, and designing better transitions. Finally, I could improve upon the quality of the stations by making activities more engaging, hands-on, and contextualized. (Chad’s first coaching reflection journal)

Table 9 indicates that the teachers used different strategies to prepare their students for working independently in their earlier coaching sessions, but they used fewer in the later coaching sessions. When comparing Tables 9 and 10, I noticed that when the teachers’ students knew how to work independently, the teachers started to work on how they could provide more opportunities for students to engage in instructional conversations at the teacher center.
Compared to the other seven teachers, Cindy did not have a lot of opportunities to develop instructional conversation skills because of student misbehavior. Cindy had been working on helping her students at the student centers to stay on task from the first to the last coaching sessions. For example, the following quote showed that because the students could not work independently, she chose to implement a Phase 1 or 2 classroom.

My classroom management is preventing us from moving into a phase three. I struggle with whether it would be more beneficial to go back to a phase one, because students really accomplished little to no work in their independent stations. (Cindy’s fourth coaching reflection journal)

According to Tharp et al. (2000), teachers’ conversations with their students in Phase 1 and 2 classrooms are not called instructional conversations because teachers mainly work with a whole class or half of the class at one time, and teachers talk most of the class time. Although Cindy did not have instructional conversations with a small group of students, she tried to improve her practice by promoting more student talk in class. For example, she planned, “Teacher will try to ask questions to encourage students speaking more than the teacher (Cindy’s sixth lesson plan).”

**Activity design.** I identified three changes in activity design that characterized teachers’ development of planning and use of instructional conversations. The changes included (a) using contextualization by connecting students’ experiences to new academic topics; (b) encouraging students to speak more mathematical language; and (c) using different ways to have instructional conversations with students.

**Contextualization.** Initially, the middle and high school teachers planned to contextualize their lessons by reviewing what the students had learned previously. Later, the middle school teachers started to reflect on what else they could contextualize the
lessons, so instructional conversations could benefit students more. For example, Chad mentioned, “I could have also improved upon contextualization by introducing a real world connection at the outset of the instructional conversations rather than waiting for the follow-up (fourth coaching reflection journal).” As for high school teachers (Jordan and Gary), although Tina asked them if they could connect students’ experiences to the new topics, they still only planned to contextualize their lessons by reviewing what the students had learned previously.

In contrast, elementary school teachers (Belinda, Betty, and Kelly) not only reviewed what students learned before but also connected students’ personal experiences to new topics. They often started their lessons by reviewing what the students previously learned. They chose to connect students’ personal experiences to the new topics either in the whole class, at the student centers or at the teacher center. The following quotes from Kelly’s data showed how contextualization was used in instructional conversations to increase student learning at the teacher center. In the fifth lesson plan, Kelly asked students to bring items related to arrays from home, so she could use these items in instructional conversations.

We brought items or drawings as a homework assignment to find arrays that we will use to create our instructional conversation joint product. They are also familiar with the visual representation of an array using dots through the bingo game they have played. (Kelly’s fifth lesson plan)

Kelly’s fifth coaching reflection below indicated how use of contextualization during instructional conversations in her fifth lesson plan helped her students connect the academic concepts to their prior experiences and the objects in their home environment.
The instructional conversation was a good example of connecting the concept with real life applications from their home environment. The centers were a combination of prior learning and practice on current concepts. From our conversations during the instructional conversations I was able to ascertain that the students connected the use of an array as an organizational tool used in many different places. (Kelly’s fifth coaching reflection journal)

**More mathematical language.** In addition to use of contextualization in instructional conversations, another way the teachers changed their activity design was to encourage students to use mathematical language. Initially, the teachers focused on encouraging students to talk more in the whole class settings or at the student centers. Later, the teachers started to think about how they could elicit students to express and judge their thoughts in their instructional conversations at the teacher center. Many of them hoped that their students would talk more than the teachers during instructional conversations.

The following quote shows that Betty was still working on how to elicit more student talk.

> At my center, I felt that I talked too much. I didn’t allow the students to discuss possible strategies with each other. I told them a lot of things instead of having them discover or tell me. (second coaching reflection journal)

Her third reflection journal showed Betty’s improvement. The student talk increased and teacher talk decreased. In contrast to the second observation, the students had more chances to discuss the topic and talk to each other.

This was the first time where I was actually happy with the amount of student talk and lack of teacher talk at my center . . . The students lead the conversations at my table and although they did not use the correct math vocabulary, they were telling each other what an inverse equation is, and in some cases how using the “opposite thing” can help you solve a problem. (third coaching reflection journal)
Among the three elementary teachers, Kelly and Betty followed a similar developmental trend in encouraging students to talk more than the teachers. Belinda’s class was different because of her students’ unique needs. In her first coaching reflection journal, she mentioned that she provided a lot of language support for her students because the students were challenged in language. At the same time, she also needed to develop their social conversational skills because the students were eager to be the first and did not kindly communicate with each other in class. Due to these unique needs, she often modeled how to express thoughts at the teacher center. In her fifth coaching reflection, she mentioned the following idea as one of her action plans for future instruction, “Continue to build conversation skills that will support instructional conversation by using the language “I agree with you because . . .” or “I disagree with you because . . .” I assumed that her modeling might have taken away a lot of time so that she did not have enough time to encourage students to talk more than she did.

The data showed that from the second coaching session, the secondary school teachers started to provide more opportunities for students to use mathematical language at the teacher center. Chad’s development was different from the other four secondary teachers. He already planned to have instructional conversations with a small group of student at the teacher center in his first lesson plan, but he did not mention how he would encourage more student talk.

Students were required to use clear language and vocabulary in my conversation station and in the textbook reading station. However, I could design better ways to have students illustrate their understanding of the text or communicate their understanding. (first coaching reflection journal)
From his third coaching reflection journal, he mentioned that he wanted to promote more student talk by using contextualization to allow opportunities for students to lead instructional conversations.

I would like to improve my instructional conversation station, specifically in terms of getting students to talk more. I can do this by leading off with contextualization or problems, then letting students’ conversations guide us to the learning objective. (third coaching reflection journal)

**Structure of instructional conversations.** The data also showed that in addition to the change to encourage student talk, the teachers in their later lesson plans began to modify the structure of instructional conversations. Depending on each teacher’s situation, I identified one or more of the following strategies from their lesson plans, coaching reflection journals, Tina’s feedback on the plans and journals, and Tina’s coaching observation notes:

1. Have a clear academic goal of the conversation and make the goal explicit to students;
2. Think of the questions that could elicit more student talk in the instructional conversations;
3. Differentiate the questions to meet the needs of students with different abilities;
4. Have a briefing statement to prepare students to enter the instructional conversations and a debriefing statement to summarize the discussion at the teacher center for students; and
5. Group students homogeneously.
Table 12 summarizes which strategies the teachers used to improve their instructional conversations. There was not a clear difference among the eight teachers except for Cindy and Belinda. As mentioned earlier, Cindy’s students struggled with working independently, and Belinda’s students needed her guidance on talking to one other appropriately. Therefore, the two teachers focused more on strategies that addressed these needs. In addition, all of the teachers except for Cindy, grouped students homogeneously when they had instructional conversations. All of the teachers also prepared questions that could advance students’ thinking to higher levels.

Table 12

Modification of Instructional Conversations at the Teacher Center

<table>
<thead>
<tr>
<th>Name</th>
<th>1st CS</th>
<th>2nd CS</th>
<th>3rd CS</th>
<th>4th CS</th>
<th>5th CS</th>
<th>6th CS</th>
<th>7th CS</th>
<th>8th CS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kelly</td>
<td>D, E</td>
<td>A, B</td>
<td>A, B,</td>
<td>B, D, E</td>
<td>C, E</td>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belinda</td>
<td>E</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Betty</td>
<td>B, E</td>
<td>A</td>
<td>A</td>
<td>B</td>
<td>B, E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chad</td>
<td>B</td>
<td>B, E</td>
<td>C, D</td>
<td>B, C, D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nancy</td>
<td>B</td>
<td>B</td>
<td>A, B,</td>
<td>A, B, D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cindy</td>
<td>B</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gary</td>
<td>B, D, E</td>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jordan</td>
<td>A, B, D</td>
<td>A, E</td>
<td>A, B,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D, E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Letters A-E were used to indicate how the teachers modified instructional conversations at the teacher center. A= having the goal of instructional conversations. B= thinking of questions that could advance student thinking to higher levels. C= having questions for different groups of students. D= having a briefing and debriefing statement. E= grouping methods.

Research Question 4: How Did Cognitive Coaching Influence Teachers’ Planning and Use of Instructional Conversations in Mathematics Teaching?
When analyzing the data, I identified coaching influences from Tina’s observation notes and her feedback to the teachers’ lesson plans and coaching reflection journals. Many of the changes mentioned in the section on what characterized teachers’ development in planning and use of instructional conversations are related to Tina’s suggestions. Tina individualized her assistance to match each teacher’s needs, and her assistance can be categorized to the following four types:

1. Help teachers to prepare students to work independently from teachers while teachers have a teacher center;

2. Assist teachers to contextualize lessons by integrating students’ personal experiences into instruction;

3. Encourage teachers to provide more opportunities for students to use mathematical language; and

4. Suggest modifications to the structure of instructional conversations.

Because each teacher’s situation was different, I present the coaching influence for each teacher individually.

**Assistance for Kelly.** The data indicated that the main assistance Kelly received from Tina was how to design her instructional conversations. Tina wrote, “Teacher didn’t feel comfortable in keeping them homogenously grouped (third coaching observation notes).” Kelly still grouped her students heterogeneously when she had instructional conversations with them during her fifth coaching observation. However, Tina noted, “The grouping has been about behavioral stuff, ability levels, and heterogeneous. She is beginning to see where they are homogenous for a phase V could be really good. This is becoming more natural (fifth coaching observation notes).”
Kelly’s reflection in her fifth and sixth coaching reflection journals also mentioned the same idea.

After reading Kelly’s reflection journal, Tina made the comment, “Let’s try it and see what happens. If it is a disaster, we can always apologize and move back to an arrangement they are comfortable with (sixth coaching reflection journal).” The following excerpt indicated that Kelly enjoyed the experience of grouping students homogeneously after she used homogeneous grouping in her seventh coaching observation.

I think that the homogenous grouping went well because the group that I thought would need more help understanding perimeter did. I was able to work with that group to review the idea of perimeter. (seventh coaching reflection journal)

**Assistance for Belinda.** Tina helped Belinda work on her instructional conversation skills. Belinda had been focusing on developing her students’ social conversation skills at the teacher center by modeling what she wanted them to do when they expressed their thoughts. After her modeling, students took turns to “play the teacher” when they shared how they solved mathematical problems. After her fifth coaching debriefing conversation with Tina, Belinda decided to modify her practice, “Separate the social/interaction skills with the concept on day 1 of going over the meat. On the first day, do a teacher center and then the second day, try more of an instructional conversation approach (fifth coaching observation notes).”

After reading Belinda’s plan, Tina followed up with Belinda’s decision by asking her, “Is this day 1 or 2? Have you already introduced the material (sixth lesson plan feedback)?” The excerpt below indicated that Tina also helped Belinda improve her questioning skills during instructional conversations.
After discussing instructional conversations further with Tina, I am beginning to understand that students really need to be beyond the “how” before they can get to the “why”. A question like “Why do people use grids?” would be a great conversation starter once students have gained basic understanding of grids and how to read and plot points on one. (fifth coaching reflection journal)

**Assistance for Betty.** Tina helped Betty to provide more opportunities to talk during instructional conversations. Betty’s lesson plans and coaching reflection journals showed that Betty had worked hard on encouraging her students to talk more than she did. The following excerpt from Betty’s second reflection journal showed that she seemed to assume that if she could limit her talk or work on her questioning skills, then her students would be able to talk more than her.

> At my center, I felt that I talked too much... I told them a lot of things instead of having them discover or tell me... I am not happy with the instructional conversations and am going to work on my questioning to promote more student talk. (second coaching reflection journal)

After reading her seventh reflection journal, Tina pointed out another possible reason why Betty’s students could not talk more than her.

> The teacher talk occurred at a much higher rate than student talk. I basically hand fed the students the information instead of assisting them with the new concepts through questioning and modeling. (seventh coaching reflection journal)

Do you think it is possible to get your students to speak at a higher level than you? I am wondering if it is because you tend to have instructional conversations when you are introducing new material. Have you had an instructional conversation on material that is already solidified? (Tina’s feedback on the seventh coaching reflection journal)

**Assistance for Chad.** Tina helped Chad to prepare his students to work independently from him, and at the same time, she assisted him with development of instructional conversation skills. In his first lesson plan Chad already planned to have instructional conversations with a small group of students at the teacher center.

However, Tina’s coaching observation notes indicated that the students at the student
centers were not able to stay on task, and the conversations at the teacher center did not flow smoothly. After their first coaching debriefing meeting, Chad planned to provide opportunities for students to practice rotations and design more authentic tasks for students to work together. The second coaching observation notes showed that these changes improved his students’ behaviors.

In addition, Tina helped Chad to refine his instructional conversation skills. The following excerpts were from the fourth coaching observation notes. During the four coaching debriefing meeting, Tina noted that Chad was not satisfied with his students’ performance and his flow of instructional conversations at the teacher center.

He felt like there were a lot of cobwebs in people’s heads. They were not with it and the teacher was tired. He felt that the instructional conversation station didn’t really work. The thing that threw him off was that they were really good at the number line. When he was doing the timing on the instructional conversation, he thought it would be a short review, but it was wrong tone for the whole conversation. He got off track in his instructional conversation. (fourth coaching observation notes)

After discussing with Tina, Chad decided to change his use of instructional conversations by asking students to explain their thoughts and contextualizing his teaching at the beginning of all conversations. The following excerpt showed that these changed improved the situation, and Chad had a positive feeling about his instructional conversations with his students.

The instructional conversation station continues to be a great way of differentiating to different student needs and connecting to students’ prior knowledge. I feel I led students to use their grasp of proportions to connect to similarity with minimal guidance from me, showing a really conceptual understanding of the day’s objective. (fifth coaching reflection journal)
**Assistance for Nancy.** Tina helped Nancy to prepare her students for independent work and refine her instructional conversation skills. In Nancy’s lesson plans and coaching reflection journals (e.g. the excerpt below from her third reflection journal), she often mentioned that she might not stay with one group for extended time because she needed to assist other groups.

I intended on staying with this group to help them better understand the new concept today instead of floating between all the groups. However, as my lesson progressed, I realized that all groups needed my attention at times at that I couldn’t just stay with the follow up group. (third coaching reflection journal)

Tina asked Nancy, “What do you need to do to make sure the other groups are independent and you can have the small group interaction you were hoping to have?” In the fifth coaching observation, Nancy still floated around to assist her students. During the coaching debriefing meeting, Tina and Nancy discussed what Nancy could do to help students work independently. Nancy decided that she would state the expectations for behaviors in the groups and prepare task cards for each student center.

In addition to helping Nancy feel comfortable staying at the teacher center without floating around to provide assistance, Tina also encouraged Nancy to examine quality and purpose of her instructional conversations. As shown earlier in Table 12, Nancy used different strategies to improve her instructional conversations, including (a) preparing academic goals and questions that could advance students’ thinking to higher levels; (b) summarizing the discussed points during instructional conversations to help students connect academic goals and discussed points; and (c) having homogeneous groups during instructional conversations. Use of these strategies could be attributed to Tina’s assistance. For example, during the fourth coaching debriefing meeting, Nancy and Tina
discussed how Nancy could refine her use of instructional conversation. After that meeting, Nancy decided to prepare a clear instructional conversation goal and summarize the conversations for students before they left the centers.

**Assistance for Cindy.** During the six coaching session, Cindy struggled in helping her students stay on task. Most of Tina’s assistance addressed this issue. As shown earlier in Table 9, Cindy used various strategies to prepare her students to work independently, and most of the strategies came from her discussions with Tina, such as behavioral expectations. Tina suggested that Cindy “contextualize this lesson a lot more and make some examples that are really relevant to students’ lives. In Hawaii, a big issue is land rights and property ownership (Tina’s feedback to Cindy’s third lesson plan).” In an email Cindy sent to Tina before submitting her fourth lesson plan, Cindy noted that contextualization seemed to help her students stay on task. The following quote is from that message.

I did a lesson on area and perimeter with Great Mahele last class period and I think it went pretty well. . . I think the kids were kind of stunned that we were talking about social studies material in class (they just learned about the Great Mahele a few weeks ago).

**Assistance for Gary.** Tina focused on encouraging him to provide more opportunities for students to use mathematical language in instructional conversations. In Gary’s coaching reflection journals, he often mentioned, “By questioning students on the process being learned. Not accepting yes/no answers without explanation and trying to have students apply what they know to the new concept.” After discussing with Tina in his fifth coaching debriefing meeting, he decided to “use appropriate math language in
his explanation and provide opportunity for the students to use/generate math language (fifth coaching observation notes).” His next lesson plan quoted below indicated this change.

[Students] will be encouraged to use correct math terms when describing the process . . . students will be required to follow the guided notes and be able to state their answers in complete sentences using the correct terminology. (sixth lesson plan)

**Assistance for Jordan.** Tina helped Jordan to change his conversations to include more student talk rather than teacher talk. After Tina reminded Jordan of what instructional conversations were in her feedback to his second coaching reflection journal, Jordan’s lesson plans and coaching reflection journals started to show that he used those ideas in describing his use or planning of instructional conversations. For example, he mentioned the goal of instructional conversations and the kind of “why” questions he would ask in the conversations.

After reading the fourth coaching observation notes quoted below, I assumed that Jordan might feel challenged implementing that lesson. Therefore, during the fourth coaching session, Tina provided assistance that focused on how to improve Jordan’s instructional conversation skill. After the meeting, Jordan decided to prepare questions that could elicit more student talk and align with his goal of instructional conversations.

Teacher felt that [when he talked to students in the small groups,] he watered down the lesson last semester but doesn’t want to do that this year. About half the class is not following. The students didn’t get through the worksheet as fast as he thought they would. Teacher felt that they couldn’t connect the dots. Teacher thinks they know the procedure because they know about tangent lines already . . . Feels students are not interested. (fourth coaching observation notes)
Chapter 5

Discussion

This chapter is divided into five sections. The first section compares and contrasts the results from the quantitative and qualitative analyses. The second section discusses these findings relative to previous literature. The third addresses implications for practice. The fourth section presents limitations and potential future directions. The fifth section presents conclusions.

Comparison and Contrast of Quantitative and Qualitative Findings

Influence of coaching assistance. Results from quantitative and qualitative analysis illustrated that coaching greatly influenced teachers’ planning of instructional conversations. Quantitative results indicated that the average of the first instructional conversation planning score was .93 on the Lesson Plan Rubric and went up to 2.39 in the last instructional conversation planning. This change in score indicates considerable growth in teachers’ planning for use instructional conversation over the year. The qualitative results suggested a similar pattern. Only four teachers planned to implement the strategy in their first lesson plan, in which three of them had an understanding that differed from the CREDE’s definition. For example, Nancy noted that she planned to implement a level 2 instructional conversation, writing, “I will lecture to students in a large group and encourage them to talk amongst themselves in order to better understand the concept learned (Nancy’s first lesson plan).” According to the Lesson Plan Rubric, her implementation of instructional conversation would be rated as level 0 because she lectured to the whole class. Thus, Nancy’s lesson plan revealed a misunderstanding at the beginning of the year.
However, Nancy’s last plan quoted below indicated that she knew what a level 4 included: working with a small group of students on an academic goal for the conversation, eliciting students’ views, and guiding the conversation. This change from the first to the last plans is attributed to Tina’s coaching assistance.

I plan on implementing a level 4 instructional conversation. I intend on staying with one group for an extended amount of time to help them better understand how to answer questions from a table. My goal is for them to understand how to read a table for the information that is needed to answer a question. (Nancy’s eighth lesson plan)

**Fluctuation of instructional conversation scores.** The means of teachers’ planning for instructional conversation was changed throughout the year (see Table 6). There was some fluctuation during the fifth to the eighth lesson plans. Though teachers’ change was significant (see Table 8), the unexplained random variance (see Table 7) invoked further explanation for possible reasons with qualitative data since the three covariates, teaching subject, grade taught, and teaching experiences, did not explain the fluctuation (see Table 8). The qualitative results suggested two reasons that might explain this fluctuation: lesson content and classroom management. First, the teachers chose to implement instructional conversations differently depending on the content. For example, for Nancy’s sixth plan, she planned to implement a level 3 instructional conversation, but in her next lesson, she planned to implement a lower level. From her seventh lesson plan:

I plan on implementing a level 1/2 instructional conversation. During the review portion of the class, I will be talking with the entire class for a somewhat extended period of time. While students are working in groups, I won’t be able to stay with one group for an extended period of time because more than one group will have the same problem and may need assistance. (Nancy’s seventh lesson plan)
The second possible explanation for the fluctuation in scores might be attributed to classroom management. In Cindy’s fifth lesson plan, she explained why she chose to plan a Phase 1 in which the teacher lectures to the whole class, “Due to a need to focus on management, I am going back to a phase 1 (fifth lesson plan).” According to the Lesson Plan Rubric, her planning of instructional conversation would be rated as level 0. This example showed that a teacher might know how to implement a higher level of instructional conversation, but might choose to do otherwise in order to address her student’s learning needs.

**Variances of instructional conversation planning scores.** The quantitative results suggested that the initial differences in teachers’ planning of instructional conversation (where the teacher submitted the first lesson before receiving coaching) was small, but the differences among the teachers increased by almost three times in the second lesson plan, which was submitted after the first coaching session. The quantitative results with three covariates (teaching experience, teaching subjects, and grade levels taught) did not explain why there was considerable variation in 28 teachers’ planning of instructional conversation. However, Figure 1 showed that the trajectories of the eight teachers’ instructional conversation scores were different among the three grade levels. In general, the elementary school teachers’ scores were higher than the middle school teachers’, and the middle school teachers’ were higher than the high school teachers’. Similarly, the qualitative results also showed that grade taught influenced teachers’ planning and use of instructional conversations. For example, in their second or third lesson plans, elementary school teachers already planned to use instructional conversations to work with small groups of students, but secondary teachers (except
Chad) still planned to use it with a large group of students while they walked around the classroom to monitor if students were on task. This finding suggests that there may be a pedagogical difference in the way elementary and secondary teachers view appropriate times to conduct instructional conversations or otherwise interact with students.

Because the qualitative analysis only examined eight teachers who taught mathematics, further research is needed to examine whether this finding would also be true for other educators and other different subjects. In addition, although the qualitative analysis only examined data from eight teachers, it included various years of teaching experience and grade levels. The qualitative results from the eight teachers provide some insights about how teaching experience and grade levels taught influence teachers’ professional growth. In the following sections, I discuss how teaching experience and grade level could be used to examine the variances among the 28 teachers.

**Grade level.** Before teachers received any CREDE coaching assistance, the coaching notes on the first lesson showed that the three elementary teachers designed activities that encouraged students to express or justify their thoughts either in a whole class or in small groups. For example, in the first observation, Tina reported that Kelly elicited students to share what their habits of mind\(^4\) that they would be working on, and she also invited a student to do a role play about what it looked like when the teacher or the student wanted to go first.

In contrast, the lessons in the secondary school classrooms did not provide such opportunities to practice speaking in front of peers as often as classrooms in the elementary school. In their first lesson plan, secondary teachers followed a similar

\(^4\) Habits of mind are strategies that people can apply to solve problems (Costa & Kallick, 2000).
design using the format:

1. Review: The teachers posted several questions that related to previous learning for students to work individually and the teachers and the class discussed the correct answers for the questions.

2. Presentation of the day’s new concept or task: The teachers taught new concepts to the whole class and asked students to take notes of the instruction.

3. Practice: The teachers provided an assignment of a similar set of problems for students to work individually or with their group members. While the students were working, the teachers floated around to provide assistance if needed.

4. Debriefing: The teachers either discussed with their students what happened in the class or let students take a quiz before the students left for another class.

Based on the teachers’ individual classroom contexts and varying situations, Tina provided different kinds of assistance. This might explain why the variances were not small after the teachers received coaching. Given that the elementary school teachers already encouraged students to express their thoughts and had worked on preparing the students to work individually, Tina helped them to refine instructional conversation skills in order to maximize students’ learning in the teacher center. For the middle school teachers, before Tina helped them to refine their instructional conversation skills, she needed to encourage them to design the activities that allowed students to use and generate mathematical language. She also helped the middle school teachers with classroom management issues. The students in the high school seemed to stay on task during most of the coaching observations, so Tina mainly helped the teachers to design the tasks and/or questions that could motivate students to talk more in class, especially at
the teacher center, where the teachers used instructional conversations.

*Teaching experience.* Both quantitative and qualitative results suggest that teaching experience did not influence teachers’ planning of instructional conversations. Although Chad, Gary, Jordan, and Cindy all had one year of teaching experience, Chad designed his classroom differently compared to the other three. Chad always planned to have instructional conversations with a small group of students at the teacher center, but the other three did not have a teacher center and tended to float to provide assistance to students who worked individually or in small groups. Three elementary school teachers had vastly different levels of teaching experience (Kelly is 28 years, and Betty and Belinda are 11-12 years), they all recognized the importance of instructional conversation in student learning and planned to use instructional conversations in most of their lessons.

**Connection to Prior Research**

*Cognitive coaching.* Findings in this study indicated that coaching interaction (e.g. coaching conversations at coaching debriefing meetings and coach’s feedback on lesson plans and reflections) had a positive impact on teachers’ planning, use, and understanding of instructional conversations. This is consistent with previous research suggesting that coaching conversations between teachers and their coach is effective in assisting teachers with the implementation of newly acquired teaching skills (Batt, 2010; Beltman, 2009; Cochran & DeChesere, 1995; Cornett & Knight, 2008; Garmston et al., 1993; Krpan, 1997; Ray, 1998; Showers, 1984; Slinger, 2004; Smith, 1997; Teemant et al., 2011).
This study adds to the literature by demonstrating how teachers have changed over time as a result of coaching. Previous studies on the influence of cognitive coaching made their conclusions based on pre- and post-tested data (e.g. Moche, 2000), teachers’ self-reported data, such as interviews, surveys, and questionnaires, collected at the end of the treatment (e.g. Batt, 2010). Other studies collected similar data at the beginning, middle, and end of treatment (e.g. Beltman, 2009). Collecting data in this way does not provide opportunities to understand what specific part(s) of coaching influenced teachers’ professional growth over time and under what situations coaches provided the assistance. Data collection in this manner can only give a general impression that overall, coaching is helpful, but does not illuminate what parts of coaching process that contribute to teacher change.

This study provides a clearer picture about how coaching assistance was related to the development of teachers’ use of instructional conversations over time by collecting data at multiple times during one year of professional development. For example, in Belinda’s fifth coaching reflection journal, she mentioned that, “After discussing instructional conversations further with Tina, I am beginning to understand that students really need to be beyond the ‘how’ before they can get to the ‘why’. Because Belinda noted what caused her to understand more about the differences between questions in her fifth coaching journal, I can conclude that with coaching assistance, from the fifth coaching session, Belinda started to understand what questions could help students with their learning in instructional conversations.
The current study makes another contribution to research on cognitive coaching by analyzing teachers’ change in lesson plans and coach’s feedback on these plans. Although coaches often help teachers with lesson planning (Costa & Garmston, 2002), which contributes to the quality of teachers’ planning and teaching effectiveness (O’Donnell & Taylor, 2007; Panasuk et al., 2002), little is known about how this support influences teachers’ professional growth (e.g. Teemant et al., 2011). The design of the present study on teachers’ improvement in planning provides potentially new research directions for examining the influence of coaching.

**Instructional conversations.** Promoting students to communicate their thoughts in class is difficult, and having students explore and justify their thoughts with their peers and teachers in the teacher center is even more difficult (Teemant et al., 2011). Findings of this study corroborate with earlier studies on instructional conversations or discourse-intensive practice by showing that external support is necessary when teachers want to promote more student discussion in classrooms (Goldenberg & Gallimore, 1991; Goldenberg, 1992/1993; Teemant et al., 2011; Tharp & Gallimore, 1988; Yamauchi, Im, & Lin, 2012; Yamauchi, Im, & Mark, in press). In the current study, although the 28 teachers’ initial planning score of instructional conversations was low, with coaching assistance, all 28 participants’ instructional conversation planning scores increased. Furthermore, consistent with the research done by Yamauchi and colleagues (Yamauchi et al., 2012; Yamauchi et al., in press), this study also showed that teaching experience did not influence teachers’ learning of instructional conversations.
In addition, teachers’ development in use of instructional conversations in the current study is similar to what Tharp et al. (2000) suggested for teachers who were new to instructional conversations. For example, most of the teachers needed to encourage their students to talk in a whole class setting before having students to actively participate in instructional conversations at the teacher center. The teachers also prepared their students to work independently from them before having a teacher center. In order to help students stay on task, the teachers needed to have effective classroom management in place. The importance of classroom management received little attention in the research on mathematical discourse. This might be because those studies tended to focus on whole-class discussion, which might have been a setting that was easier for teachers to manage student behaviors.

According to the Lesson Plan Rubric, the highest score of instructional conversation is five. However, on average, the planning score of the last lesson plans was less than three. This finding was similar to previous studies on instructional conversations, which indicated it takes more than one-year professional development for teachers to fully enact instructional conversations (e.g. Goldenberg, 1992/1993; Teemant et al., 2011; Tharp & Gallimore, 1988).

Other studies examining instructional conversations have tended to focus mainly on the teachers who taught similar grade levels or subjects (e.g. Goldenberg, 1992/1993; Saunders & Goldenberg, 2007; Teemant et al., 2011; Yamauchi et al., in press). Different from the previous studies, the present study appears to be the first to examine the development of instructional conversations among teachers with diverse backgrounds relating to their teaching subjects and grade levels they taught. The findings of the
current study extend the research by showing that despite various backgrounds, all of the teachers’ planning of instructional conversations improved positively with coaching.

**Mathematical discourse.** Findings from the current study contribute to the research on mathematical discourse. For example, results suggest that external support is necessary for teachers, especially for novice teachers, to promote mathematical discussions because many teachers are underprepared (Nathan & Knuth, 2003; Russell & Corwin, 1993; Saunders et al., 1992; Simon & Schifter, 1991; Stein, Engle, Smith, & Hughes, 2008; Wood et al., 1991). The study extends research on mathematical discourse by examining the mathematical discourse of eight teachers from K-12 while previous studies often focused on fewer teachers (Brendefur & Frykholm, 2000; Hufferd-Ackles et al., 2004; Nathan & Knuth, 2003; Ray, 1998; Wood et al., 1991) and teachers from similar grade levels (Brendefur & Frykholm, 2000; Hufferd-Ackles et al., 2004; Stein, Silver, & Smith, 1998). By comparing and contrasting the eight teachers’ data, the study provided a more comprehensive picture of teachers’ development in orchestrating mathematical discourse.

Although the literature on mathematical discourse tends to focus on whole-class discussion (e.g. Huffered-Ackles et al., 2004; Nathan & Knuth, 2003; Rittenhouse, 1998; Staples, 2007; Stein et al., 2008) and the current study examined small-group discussion, the results of this study indicated that most of the strategies used to encourage students to express their thoughts in class were consistent with previous research on mathematical discourse.
Moreover, the findings of the study extend research on mathematical discourse by adding two more strategies that teachers can use when they wanted to elicit more student talk (e.g. Baxter & Williams, 2010; Rittenhouse, 1998; Stein et al., 2008). First, the coach of the study encouraged teachers to use contextualization by integrating students’ prior experiences from their family and community into classroom instruction. These familiar experiences often helped students feel comfortable sharing in front of their peers and teachers. The use of contextualization has not received much attention in literature on mathematical discourse, but this study indicated that contextualization increased student talk in class. Second, the results of the study demonstrated that how teachers grouped students influenced the success of their discussions at the teacher and student centers. The teachers spent time preparing students to work independently from the educators, so they could discuss with peers while their teachers worked with another group of students. Grouping students by ability levels improved the instructional conversations because teachers can base on students’ learning needs to prepare appropriate questions that can assess and assist student learning in instructional conversations. The importance of grouping has received little attention in literature of mathematical discourse, but definitely influenced the quality of classroom discussion in the current study.

Finally, the quantitative analysis revealed that teaching subject did not contribute to teachers’ growth in planning of instructional conversations. That is, whether educators taught mathematics or other non-mathematics subjects, did not have an influence on their instructional conversation planning. This is different from prior studies on mathematical discourse which often mentioned that instruction in mathematics seldom provides
opportunities for students to express their thoughts related to the learning processes (Draper, 2002; Hilberg et al., 2000; Jacobs et al., 2006), and the teachers often reported challenges in using discourse promoted by mathematical reform (Nathan & Knuth, 2003; Stein et al., 2008).

Prior studies on mathematical discourse reported that instruction did not promote discussion tended to focus on secondary schools (e.g. Draper, 2002, Hilberg et al., 2000; Jacobs et al., 2006). The qualitative findings of the current study were consistent with this focus by showing that secondary mathematics teachers lectured more before they received coaching assistance. As represented in Figure 1, high school teachers’ growth in planning of instructional conversations was slower than that of their peers in elementary schools.

**Implications**

Several implications are suggested based on the findings of the current study. First, many teachers still have difficulty promoting the discourse-based classrooms because the guidelines in reform documents (NCTM, 1989, 1991, 2000) only provide teachers with general guidelines for transforming their own instruction to the reform-based practice (Draper, 2002; Hufferd-Ackles et al., 2004; Nathan & Knuth, 2003; Silver & Smith, 1996). This situation was not improved in the later reform documents, such as CCSSM, either. Although most of the states in the U.S. adopted the CCSSM, teachers in those schools often reported unprepared to use the CCSSM (Gewertz, 2010). Furthermore, usefulness of many resources that were designed to prepare teachers to use CCSSM in their instruction was not examined yet (e.g. “Inside Mathematics,” n.d.; Moschkovich, 2012; “The Illustrative Mathematics Projects,” n.d.; White & Dauksas,
Therefore, the findings in the present study may fill in the gap because they showed how teachers from different grade levels developed their instructional conversation skills over time. These findings are not only helpful for in-service teachers but also for pre-service teachers. They may be recommended to teacher educators who provide pre-service professional development.

Second, teachers in the current study articulated the specific challenges they encountered and the specific changes they made to improve their instructional conversations for their students with diverse needs. The strategies related to classroom management were seldom mentioned in the research on mathematical discourse. However, the findings of the study showed that effective classroom management was necessary before the teachers started to implement instructional conversations. Therefore, the strategies that the teachers used to prepare students to stay on task may provide useful insights for K-12 teachers who are interested in having mathematical discourse either in a whole-class or a small-group setting.

Third, previous studies on mathematical discourse mainly focused on whole-class discussion (e.g. Huffered-Ackles et al., 2004; Khisty & Chval, 2002; Nathan & Knuth, 2003; Staples, 2007). The results of the study extended the research by showing how teachers could transform their whole-class instruction to differentiated small-group instruction. Previous studies on small-group instruction illustrated that it is not easy to have successful small-group instruction because it takes a lot of preparation; however, it is worthy because small-group instruction greatly benefits student learning (Gibson, 2011). As Doherty et al. (2002) argued, small-group instructional conversations are necessary because teachers are able to (a) assist and assess conceptual development of all
students in the small group, (b) encourage all group members to participate in the learning process, (c) integrate the members’ prior knowledge or experiences into the new concept, and (d) adjust the teaching content and method to meet the ability levels of all group members. Furthermore, when comparing teachers who used instructional conversations in a small group with those who in a whole class, Doherty et al. (2003) found that students in the former class had more achievement gains on standardized comprehension tests (SAT-9). From my study, the eight teachers’ development of instructional conversations at the teacher center may provide practical steps for other teachers to model in their classrooms.

Fourth, in order to help teachers smoothly integrate CCSSM into their instruction, effective professional development is necessary (Ash, 2012; Hirsh, 2012; Sztajn, Marrongelle, Smith, & Melton, 2012). Although teachers can easily access the various resources on the website, but the teachers need to use them with caution. A teacher’s concern quoted in Ash’s (2012) study deserves teachers’ attention, “My worry about online professional development around common-core standards is that it’ll be one-size-fits-all. Even as we’re thinking nationally, we need to aware locally [of teachers’ specific backgrounds and instructional methods].” Therefore, in order to support implementation of CCSSM in class, teachers need not only these resources but also professional development in which experts of CCSSM assist them over an extended period of time (Hirsh, 2012; Sztajn et al., 2012). The current study reveals how a cognitive coach provided appropriate assistance for individual teachers to adopt a research-based strategy, instructional conversation, in their instruction for one year. The findings of the study may provide insights for those schools who are looking for professional development for
their mathematics teachers and for those CCSSM professional development designers.

**Limitations and Future Research**

**Limitations.** Three limitations of this study should be noted. They are related to the sample size, the requirements of the CREDE professional development program, and the suggestions from only one cognitive coach. Although the sample size of the study was able to produce significant results, given this small number of participants, the results may not generalize to a larger population without considering differences in context. The results indicate there was random fluctuation not explained by the proposed model at each collected data point. With the small sample size, the study was able to include three covariates, but the three variables did not quantitatively explain the random variances.

Another limitation related to the sample size is the comparison and contrast between the quantitative and qualitative results. Initially, I was planning to use the proposed model for the 28 teachers’ data to run the eight teachers’ data, but the model with the eight teachers’ data did not converge. Therefore, instead of comparing the quantitative and qualitative results from the eight teachers, I used the 28 teachers’ quantitative results to compare with the eight teachers’ qualitative results.

Although Figure 1 showing the trajectories of eight teachers’ estimated instructional conversation scores provided some connections between qualitative and quantitative results, the comparison and contrast between the qualitative and quantitative results discussed earlier in this chapter were based on smaller sample size. Future inquiries with larger samples may provide a deeper understanding of the findings.
There is yet another area that warrants emphasis when considering teachers’ planning and growth over time. In order to analyze how coaching influenced teachers’ use of the CREDE Standards, the CREDE professional development provided a guideline for teachers to write their lesson plans and coaching reflection journals, but the teachers had the opportunities to follow the guidelines or dismiss them. This decision might have affected their lesson planning scores. For example, when teachers did not describe how they would implement instructional conversations, the coders based scores on other clues in the lesson plans to rate their planning of instructional conversations. If there were not any clues of planning of instructional conversations, the coders would rate the planning of instructional conversation as 0. Therefore, when teachers followed the guidelines, whether they planned to use instructional conversations or not was clear.

The third limitation is related to the study focusing only on one cognitive coach. The suggestions from this coach had a positive influence on teachers’ planning and use of instructional conversations, however, it could be that the suggestions and results might have been different if the teachers were coached by someone else. As mentioned earlier in Chapter 3, the influence of cognitive coaching on teachers’ professional growth depends on coaching relationship and coaching conversations. Although all of the CREDE coaches follow the CREDE model and cognitive coaching techniques, their individual coaching styles might influence how they assist teachers with instructional conversations.

**Future directions.** The limitations mentioned above imply several possible future directions in the area of helping K-12 teachers develop their instructional conversation skills. First, in order to explain the variances at the eight data collected points, larger
samples are needed, so that other variables, such as teachers’ attitude toward instructional conversations or teachers’ background from Hawai‘i or other states, might be considered in future quantitative analysis. Second, larger samples with a similar background, such as teachers from the same school districts or from the same grade levels might be tested to see if the variance results in different patterns compared to the current study with teachers from different school districts and grade levels.

Third, the current study used mixed methods (quantitative and qualitative analysis) to examine teachers’ growth in planning and use of instructional conversations and showed positive results. Because the qualitative analysis only analyzed data from eight teachers instead of all 28 teachers, in a future study, it might be needed to use other research methods (e.g. videotape 28 teachers’ implementation of those submitted plans and rate their use of instructional conversations), so all of the participants’ performance can be compared to their planning development.

Fourth, the usefulness of the strategies that the cognitive coach suggested to her teachers, as well as the processes about how the teachers changed their practice to foster productive instructional conversations might be another line of research inquiry. I believe replication of the study with (a) more coaches; (b) other groups and other types of data that capture the influence of cognitive coaching on teachers’ growth in instructional conversation would add richness to our understanding of how to best support teachers’ learning of instructional conversations.

Fifth, helping teachers with planning is often mentioned in the research on professional development (Batt, 2010; Garet et al., 2001; Teemant et al., 2011), but how to measure teachers’ growth in planning receives little attention. The Lesson Plan Rubric
was a modification of a valid measurement, Standards Performance Continuum (Doherty et al., 2002). The quantitative analysis with the use of Lesson Plan Rubric showed positive results indicating that the rubric has potential to be an example for other researchers who might want to investigate how teachers’ planning on certain skills changes across time. Overall, more evidence and research is needed because the positive findings in this investigation are only preliminary.

The future inquiries might help professional development designers or teacher educators to identify what specific aspects of school and student factors affect teachers’ professional development. At this point, the designers and educators could address these issues effectively, so students, teachers, and schools might benefit more from professional development programs.
Appendix A
CREDE Lesson Plan Template

<table>
<thead>
<tr>
<th>Standards/Objectives</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Description</td>
</tr>
<tr>
<td>---</td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>CREDE Phase</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description of the Activities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Time in each activity</td>
<td>Setting</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CREDE Standards</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CREDE Standard</td>
<td>How it will be used</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>JPA Joint Productive Activity</td>
<td></td>
</tr>
<tr>
<td>LLD Language &amp; Literacy Development</td>
<td></td>
</tr>
<tr>
<td>CTX Contextualization</td>
<td></td>
</tr>
<tr>
<td>COT Complex thinking</td>
<td></td>
</tr>
<tr>
<td>IC Instructional Conversation</td>
<td></td>
</tr>
</tbody>
</table>
**Appendix B**

**Assessment for Lesson Plan**

Teacher’s name:
Overall Grade:
Coach’s comment and feedback:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Does not meet expectations (C or lower)</th>
<th>Meets Expectations (B)</th>
<th>Exceeds Expectations (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Submission deadlines.</td>
<td>1. The submission deadline was not met.</td>
<td>1. The submission deadline was met.</td>
<td>1. The submission deadline was met.</td>
</tr>
<tr>
<td>2. Statement of lesson objectives</td>
<td>2. The statement of the lesson objectives may be unclear or incomplete.</td>
<td>2. You clearly state your lesson objectives.</td>
<td>2. You clearly state your lesson objectives, noting why you chose them (e.g., Hawai’i Content and Performance Standard, GLO, tie to previous lesson).</td>
</tr>
<tr>
<td>3. Statement of the assessments</td>
<td>3. There may not appear to be appropriate assessments for all objectives stated.</td>
<td>3. The assessments generally seem appropriate, but may need some clarification.</td>
<td>3. All of your assessments are appropriate for the objectives and are feasible. There is adequate evidence for you to judge whether or not the students have reached the objectives.</td>
</tr>
<tr>
<td>4. Statement of the Phase (1-5) you are trying to use</td>
<td>4. You do not state which Phase you are trying to use.</td>
<td>4. You state the Phase you are trying to use.</td>
<td>4. You state the Phase you are trying to use and explain why you are using it.</td>
</tr>
<tr>
<td>5. A plan for how you will use the CREDE Standards.</td>
<td>5. You may not state which of the CREDE Standards you are planning to use. The Standards highlighted may not fit the Phase</td>
<td>5. You state which of the seven CREDE Standards you are planning to use. For the most part, the Standards highlighted fit the Phase you are trying to implement.</td>
<td>5. You clearly state which of the seven CREDE Standards you are planning to use. Your application of the Standards shows an accurate</td>
</tr>
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<td></td>
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<tr>
<td>---</td>
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<td></td>
</tr>
<tr>
<td>you are trying to use. It may not be clear how the strategies stated are related to the Standard they are supposed to reflect. Your use of the Standards may not be accurate.</td>
<td>Some clarification may be needed regarding how a few of the stated strategies are related to the Standard they are supposed to reflect. There may be some minor misunderstandings about the Standards.</td>
<td>understanding of the concepts. The Standards highlighted fit the Phase you are trying to implement. The strategies you suggest are appropriate and may be insightful or creative.</td>
<td></td>
</tr>
<tr>
<td>6. Description of the activities</td>
<td>6. It is not clear what activities you have planned for the lesson. You may not describe what you and/or the students will be doing.</td>
<td>6. You describe the activities that are planned, but some of the details may not be clear enough for someone to take over the class. It is not entirely clear what you and your students will be doing.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. You clearly describe the activities that you have planned such that another educator could teach the lesson. It is clear what you and your students will be doing.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix C
CREDE Coaching Reflection Journal Template

Teacher’s name:

<table>
<thead>
<tr>
<th>What my students learned and how I know this</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Use of the CREDE Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint Productive Activity</td>
</tr>
<tr>
<td>---------------------------------------------</td>
</tr>
</tbody>
</table>

Reflect on the use of Joint Productive Activity

Reflect on the use of Language & Literacy Development

Reflect on the use of Contextualization

Reflect on the use of Complex Thinking

Reflect on the use of Instructional Conversation

Describe what went well

Describe what could be improved

Describe your action plan for future instruction
### Appendix D
**Assessment for Coaching Reflection Journal**

Teacher’s name:  
Overall Grade:  
Coach’s feedback and comment:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Does not meet expectations (C or lower)</th>
<th>Meets Expectations (B)</th>
<th>Exceeds Expectations (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Submission deadlines.</td>
<td>1. The submission deadline was not met.</td>
<td>1. The submission deadline was met.</td>
<td>1. The submission deadline was met.</td>
</tr>
<tr>
<td>2. Analysis of what students learned.</td>
<td>2. You did not discuss what your students learned and/or how you know what students learned.</td>
<td>2. You clearly state what your students learned and how you know this. You discuss intended objectives and other things students learned that might not have been part of the original lesson plan.</td>
<td>2. You provide an insightful analysis of what your students learned and how you know this. You discuss intended objectives and other things students learned that might not have been part of the original lesson plan.</td>
</tr>
<tr>
<td>3. Analysis of use of each of the CREDE Standards.</td>
<td>3. You did not provide Classroom Observation Rubric scores for each of the CREDE Standards. You may not have explained the scores or referred to Classroom Observation Rubric criteria and what happened about them.</td>
<td>3. You provide a Classroom Observation Rubric score for each of the CREDE Standards and a reasonable explanation for these scores referring to the Classroom Observation Rubric criteria and what happened in your lesson(s).</td>
<td>3. You provide a Classroom Observation Rubric score for each of the CREDE Standards and an insightful explanation for these scores referring to the Classroom Observation Rubric criteria and what happened in your lesson(s).</td>
</tr>
<tr>
<td>4. Analysis of the Phase you were trying to apply.</td>
<td>4. You did not discuss the extent to which you were successful in applying the Phase you were trying to apply or there appears to be misunderstandings</td>
<td>4. You discuss the extent to which you applied the Phase you were trying to use, but may not provide a clear rationale for this judgment. Your</td>
<td>4. You provide a clear discussion about the extent to which you applied the Phase you were trying to use and provide a rationale</td>
</tr>
<tr>
<td>Section</td>
<td>Description</td>
<td>Feedback</td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>5. Analysis of what went well.</td>
<td>You did not provide a clear or reasonable analysis of the strengths of your lesson and instruction.</td>
<td>5. You provide a clear and reasonable analysis of the strengths of your lesson and instruction.</td>
<td></td>
</tr>
<tr>
<td>6. Analysis of what could be improved.</td>
<td>You may not provide a clear or reasonable analysis of how your lesson and instruction could be improved.</td>
<td>6. You provide a clear and reasonable analysis of how your lesson and instruction could be improved.</td>
<td></td>
</tr>
<tr>
<td>7. Action plan for future instruction</td>
<td>You may not provide a clear or reasonable plan for how you will address what needs to be improved in the lesson.</td>
<td>7. You provide a clear and insightful plan for how you will address what needs to be improved in the lesson.</td>
<td></td>
</tr>
</tbody>
</table>
References


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