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Fostering Metacognition in the Middle School Classroom: An Exploration of Teachers' Practices

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FOSTERING METACOGNITION IN THE MIDDLE SCHOOL CLASSROOM: AN
EXPLORATION OF TEACHERS’ PRACTICES

by

Markeya S. Peteranetz

A THESIS

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Lincoln, Nebraska

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FOSTERING METACOGNITION IN THE MIDDLE SCHOOL CLASSROOM: AN EXPLORATION OF TEACHERS’ PRACTICES

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University of Nebraska, 2014

Adviser: Kenneth A. Kiewra

This thesis investigated how middle school teachers foster metacognition through instruction. Metacognition is the knowledge and awareness of one’s thinking as well as monitoring and control of thought processes. Metacognition is related to student achievement and can be increased through both implicit and explicit instruction. Explicit instruction takes place when the teacher points out, explains, or discusses the benefits of metacognition. Implicit instruction occurs when the teacher models or prompts the use of metacognition without expressly acknowledging or discussing it. This thesis used both quantitative and qualitative methods to determine the extent that metacognition is fostered in middle school classrooms and the beliefs and efforts of teachers who frequently make metacognition part of their teaching. Participants were middle school teachers from a medium-sized city in the Midwest. Data was collected in three phases: the Survey Phase, the Observation Phase, and the Interview Phase. Participants completed a survey on classroom practices that foster metacognition. Five participants who completed the survey were observed teaching for two class periods. Observations focused on what teachers did and said to foster metacognition. Four participants who were observed were then interviewed. Interviews focused on the role of metacognition in participants’ classrooms and influences on participants’ use of metacognition instruction.
Results indicated that previous research has underestimated the amount of metacognition instruction that takes place in classrooms, that teachers intentionally foster metacognition in a variety of ways, and that teachers use more implicit instruction than explicit instruction. Implications for teacher training are discussed.
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reason I am where I am today, and there are not enough words for me to tell you how much I appreciate the sacrifices you have made so that I could get to this point in my life.
# Table of Contents

Introduction .................................................................................................................. 1

Conceptual Overview of Metacognition ...................................................................... 5

Metacognition and Academic Achievement ................................................................. 10

Changes in Metacognition ............................................................................................ 10

Recommendations for Fostering Metacognition .......................................................... 13

Research on Metacognition Instruction ...................................................................... 16

Gaps in the Research Literature ................................................................................. 19

The Present Study ........................................................................................................ 23

Method ........................................................................................................................ 27

Participants and Context ............................................................................................. 28

Materials ...................................................................................................................... 29

Survey ........................................................................................................................... 29

Observation Instrument ............................................................................................... 30

Interview Protocol ....................................................................................................... 32

Procedures .................................................................................................................... 32

Results .......................................................................................................................... 34

Quantitative Findings: Survey and Observation ......................................................... 35

Survey ........................................................................................................................... 35

Observations ................................................................................................................ 42

Coding ........................................................................................................................... 42

Findings .......................................................................................................................... 43

Qualitative Findings: Observations and Interviews ...................................................... 46
Coding observations .................................................................................................................. 47
Coding and Analyzing Interviews ......................................................................................... 48
Themes .................................................................................................................................. 48

Teachers foster both metacognitive knowledge and metacognitive skills primarily through implicit metacognition instruction ...................................................... 48

Teachers’ attempts to foster metacognition are dynamic and respond to changes in students’ ability level and level of prior knowledge ........................................................................... 52

Teachers intentionally engage students’ metacognition, believe it is important to do so, and see it as part of their responsibility as a teacher ........................................................................ 53

Core teachers have more training related to fostering metacognition than do music teachers ...................................................................................................................... 59

Core teachers seem to be more comfortable and familiar with the language of metacognition than music teachers ................................................................. 60

General Discussion .................................................................................................................. 62

The Question of Prevalence .................................................................................................... 62

The Question of Validity .......................................................................................................... 63

The Question of Techniques .................................................................................................... 64

The Question of Congruity ....................................................................................................... 65

The Question of Intentionality ................................................................................................ 65

The Question of Influences ...................................................................................................... 66

Implications for Teacher Training .......................................................................................... 66

Research Limitations and Recommendations ......................................................................... 68

Conclusions .............................................................................................................................. 70

References ................................................................................................................................. 72
Appendix A .................................................................................................................................79
Appendix B .................................................................................................................................84
Appendix C ...................................................................................................................................85
List of Figures and Tables

Figure 1 A sample matrix-organizer for learning about the Founding Fathers ..........1
Figure 2 Theoretical framework of metacognition .................................................6
Figure 3 Taxonomy of metacognition instruction .......................................................14
Figure 4 Relationship between study purpose, method, phases, research questions, and literature gaps ..........................................................24
Table 1 Participants’ Professional Demographics .......................................................36
Table 2 Means and Standard Deviations for Survey Items from the General Behaviors Section .................................................................38
Table 3 Means (and Standard Deviations) for Survey Items from the Teaching Techniques Section .................................................................39
Table 4 Number of Quantitative Codes per Instructional Technique during Classroom Observations of Five Teachers ..............................44
Figure 5 Number of times each instructional technique was used by each teacher, combined over two class periods .........................45
Fostering Metacognition in the Middle School Classroom: An Exploration of Teachers’ Practices

Imagine a middle school where eighth grade American history is taught by four different teachers: Ms. Pierson, Mr. Samuels, Mr. Brown, and Ms. Andrews. All the eighth grade students are learning about the United States’ Founding Fathers, but these teachers differ in how they help students learn the material. Ms. Pierson tells her students to read the chapter from the textbook and gives them class time to do so. Down the hall, Mr. Samuels also gives his students class time to read the chapter, but he gives his students a worksheet to complete as they read. He tells them, “Fill this sheet out as you read, and turn it in when you are done. We will talk about it tomorrow and see how well you understand the chapter.” The worksheet contains a matrix organizer (as shown in Figure 1) that provides space for the students to record important information about the Founding Fathers. The top row of the matrix contains all the Founding Fathers who are discussed in the chapter, and the left-most column contains categories that can be used to compare the Founding Fathers.

<table>
<thead>
<tr>
<th></th>
<th>George Washington</th>
<th>Thomas Jefferson</th>
<th>Benjamin Franklin</th>
<th>John Adams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birthdate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death date</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Nickname</td>
<td></td>
<td></td>
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<tr>
<td>Profession(s)</td>
<td></td>
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<tr>
<td>Offices held</td>
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<tr>
<td>Documents signed</td>
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*Figure 1.* A sample matrix-organizer for learning about the Founding Fathers.
In the next classroom, Mr. Brown gives students the same matrix organizer worksheet and time to read the chapter in class. However, before Mr. Brown lets his students begin working he tells them, “Let’s look at the different topics and categories in this matrix organizer. You can see that the top row lists several Founding Fathers such as George Washington, Thomas Jefferson, and Benjamin Franklin. You can also see the left column lists categories such as birthdate, death date, and nicknames. Now that we know what is on the matrix organizer, let’s look at the chapter. Follow along with me as I start reading the section about George Washington. ‘George Washington was born on February 22, 1732 in Westmoreland County, Virginia.’ I remember that birthdate is a category in my matrix, so I am going to write ‘February 22, 1732’ in the cell that connects George Washington and birthdate. As you read, look for information that corresponds to the topics and categories in the matrix. By the end of the chapter, you should have filled all the cells.”

Ms. Andrews also has her students complete a similar matrix organizer worksheet while completing the reading in class. The matrix she provides is identical to the one that Mr. Samuels and Mr. Brown used, except that the one Ms. Andrews provides does not include “professions,” “offices held,” and “documents signed” in the list of categories. When providing the matrix, she explains, “This table is called a matrix. It has rows and columns that can be used to organize any information that compares two or more topics along one or more categories in a way that makes it easier to remember information and see relationships within that information. You can use a matrix whenever you are learning about multiple topics that can be compared. On this sheet, I have provided the topics and some categories for you. When creating a matrix, we put the topics on top. As
you can see, the topics of this chapter include many of our Founding Fathers, such as George Washington, Thomas Jefferson, and Benjamin Franklin. The categories are in the leftmost column, and they are the characteristics used to compare the topics. You can see I have given you a few sample categories: birth date, death date, and nicknames. You can also see that I left some of the boxes in that column blank, because you need to generate a few categories on your own. As you read the text, try to find the details that intersect topics and categories. For example, one of George Washington’s nicknames is Father of His Country. Such details go in the box that is at the intersection of the relevant topic (e.g., George Washington) and category (e.g., nickname). After you read each paragraph, be sure to ask yourself, ‘Can I put anything from that paragraph in my matrix?’ If you pause after each paragraph, you will be more likely to capture all of the important details in your matrix. Once you have finished reading the chapter and have completed your matrix, you will have an excellent study tool that you can use to study for the next test. It should be easy for you to see the similarities and differences among these Founding Fathers, and seeing those relationships will help you better understand the roles they played in our country’s history.” After Ms. Andrews finishes her explanation, the students begin reading and completing their matrices.

The four teachers at this middle school are teaching the same material, but the extent to which their methods support student learning differs considerably. Ms. Pierson did the least: she only provided students class time to read. She did not provide any additional support for her students’ learning, and it is completely up to students to learn from the reading. Mr. Samuels helped students learn by providing the matrix organizer. This instructional tool helped students extract and organize important information from
the reading, but Mr. Samuels did not show them how to use it, tell them why it is a beneficial tool, or provide any additional support that would help students use this type of tool in the future. Mr. Brown provided the same instructional tool but also showed students how to use the strategy on their own by modeling how to use it. He also prompted students to look at the structure of the matrix organizer before reading so that they could use it efficiently. However, Mr. Brown failed to explain why the matrix is a beneficial tool or provide additional information that would help students use this type of tool independently in the future. Ms. Andrews provided the same type of instructional tool, but she supported students’ present and future learning. She taught students how to use it (e.g., “When creating a matrix, we put the topics on top”), why it is a helpful learning tool (e.g., “It should be easy for you to see the similarities and differences”), and how they can create a matrix independently in the future (e.g., “You can use a matrix whenever you are learning about multiple topics that can be compared”). Moreover, Ms. Andrews prompted students to monitor their organizer use periodically by pausing to ask themselves questions about how they could use it. Ms. Andrews supported students’ learning the most because she taught students how to use a matrix now and in the future by providing explicit instruction on how, why, and when to use matrix organizers.

Mr. Brown and Ms. Andrews demonstrate different ways teachers can teach students how to become effective learners by fostering metacognition. Metacognition is knowledge, awareness, and control of one’s thinking. To foster metacognition is to provide instruction related to knowledge, awareness, and control of one’s thinking. Mr. Brown modeled metacognition and prompted students to use metacognition without expressly acknowledging it, a practice referred to as implicit metacognition instruction.
Ms. Andrews explicitly taught students how and why to use the matrix-learning strategy, explained why it is beneficial, and pointed out how they could use their organizer in the future. Ms. Andrews’s practices reflect what is known as explicit metacognition instruction.

The remainder of this introduction makes the case for why it is important for educators to foster students’ metacognition intentionally (with both implicit and explicit instruction) like Mr. Brown and Ms. Andrews did. First, a conceptual overview of metacognition is provided. Second, the importance of fostering metacognition is highlighted by examining the relationship between metacognition and academic achievement. Third, evidence that metacognition changes as a result of both instruction and development is presented. Fourth, a review of what teachers can do to foster metacognition both implicitly and explicitly is presented. Fifth, existing research related to metacognition instruction is described. Sixth, gaps in the literature regarding teachers’ roles in fostering metacognition are identified. Last, the present study is described along with how it addresses the gaps in the discussed literature.

**Conceptual Overview of Metacognition**

Metacognition is frequently given the terse definition, “thinking about thinking” or “cognition about cognition.” The term was introduced by Flavell (1979), and his early ideas have been analyzed and expanded upon in the 35 years since. Although there is not complete consensus in the literature about what is and is not metacognition, many theorists and researchers recognize that metacognition includes both knowledge of cognition and regulation of cognition (Schraw, 1998; Tarricone, 2011), also referred to as metacognitive knowledge and metacognitive skills (Veenman & Spaans, 2005; Veenman,
Van Hout-Wolters, Afflerbach, 2006), respectively. Figure 2 provides a conceptual framework for frequently identified components of metacognition. Knowledge of cognition includes what a person knows about strategies, his own thought processes, and people in general as cognitive beings (Pintrich, 2002). It includes the sub-components of declarative, procedural, and conditional knowledge (Schraw, 1998). Declarative knowledge includes knowledge about one’s own cognitive abilities and factors that influence learning and performance. Procedural knowledge is knowledge of how to carry out tasks and strategies. Conditional knowledge refers to the understanding of when and why to use a particular strategy, that is, knowing and recognizing the conditions under which a strategy should be used (Schraw, 1998; Schraw, Crippen, Hartley, 2006; Veenman, 2011). Epistemological cognition, defined as knowledge of the nature of knowledge, justification, and truth, is also sometimes identified as a separate area of metacognitive knowledge (Hofer, 2004; Moshman, 2011). To illustrate, imagine Emma is

![Figure 2. Theoretical framework of metacognition.](image)
reading a novel for her seventh grade English class. Emma knows that she frequently gets confused while reading novels because she has difficulty remembering details about each individual character. She knows that like most novels, this new novel will likely have several characters, and the author will likely describe the physical appearance and personality of each character as well as any important relationships among characters.

Emma decides to create a graphic organizer that can be used as a reference when she gets confused while reading or when her class is discussing the book. On a piece of paper, Emma creates a matrix by writing the main characters names in one row toward the top of the paper and listing a few categories for comparison like “appearance” and “relationship to others” down the left-hand side. As she reads, she adds more categories and characters’ names, and she fills in the cells of the matrix. She includes a page number each time she puts a note in a cell so she will know exactly where she got that information. Each aspect of metacognitive knowledge is found in this example. Emma’s understanding of her weakness as a reader exemplifies declarative knowledge. Her recognition of the appropriateness and usefulness of a graphic organizer for comparing story characters indicates she has conditional knowledge about the matrix strategy. Her ability to use the matrix strategy reveals she has procedural knowledge. Emma’s decision to use page number references reflects her epistemological cognition because she can use those references to justify the things she has written down.

Regulation of cognition makes up the “active” side of metacognition. This group of skills includes processes such as planning, monitoring, controlling, and evaluating cognition (Schraw, 1998; Veenman & Spaans, 2005). Planning cognition includes things such as goal setting, pre-selecting strategies, and determining the order in which steps are
completed. Monitoring cognition is awareness of comprehension, thought processes, and strategy use while completing a task (Schraw & Moshman, 1995). Monitoring allows learners to recognize when they do not understand what they are reading, and it also allows them to use strategies flexibly. Controlling cognition includes processes such as managing attentional resources, inhibiting undesired responses, and constraining thoughts (Zimmerman, 2000). Evaluating cognition includes detecting and correcting errors, comparing outcomes to goals, reflecting on performance, and gauging the efficiency of one’s learning (Schraw, 1998). Dividing regulation of cognition into these four processes makes it apparent that regulation of cognition can be used before, during, and after the focal cognitive activity (Zimmerman, 2000). For example, Jamal has to write a report about a current United States senator for his eighth grade social studies class. His teacher allows students to choose the senator they write about, and he has provided a few general guidelines that the report should cover. Each student’s report should include information on the senator’s schooling, work before becoming a senator, and accomplishments while in office. Students may include other topics that they believe are important or interesting. After Jamal selects his senator, he decides to do some preliminary reading so he can start planning his paper. While reading, he monitors his understanding and recognizes that he cannot make sense of much of the information about the senator’s work in congress. Jamal then searches the Internet to look up acronyms and jargon he does not understand. Once he has gathered some information, Jamal continues planning by creating an outline that will guide his writing. Jamal does not like to write. Therefore, as he works on his paper, he controls his attention by removing possible distractions from his work area.
After completing his paper, Jamal evaluates his work by reading through it to check for errors and to compare his writing to the outline he prepared.

Regulation of cognition is also referenced in the self-regulated learning (SRL) literature. Self-regulated learning “is the self-directive process by which learners transform their mental abilities into academic skills” (Zimmerman, 2002, p. 65), and it involves metacognitive, motivational, and behavioral processes. Some believe there is considerable overlap between metacognition and SRL, both conceptually and practically (e.g., Dinsmore, Alexander, Loughlin, 2008; Ley & Young, 2001). This overlap is evident by simply scanning the reference lists of articles in either area: articles on metacognition cite many articles that focus on SRL, and vice versa. This is not necessarily problematic because both constructs are conceptualized in a way that encompasses at least part of the other. As Veenman (2011) explained, “metacognition researchers consider self-regulation to be a subordinate component of metacognition, whereas SRL researchers regard self-regulation as a concept superordinate to metacognition” (p. 197). As previously mentioned, SRL theories generally identify metacognition as one of several areas of self-regulation that enhances learning. The SRL perspective limits metacognition to only the regulation of cognition and considers it independent of regulation of either motivation or affect. Metacognitive theories, as described above, hold a broader view of metacognition that reflects the whole of “thinking about thinking.” In this sense, metacognition could be directed toward a great number of cognitions, including those related to motivation and behavior. This review is centered on metacognition, and references to the SRL literature consider only the metacognitive components of SRL (e.g., monitoring cognition).
Metacognition and Academic Achievement

Research has shown that metacognition is positively related to achievement (Labuhn, Zimmerman, & Hasselhorn, 2010; Pintrich, 2002; Swanson, 1990; Veenman, Wilhelm, Beishuizen, 2004), and it is one of the greatest influences on academic performance (Schraw, 1998; van der Stel & Veenman, 2010; Veenman & Spaans, 2005; Veenman et al., 2006; Wang, Haertel, & Walberg, 1990). In their study examining the development of metacognitive skills, van der Stel and Veenman (2010) measured middle-school aged students’ use of metacognition during learning activities in history and mathematics over two years. They found that metacognition was significantly related to academic achievement, even after controlling for differences in intellectual ability. In fact, metacognition had a stronger relationship with achievement than intellectual ability in all but one age-group/subject pairing. Wang, Haertel, and Walberg (1990) conducted a meta-review to determine which variables had the strongest influence on learning outcomes. They concluded that metacognition has a stronger, more consistent relationship with academic outcomes than virtually any other variable that has been researched, including student demographic variables, students’ prior knowledge, student-teacher interactions, and socioeconomic status.

Changes in Metacognition

There is evidence that changes in metacognitive abilities are a result of both development (Krebs & Roebers, 2010; van der Stel & Veenman, 2010; Veenman et al., 2004) and instruction (Hilden & Pressley, 2007; Huff & Nietfeld, 2009; Moely et al., 1992; Pape, Bell, & Yetkin, 2003; Ramdass & Zimmerman, 2008; Veenman, 2013). Flavell (1992) suggested that the emergence of metacognition is connected to traditional
Piagetian stages of development. Piaget’s theory outlined cognitive development in terms of changes in the way an individual interacts with and reasons about the world. He argued that developmental stages are characterized by the types of mental operations one is capable of completing. In Piaget’s theory, the most advanced stage of cognitive development is the formal-operational stage, which is believed to begin around 11 or 12 years of age. The formal-operational stage is characterized by the ability to use deductive reasoning and the ability to perform complex, abstract mental operations (Moshman, 2011). Flavell (1992) believes that formal-operational reasoning requires metacognitive control. Researchers have yet to determine if metacognition precedes formal-operational reasoning or vice versa, but they believe there is a connection between the two. A general developmental perspective of metacognition is also supported by research that has found age-related increases in metacognitive skillfulness across students ranging from fourth grade through college (Krebs & Roebers, 2010; Veenman & Spaans, 2005; Veenman et al., 2004). In their study of the relationship between metacognition, intelligence, and development, Veenman and colleagues (2004) looked across age groups to compare students’ learning and use of metacognition on complex, computer-based inductive learning tasks. They found that students’ use of metacognitive skills increased with age and contributed positively to task performance. In another study examining the relationship between metacognition and development, Krebs and Roebers (2010) investigated test-taking strategies and confidence judgments among students between the ages of 8 and 12. Students watched a short informational video and were later tested over its content. The testing process had three steps. Students first answered test questions, then gave a confidence rating for each of their answers, and finally crossed out any
answers they believed were incorrect. The researchers found that all students were able to reliably differentiate between their own correct and incorrect answers for low difficulty test items, but that older students (11-12 year-olds) were better than younger students (8-9 year-olds) at differentiating between correct and incorrect answers for high difficulty test items. It appears that children already have some metacognitive monitoring ability by age 8, but that it continues to develop with age.

Even though an individual’s use of metacognition might increase as a result of normal cognitive development, there is evidence that metacognition can also be improved through instruction. Research has found that students receiving explicit instruction in metacognitive knowledge and skills improve both their metacognitive abilities (Hilden & Pressley, 2007; Huff & Nietfeld, 2009; Moely et al., 1992; Pape, Bell, & Yetkin, 2003; Ramdass & Zimmerman, 2008; Veenman, 2013) and their academic achievement (Haller et al., 1988; Csíkos, & Steklács, 2010; Schraw, 1998). In one study investigating the efficacy of metacognition-based interventions, students’ reading comprehension and mathematics achievement improved following a two-month intervention where students learned about and practiced planning, monitoring, and evaluation strategies (Csíkos & Steklács, 2010). Teachers provided explicit metacognition instruction that was embedded in reading and mathematics lessons. Pre-test to post-test gains in achievement were significantly greater for students involved in the intervention than for students in a control group. The metacognition instruction was more beneficial than traditional reading and mathematics instruction.

In their meta-analysis of studies examining metacognitive instruction of reading comprehension, Haller, Child, and Walberg (1988) concluded that metacognitive skills
training might have the greatest impact for middle-school aged students, a notion further supported by a later meta-analysis conducted by Dignath and Büttner (2008). Most students begin middle school when they are either 11 or 12 years old, the ages at which formal-operational thinking usually first appears. It is not surprising then that metacognitive training is particularly beneficial for individuals who are developing the mental capacity for such thinking.

**Recommendations for Fostering Metacognition**

There are many things teachers can do to foster metacognition (Joseph, 2009; Paris & Paris, 2001; Paris & Winograd, 2003; Pintrich, 2002; Schraw, 1998; Zumbrunn, Tadlock, & Roberts, 2011), all of which belong to one of two broad categories: implicit instruction or explicit instruction. Figure 3 shows a taxonomy of metacognition instruction, including the purpose and examples of each instruction type. Implicit instruction occurs when the teacher models or prompts the use of metacognition without expressly acknowledging or discussing it (Dignath-van Ewijk et al., 2013; Kistner et al., 2010), like Mr. Brown’s instruction in the opening scenario. For example, when a teacher says to the class, “If the paragraph does not make sense to you the first time, reread it,” he is prompting students to monitor their comprehension and apply a strategy if necessary. The teacher is reminding students to use metacognition without explicitly teaching them how or why to do so. Explicit instruction takes place when the teacher points out, explains, or discusses the benefits of metacognition (Dignath-van Ewijk et al., 2013; Kistner et al., 2010), like Ms. Andrews did in the opening scenario. For example, a teacher might say, “Planning your paper before you write can help you generate better quality ideas and make it easier for you to determine the best order for presenting those
### Metacognition Instruction

<table>
<thead>
<tr>
<th>Implicit</th>
<th>Explicit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prompting</td>
<td>Modeling</td>
</tr>
</tbody>
</table>

#### Purpose:
- Encourages students to engage metacognition
- Shows students metacognition in action
- Provides students with declarative, procedural, and/or conditional knowledge
- Provides motivation for acquiring new strategies and using metacognition

#### Math Example:
- "How did you get your answer?"
- "I know that word problems are hard for me, so the first thing I am going to do is draw a picture that represents the problem I am trying to solve."
- "One strategy you can use for multiplying binomials is called FOIL. It stands for first, outside, inside, last, and it will help you remember to multiply all the terms in the expression."
- "If you are aware of what steps you are using to solve those problems and can articulate them, it will be easier for you to figure out where your error is when you get an incorrect answer."

#### Music Example:
- "What part of this song do you think is the most difficult for you to play?"
- "I forgot that we have three flats in the key signature, and I played E natural instead of E flat. I am going to write in the accidental next to that note so I do not forget again."
- "Before you begin to play a piece of music for the first time, you should look at the tempo, time signature, key signature, dynamic levels, and any accidentals that appear in the song."
- "Being able to hear your instrument separate from all the others helps you know if you’re in tune and blending with the rest of the ensemble. If everyone can hear themselves and make adjustments when needed, the overall quality of our playing will increase."

*Figure 3. Taxonomy of metacognition instruction.*

ideas. One way to do this is to write out your ideas and organize them into an outline.”

This teacher is describing why planning is a helpful activity and pointing out steps the students can use to plan successfully. Discussing the benefits of metacognition is particularly important because doing so motivates students to acquire these new strategies.
or thinking skills (Veenman et al., 2006). Both explicit and implicit metacognition instruction are considered important (Joseph, 2009; Paris & Paris, 2001; Paris & Winograd, 2003; Pintrich, 2002; Veenman et al., 2006), but teachers use explicit instruction less frequently than implicit instruction (Veenman, 2011). One study found that only 15% of teachers’ strategy instructions were explicit (Kistner et al., 2010). This is potentially problematic because evidence suggests that explicit strategy instruction is related to gains in student achievement, whereas implicit instruction is not (Kistner et al., 2010).

Three general principles for implementing effective metacognition instruction have been identified (Veenman et al., 2006; Veenman, 2013). First, Veenman proposes that instruction should be embedded into an authentic learning context. Although metacognition could be taught independent of other content, it is most effective when presented concurrently with course material. Embedded presentation allows students to connect the metacognitive knowledge or skills to an authentic learning task. Thus, students see how metacognition can aid their performance in that specific context. Furthermore, part of metacognitive knowledge is conditional knowledge, and pairing metacognition with an authentic task provides exposure to related conditions under which a skill should be used. Conditional knowledge makes strategy transfer possible. This is critical because the primary value of strategies is that they can be used in multiple situations. In the opening scenario, both Mr. Brown and Ms. Andrews embedded metacognition instruction into the lesson about the Founding Fathers. The students were able to learn and practice the matrix-organizer strategy during an authentic learning task.
Ideally, those students would later recognize that they benefitted from using the strategy, and they would be motivated to use the strategy again.

Veenman’s second principle states that metacognition should be taught using what is referred to as informed training (Campione, Brown, & Ferrara, 1982). Informed training involves informing learners of the benefits of using metacognition. Understanding such benefits motivates students to use metacognition and increases expectations of success. Informed training is represented as “Teaching Benefits” in the taxonomy of metacognition instruction (Figure 3). Ms. Andrews used informed training in the opening scenario when she described how the matrix organizer would help students learn and prepare for the upcoming test.

Veenman’s last principle of metacognition instruction is prolonged training. The acquisition of metacognitive skills and knowledge is a long-term process, and any efforts to foster metacognition should extend over several weeks and months. Generally speaking, the longer the training, the better results will be (Dignath & Büttner, 2008; Veenman, 2013).

Research on Metacognition Instruction

Quantitative research provides evidence that metacognition instruction rarely happens in the classroom (Clift, Ghatala, Naus, & Poole, 1990; Dignath-van Ewijk, Dickhäuser, & Büttner, 2013; Dignath-van Ewijk & van der Werf, 2012; Hamman, Berthelot, Saia, & Crowley, 2000; Kistner et al., 2010; Moely et al., 1992). Most studies examining metacognition instruction from a quantitative perspective have used self-report or observation methodology. Studies using self-report methodology have found that few teachers report integrating any metacognitive instruction into their teaching
(Clift, et al., 1990; Dignath-van Ewijk, & van der Werf, 2012). For example, Clift and colleagues (1990) found that teachers rarely integrate explicit strategy instruction into their teaching, and when they do they often fail to include metacognitive knowledge with instruction. Studies involving teacher observations have supported these findings (Dignath-van Ewijk et al., 2013; Durkin, 1978; Hamman, Berthelot, Saia, & Crowley, 2000; Kistner et al., 2010; Moely et al., 1992; Veenman, 2011). For example, Hamman and colleagues (2000) videotaped middle school teachers as they taught three separate lessons throughout a semester. The lessons were 30 minutes long, and each lesson was segmented into 30-second units for coding (therefore each lesson consisted of 60 segments). Results indicated that fewer than 7% of segments contained an instance of either implicit or explicit metacognitive instruction (although the researchers did not make this distinction in their analysis). Similarly, Kistner et al. (2010) found that German math teachers, on average, provided between one and two implicit or explicit metacognitive strategy instructions during a 45-minute lesson. Dignath-van Ewijk et al., (2013) used both self-report and observation to determine how much metacognition instruction teachers included in seventh grade mathematics classes. Observations revealed that teachers, on average, provided fewer than four implicit or explicit metacognition instructions during a 45-minute period. Additionally, there was no correlation between observed metacognition instruction and teachers’ self-reports of metacognition instruction. This non-significant finding has at least two possible explanations: either teachers and researchers have different ideas of what constitutes metacognition instruction, or teachers misestimate their metacognition instruction. The researchers concluded that self-report measures should not be substituted for
observational measures when studying metacognition instruction. Overall, these quantitative studies have determined that little metacognition instruction takes place in k-12 classrooms.

Only a few studies have examined how teachers foster metacognition from a qualitative perspective (Perry, 1998; Perry & VandeKamp, 2000; Perry et al., 2002). Perry and her colleagues studied metacognition instruction in elementary school classrooms. While working with researchers in a focused professional development program, teachers frequently used explicit strategy instruction, reflection activities, and classroom discussions involving knowledge of cognition (Perry & VandeKamp, 2000; Perry et al., 2002). When not involved in relevant professional development, some teachers incorporated frequent metacognition instruction into their teaching, and some rarely or never incorporated metacognition instruction (Perry, 1998). For example, two different teachers involved in the professional development program ended each reading lesson with a “sharing circle.” In the sharing circle students talked about things they learned about themselves as readers as well as strategies that helped them during the lesson (Perry et al., 2002). This activity builds students declarative knowledge of cognition (Row 1 of Figure 2) by making self-knowledge and knowledge of relevant strategies explicit. The frequent use of metacognition instruction described by Perry and her colleagues (Perry, 1998; Perry & VandeKamp, 2000; Perry et al., 2002) indicates that metacognition instruction occurs more frequently than quantitative findings suggest. However, some of the qualitative studies were conducted while teachers were participating in a relevant professional development program, whereas participants in
quantitative studies were not. This critical difference makes it difficult to determine if the difference in findings are due to professional development or study methodology.

Gaps in the Research Literature

Quantitative and qualitative studies have painted different pictures of metacognition instruction, and little has been done to reconcile this disagreement. To my knowledge, no studies examining metacognition instruction have employed mixed methods. Because the two methodologies have yielded different findings, mixed methods might reveal the reasons behind those differences. Bringing the two methodologies together into a single study makes it possible to examine each teacher’s practices from both a quantitative and qualitative perspective and thereby identify discrepancies in findings due to different methodologies. In addition to the absence of mixed method studies, there are six specific gaps in the research on metacognition instruction. These gaps are related to (a) the piecemeal approach to studying metacognition instruction, (b) the validity of self-report measures, (c) the techniques used by teachers, (d) the congruity of teachers’ instruction and recommendations in the literature, (e) the intentionality of metacognition instruction, and (f) influences that contribute to metacognition instruction. Each is described in turn.

First, existing research has taken a piecemeal approach to studying metacognition instruction, and therefore it has not been possible for researchers to account for the many ways teachers can foster metacognition. To my knowledge, no studies have examined metacognition instruction from a perspective that includes both knowledge of cognition and regulation of cognition (i.e., the two main components of metacognition, as shown in Figure 2), as well as both implicit and explicit instruction (i.e., the two types of
metacognition instruction, as shown in Figure 3). Previous studies have focused on small pieces of metacognition instruction (e.g., metacognitive strategy instruction, Dignath-van Ewijk et al., 2010; reading comprehension instruction, Durkin, 1978), or did not differentiate between implicit and explicit instruction (e.g., Hamman et al., 2000). Because existing studies focus on only a few facets of metacognition instruction, they are unable to provide a complete picture of all the ways teachers can foster metacognition. Therefore, the prevalence of metacognition is unknown.

Second, despite concerns about the possibility of low validity with self-report measures (Dignath-van Ewijk et al., 2013; Kistner et al., 2010), little has been done to validate self-report measures using other types of data. In cases where validation was attempted, methodological flaws precluded validation. Specifically, Dignath-van Ewijk and colleagues (2013) found no significant relationships between observer ratings and teachers’ self-report. However, these teacher self-report scales were comprised of items from two different scales that were created to assess teacher quality. Moreover, the study had a small sample size that limited its power. The degree to which self-reported metacognition instruction corresponds to observational data remains unclear.

Third, little is known about the techniques teachers use to foster metacognition. Distinguishing between implicit and explicit instruction provides some information related to how teachers foster metacognition, but little research has looked at teachers’ techniques in more detail. Perry’s (Perry & VandeKamp, 2000; Perry et al., 2002) previously described qualitative work provides the only detailed information about how teachers foster metacognition. However, teachers in those studies were part of an ongoing professional development program focused on fostering self-regulated learning. The
literature does not provide detailed information about the techniques teachers use to foster metacognition when not taking part in specialized professional development.

Fourth, little has been done to examine the congruity between what teachers do to foster metacognition and what has been recommended in the literature. A few studies have examined this issue from the broad perspective of implicit and explicit instruction (Dignath-van Ewijk, et al., 2013; Kistner et al., 2010). Findings show that explicit instruction is rare even though the literature recommends making metacognition instruction explicit (Pintrich, 2002; Veenman, 2011). Furthermore, many articles that include recommendations for educators include specific approaches that can be used (Joseph, 2009; Paris & Paris, 2001; Paris & Winograd, 2003; Pintrich, 2002; Schraw, 1998; Zumbrunn, Tadlock, & Roberts, 2011). For example, Schraw (1998) recommended that teachers use a combination of direct instruction, modeling, reflection activities, and peer discussions to foster metacognition. At this point no studies have examined teachers’ practices with this level of specificity.

Fifth, research has not investigated whether or not teachers’ efforts to foster metacognition are intentional. It is possible that a teacher might use techniques that foster metacognition for reasons other than their potential to foster metacognition. For example, imagine Mrs. Norwood is helping Bryan with his algebra assignment. Bryan attempted a word problem, but got the wrong answer, and Mrs. Norwood asks him, “Why did you decide to set up your equation that way?” This question prompts Bryan to use metacognition because he must recall and articulate the steps he went through when he made that decision. However, Mrs. Norwood asked the question because she wants to understand why he made that error, not because she wants him to use metacognition.
Studies that use only observation are unable to differentiate between intentional and unintentional use of metacognition instruction.

The final gap in the literature is related to influences on teachers’ metacognition instruction. Professional development programs can help teachers foster metacognition (Hilden & Pressley, 2007; Perry & VandeKamp, 2000; Perry et al., 2002), but less is known about what contributes to teachers use of metacognition instruction when they are not involved in special training. Clift and colleagues (1990) found that nearly two-thirds of teachers believed their training for teaching study strategies was inadequate, but no other studies have examined training regimes that might influence the techniques a teacher uses.

In addition to these identified gaps, there is another weakness in the existing literature. The existing literature is limited in its generalizability to teachers presently working in the American public school system. Only four of the previously cited studies that investigated teachers’ promotion of metacognition were conducted in the United States, and they were published between 14 and 36 years ago (Clift et al., 1990; Durkin, 1978; Hamman et al., 2000; Moely et al., 1992). Metacognition is undoubtedly more widely studied and discussed now than it was when Durkin (1978) published her study on reading comprehension instruction, and it is likely that the number of teachers that have at least heard of metacognition is greater now than it was over 30 years ago. It is also likely that activities and practices in today’s classrooms are not the same as they were at the time those studies were conducted. For example, Palincsar and Brown (1984) introduced reciprocal teaching as a technique for improving text comprehension through direct strategy instruction and strategy practice with peers. Reciprocal teaching involves
strategy instruction that incorporates procedural and conditional knowledge of cognition as well as teacher and peer modeling (Palincsar, 1986). Reciprocal teaching has been widely used and researched since it was first introduced (Galloway, 2003). It is just one technique for fostering metacognition that is supported by research and has been made available to teachers in the past 30 years (Joseph, 2009). Furthermore, there have been multiple changes in American education since the turn of the century. One important change was the implementation of the No Child Left Behind Act (2002) and the resulting focus on school and teacher accountability through standards and assessment (Dee & Jacob, 2011). The Common Core State Standards Initiative is the most widely adopted set of standards (“Standards in Your State,” n.d.), and it emphasizes teaching students a variety of strategies and the conditional knowledge needed to implement those strategies effectively. It is possible that the increased emphasis on strategies has increased the amount of metacognition instruction that takes place in classrooms. The research literature’s generalizability is also limited in that recent studies examining metacognition instruction were conducted either in Canada (Perry & VandeKamp, 2000; Perry et al., 2002) or Europe (Dignath-van Ewijk et al., 2013; Kistner et al., 2010). It is imprudent to assume that teacher training in Canada and Europe is identical to teacher training in the United States. In sum, the present state of metacognition instruction in American classrooms is unknown.

**The Present Study**

The present study addresses these literature gaps by using both quantitative and qualitative methods to examine how teachers foster metacognition in middle school
**Purpose:** Determine to what extent metacognition is fostered in middle school classrooms. Understand the beliefs and efforts of teachers who make metacognition part of their teaching.

**Method:**
- **Quantitative:**
- **Qualitative:**

**Phases:**
- Survey
- Observation
- Interview

**Questions:**
- Prevalence
- Validity
- Techniques
- Congruity
- Intentionality
- Influences

- How much metacognition instruction takes place in the context of content instruction?
- Are teachers’ self-reported practices supported by researcher observations of instruction?
- How do teachers foster metacognition?
- Are the methods that teachers use to foster metacognition consistent with recommendations in the literature?
- Do teachers intentionally foster metacognition?
- What or who has influenced teachers to foster metacognition in their classrooms?

**Literature Gaps:**
- Piecemeal approach
- Validity of self-report measures
- Techniques used by teachers
- Congruity
- Intentionality
- Influences

*Figure 4. Relationship between study purpose, method, phases, research questions, and literature gaps.*

...classrooms. The relationship among the purpose, literature gaps, research questions, and design for the present study is shown in Figure 4.

The twofold purpose of this study (top row of Figure 4) is to fill the previously described gaps in the literature (bottom of Figure 4) by (a) determining the extent that metacognition is fostered in middle school classrooms, and (b) determining the beliefs and efforts of teachers who frequently make metacognition part of their teaching.

Because this study focused on what teachers do to foster metacognition as well as how and why they do it, both quantitative and qualitative approaches were used (second row of Figure 4). Quantitative measures provided descriptive data and were used to address...
the first part of the study’s purpose (i.e., determining to what extent metacognition is fostered in the classroom). Qualitative measures were used to address the second part of this study’s purpose (i.e., determining the beliefs and efforts of teachers who frequently make metacognition part of their teaching). A qualitative approach to this part of the study’s purpose is appropriate, and possibly even necessary, because the relationship among the classroom context, the teacher’s beliefs and attitudes toward metacognition, and events in the classroom are intertwined and best understood when examined concomitantly (Patrick & Middleton, 2002). In many cases, quantitative and qualitative methods provide complementary data that lead to a better understanding than would be reached if either was used in isolation, and it is for that reason that both approaches were used in this study.

The following research questions (fourth row of Figure 4) guided this study:

1. **The question of prevalence:** How much metacognition instruction takes place in the context of content instruction?
2. **The question of validity:** Are teachers’ self-reported practices supported by researcher observation of instruction?
3. **The question of techniques:** How do teachers foster metacognition?
4. **The question of congruity:** Are the methods that teachers use to foster metacognition consistent with recommendations in the literature?
5. **The question of intentionality:** Do teachers intentionally foster metacognition?
6. **The question of influences:** What or who has influenced teachers to foster metacognition in their classrooms?
The present study was conducted in three phases wherein a different data collection method was used (third row of Figure 4). First was the Survey Phase, second was the Observation Phase, and third was the Interview Phase. Survey data were used for descriptive, quantitative analysis. Observation data were used for both quantitative and qualitative analysis. And, interview data were used for qualitative analysis.

The question of prevalence addressed the literature gap created by the piecemeal approach to studying metacognition. This was done by using survey and observation data to measure how frequently teachers fostered metacognition using a variety of teaching techniques. I expected to observe more frequent and varied metacognition instruction than has been reported by previous quantitative research because previous research has focused on narrow aspects of metacognition instruction whereas this study had a broader perspective of metacognition instruction. The question of validity addressed the literature gap created by the failure to validate teachers self-reports with observations. This was addressed in this study by comparing what teachers reported doing in the Survey Phase with what was seen in the Observation phase. Limited prior research led me to expect a weak correspondence between teachers’ self-report of metacognition instruction and observation (Dignath-van Ewijk, et al., 2013). The question of techniques addressed the literature gap related to the techniques teachers use to foster metacognition. This was addressed in this study by using survey, observation, and interview data to identify specific behaviors or instructional methods that foster metacognition. In line with previous findings (Kistner et al., 2010; Veenman, 2011), I expected to find teachers using more implicit instruction than explicit instruction. The question of congruity addressed the literature gap related to the congruity between what teachers do to foster
metacognition and what is recommended. This was addressed in this study by comparing the specific behaviors and instructional methods identified through survey, observation, and interview data to recommended practices. I expected teachers to use implicit and explicit instruction, both of which are recommended, because previous studies (Kistner et al., 2010; Veenman, 2011) have reported teachers using both implicit and explicit instruction. I did not have predictions regarding specific behaviors or instructional methods because previous research has not reported teachers’ practices in detail nor has it compared specific practices to recommendations. The question of intentionality addressed the literature gap related to whether or not teachers purposefully use techniques to foster metacognition. This was addressed in this study by using observation and interview data to understand why teachers used techniques that foster metacognition. Because of the lack of research related to intentionality of instruction, I did not have specific predications for this research question. Finally, the question of influences addressed the research gap related to what or who has influenced teachers to foster metacognition. This was addressed in this study by using observation and, primarily, interview data to identify any persons, materials, or training that influenced teachers’ metacognition instruction. Because of the lack of research related to influences on instruction, I did not have specific predictions related to these topics.

**Method**

The study had three phases. First was the *Survey Phase*. Participants responded to a survey about the ways they foster metacognition in their classroom and their understanding of metacognition. Second was the *Observation Phase*. A subset of participants from the Survey Phase was observed teaching with each teacher being
observed during two class periods that were approximately a week apart. Observation
focused on what teachers did and said to foster metacognition through their teaching. The
third phase was the Interview Phase. A subset of the observed teachers was interviewed
about the role of metacognition in their classroom and how their attempts at fostering
metacognition have changed during their career.

Participants and Context

Participants were middle school teachers from a local public school district in a
medium-sized city in the Midwest. This district was chosen because of its size (it had 11
middle schools) and its proximity to the researcher. Nine teachers participated in the
Survey Phase, five of them participated in the Observation Phase, and four of them
participated in the Interview Phase. Each of the three phases involved fewer participants
and more intensive examination of metacognition instruction. Starting with a larger
sample and gradually narrowing the focus while increasing the depth of investigation
afforded two advantages. First, it made it possible to gain a broad perspective of what
teachers in a variety of subjects are doing to help students develop metacognitive
thinking skills. Second, it made it possible to gain a deeper understanding of how and
why these teachers make efforts to foster students’ metacognition. Middle school teachers
were selected because of the previously discussed evidence that middle school students
might benefit most from metacognitive skills training (Dignath & Büttner, 2008; Haller et
al., 1988). The nine participants who completed the survey worked at three different
middle schools. These three middle schools were represented during the Observation
Phase, and two of the three schools were represented during the Interview Phase. All data
collection took place during the spring 2014 semester over a period of three months.
Materials

The Survey, Observation, and Interview phases each had a corresponding instrument: self-report survey, observation instrument, and semi-structured interview protocol, respectively.

Survey. The self-report survey was modeled after Terlecki’s (2012) survey of college teachers’ use of metacognitive teaching strategies, but was modified in accordance with the literature for the purposes of this study. The survey was expanded to include a variety of techniques that can be used to foster different aspects of metacognition implicitly or explicitly. (The original survey generically asked teachers how often they taught a variety of strategies.) Furthermore, some items from the original survey that were less directly connected to metacognition were dropped (e.g., “How often do you advanced technology, such as iPads or clickers?”). The resulting survey (see Appendix A) was designed to capture the different components of metacognition as well as the different ways in which metacognition instruction can be carried out (Joseph, 2009; Schraw, 1998; Veenman, 2013; Veenman et al., 2006). The survey was administered electronically through the Qualtrics survey platform and was composed of four sections. The first section, Demographics, requested demographic information such as subject area teaching assignment, years of teaching experience, and number of college credit hours earned beyond the bachelor’s degree. The second section, General Behaviors, required participants to use an 8-point Likert-like scale to indicate how frequently the engage in a variety of general behaviors related to fostering metacognition. Responses were given a score from 1 to 8, with 1 representing “never” and 8 representing “daily.” Thus, higher values indicated more frequent behavior and lower values indicated less frequent
behavior (see Appendix A for all value labels). The third section, Teaching Techniques, required participants to use the same 8-point scale to indicate how frequently they provide instruction for nine different strategies (e.g., “self-monitoring of thinking, learning, or performance”). This third section had four different subsections, and each pertained to one of the instructional techniques identified in the metacognition instruction taxonomy (taxonomy is shown in Figure 3). The four techniques addressed were (a) teaching benefits (e.g., teaching students about the benefits of using strategies and metacognition), (b) direct instruction (e.g., providing direct instruction of strategies and metacognition), (c) prompting (e.g., prompting the use of strategies and metacognition), and (d) modeling (e.g., modeling the use of strategies and metacognition). Teaching benefits and direct instruction are types of explicit instruction; prompting and modeling are types of implicit instruction. Section four, Understanding of Metacognition, measured participants’ knowledge of metacognition and their perception of how instruction influenced students’ metacognition. Using a 5-point Likert-like scale, participants indicated the degree to which they agreed with two statements: “I understand what metacognition means” and “My instruction regularly encourages students to think metacognitively.” This scale ranged from “strongly disagree” to “strongly agree,” and responses were given a value from 1 to 5, respectively. The final item in section four was a constructed-response question that asked participants to describe their understanding of what metacognition is. This item was not scored quantitatively, but responses served as an indicator of participants’ declarative knowledge about metacognition.

Observation Instrument. The instrument used in the Observation Phase (see Appendix B) was modeled after the observation instrument developed by Perry (1998).
Although the original form of the instrument was used in quantitative research, it has been adapted for qualitative observation (Perry et al., 2002). The original instrument contained three sections. For the present study Sections 1 and 2 were used in the original form and the third was used with minor adaptations. Section 1 of the instrument provided space for basic information about the observation setting including date, time, and a brief description of the classroom. Section 2 allowed space for a “running record” of events in the classroom, including activities, instructions, and verbatim samples of the teachers’ speech and approximate times when they took place. Section 3 of the original instrument contained a categorization checklist that allowed the observer to classify events that supported SRL. For the present study, Section 3 was altered so that it was consistent with the present study’s purpose. It contained a checklist-like coding grid that provided a way to identify what component of metacognition was addressed, when it was addressed, and what technique the teacher used to foster metacognition. The grid consisted of columns that displayed the components of metacognition (e.g., declarative knowledge of cognition, conditional knowledge of cognition) and rows that divided time into three-minute intervals. After the observation, cells were marked with codes that corresponded to sections of the taxonomy of metacognition instruction (i.e., teaching benefits [B], direct instruction [I], prompt [P], and model [M], see Figure 3). Once again, (a) teaching the benefits and (b) direct instruction are types of explicit instruction; (c) using prompts and (d) modeling are types of implicit instruction. An additional code, “O” stood for “other” and was available to indicate that an event fostered metacognition but did not fit well into one of the other categories. For example, “O” was used when a teacher praised a student’s unprompted strategy use.
**Interview Protocol.** The interview was semi-structured and consisted mostly of predetermined, open-ended questions. The purpose of the interview was to allow participants to (a) describe their beliefs and efforts related to metacognition instruction, (b) elaborate on teaching techniques recorded during the observation phase, and (c) discuss relevant experiences that influenced their metacognition instruction. Interview questions were created to address the previously described research questions of Techniques, Congruity, Intentionality, and Influences. For example, there were questions that addressed participants’ efforts to promote metacognition through their teaching (i.e., Do you intentionally incorporate metacognition instruction into your classroom?), any support or training they have had in teaching students to be metacognitive (i.e., Have you had any training in teaching students to use metacognition in the classroom?), and their beliefs about the role metacognition plays in education (i.e., What do you think is the most valuable thing you do to help your students become more metacognitive toward their learning?). Appendix C shows all planned questions.

**Procedures**

Prior to Survey Phase, all middle school principals from the city’s public school system were contacted about the study. The principals served as the main contact in each school building and were asked to forward an email containing information about the study to teachers in their buildings. All teachers were informed about the three-phase (Survey, Observation, and Interview) nature of the study and informed that participation in the initial Survey Phase did not mandate participation in later phases. The email also contained a copy of the informed consent form and a link to the electronic survey. Participants were asked to complete the survey within two weeks. Toward the end of the
two week period a follow-up email was sent (via school principals) to remind all potential participants of the study. Three weeks after the initial recruitment email had been sent, a total of 15 people had accessed the survey and nine had completed it. Completed surveys were scored and the data were used to identify participants as low- or high-frequency metacognition instructors. (A detailed explanation of the identification process is provided in the Results section.) Because of the lower than expected survey response rate, all participants who completed the survey were invited to participate in the Observation Phase. Five participants agreed and participated in the Observation Phase.

Participants involved in the Observation Phase were observed for two separate class periods. Observations were between one and two weeks apart, and the same class (e.g., 8th period algebra) was observed on both occasions. Most observed class periods were between 40 and 50 minutes long, with the shortest lasting approximately 39 minutes and the longest lasting approximately 57 minutes. During each observation, I sat toward the back of the classroom so that I could see the entire room while being as unobtrusive as possible. Observations focused on teachers’ instructional practices that promoted metacognition. I specifically looked for dialogue relating to metacognition, explicit instruction, modeling, or prompts for students to engage in metacognitive thinking. Field notes taken in Section 2 of the previously described observation instrument detailed as much instructional activity as possible by using verbatim samples and paraphrases of teachers’ speech along with rich descriptions of classroom events. Individual student behaviors were not directly recorded, but were occasionally described indirectly (e.g., when the teacher responded to a student question). Class-wide behaviors (e.g., working in groups or completing practice activities) were also recorded. Immediately after an
observation was completed, I reviewed the running record and assigned codes in the Teaching Techniques section of the observation instrument. Later, the running record was reviewed again and more detailed qualitative codes were assigned (e.g., a code of “P” was expanded to “prompted self-assessment”).

After the Observation Phase was completed, four of the five teachers who participated in the Observation Phase participated in the Interview Phase. One teacher did not participate in the Interview Phase due to schedule constraints. The goals of interviews were to better understand the teachers’ attitudes and beliefs about metacognition instruction and to determine what professional and educational experiences influenced their metacognition instruction. Events from the observed class periods were also addressed and explored. For example, during an observation one of the music teachers reminded students to complete assigned practice activities. In the interview, I asked the teacher to explain the practice activities and anything she does to help students benefit from practice sessions when an instructor is not present to provide feedback. Interviews lasted between 30 and 60 minutes and were audio recorded and transcribed verbatim for analysis. After transcription, but prior to analysis, participants reviewed transcripts to ensure that their thoughts and experiences were reflected accurately, a qualitative validation process known as member checking. Qualitative analysis of the interviews began once the member checking process was complete.

Results

Quantitative results are presented first, followed by qualitative results. Quantitative results were derived from data collected during the Survey and Observation
Phases. Qualitative results were derived from data collected during the Observation and Interview Phases.

**Quantitative Findings: Survey and Observation**

Quantitative analyses were conducted with two main goals. First, survey data were used to guide decisions about selecting participants for observation by identifying participants as either high- or low-metacognition instructors. Second, survey and observation data were analyzed to determine how and to what extent metacognition was being fostered in these teachers’ classrooms. The process of identifying high- and low-metacognition instructors, analyses (survey data), coding (observation data), and findings are described next.

**Survey.** Fifteen teachers gave their consent and participated in the Survey Phase. Of the 15, only 9 completed the survey. All incomplete surveys were dropped from further analysis, and only those who completed the survey were eligible for participation in later phases of the study. These nine participants taught at three different middle schools within the school district. Two participants split their time between a middle school and multiple elementary schools, and one participant spilt his time between a middle school and a high school. Subject area, grade levels taught (middle school grades only), years of experience, and completed graduate education hours for each participant is shown in Table 1. Years of teaching experience for this group of teachers ranged from 2 to 35 years ($M = 18.9$, $SD = 13.2$), with four teachers having 10 or fewer years of experience, and five having 25 or more. Seven participants had at least the minimum number of hours required for a Master’s degree, and the only two teachers with fewer graduate hours had been teaching less than five years. Four participants taught core
subjects (e.g., language arts) and five taught non-core subjects (e.g., physical education). Three of the non-core teachers taught music. Because of the relatively large number of music teachers, this subgroup is sometimes referred to separately.

Because of the small sample size, no inferential statistics were used during analysis. First, participants’ self-reported frequencies of metacognition instruction were compared by looking at responses for the General Behaviors section and each subsection.

**Table 1**

*Participants’ Professional Demographics*

<table>
<thead>
<tr>
<th>Subject Area (Group)</th>
<th>Label in qualitative results</th>
<th>Grade(s) Taught</th>
<th>Years of Experience</th>
<th>Graduate Hours Completed</th>
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</thead>
<tbody>
<tr>
<td>Math (Core)</td>
<td>Math teacher</td>
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<td>31</td>
<td>63</td>
</tr>
<tr>
<td>Language arts (Core)</td>
<td>Reading teacher</td>
<td>6</td>
<td>30</td>
<td>45</td>
</tr>
<tr>
<td>Music (Non-core)</td>
<td>Small-group music teacher</td>
<td>6</td>
<td>35</td>
<td>54</td>
</tr>
<tr>
<td>Music (Non-core)</td>
<td>Orchestra teacher</td>
<td>6, 7, 8</td>
<td>28</td>
<td>72</td>
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<tr>
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<td>10</td>
<td>36</td>
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<td>3</td>
<td>9</td>
</tr>
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<td>Physical education (Non-core)</td>
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</tr>
<tr>
<td>Music (Non-core)</td>
<td></td>
<td>6</td>
<td>25</td>
<td>60</td>
</tr>
<tr>
<td>Guidance counselor (Non-core)</td>
<td></td>
<td>6, 7, 8</td>
<td>7</td>
<td>57</td>
</tr>
</tbody>
</table>
of the Teaching Techniques section (i.e., teaching benefits, direct instruction, prompting, and modeling). Subsection totals were calculated for each participant by summing item responses within a subsection. Next, participants were ranked from highest reported frequency to lowest reported frequency for each subsection. Most participants were ranked consistently in either the top half or bottom half of all participants. Four participants (three core teachers, one music teacher) were consistently in the top half and were classified as high-frequency instructors. Four participants (two non-core teachers, two music teachers) were consistently in the bottom half and were classified as low-frequency instructors. One participant (a core teacher) was classified as “mixed-frequency” because she had subsection totals that fell on both the high- and low-frequency ends of the spectrum. A second round of comparison was completed by looking at responses for all instructional techniques (e.g., modeling, prompting) across individual strategies (e.g., self-monitoring of thinking, learning, or performance). The process of calculating totals, ranking, and grouping was repeated with sums for each of the nine individual strategies, and the resulting participant classifications were consistent with the previous classifications. The consistency across both classification processes indicates that it is unlikely that any participant was identified as a high- or low-frequency instructor because of a single area of strength or weakness in either instructional techniques or individual strategies. Furthermore, responses to the questions in section four, Understanding of Metacognition, indicate that these classifications were probably not merely an artifact of participants’ knowledge of metacognition, because most participants had at least a base level of declarative knowledge related to metacognition. When asked to describe their understanding of metacognition, 8 of the 9 participants
responded with a variation of the commonly used definition, “thinking about thinking.”

One participant indicated she did not know what metacognition is.

Tables 2 and 3 contain the means and standard deviations for all survey items in the General Behaviors and Teaching Techniques sections of the survey. Participants

Table 2

*Means and Standard Deviations for Survey Items from the General Behaviors Section*

<table>
<thead>
<tr>
<th>Item (completing the question “how often do you...?”)</th>
<th>M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Think aloud (verbalizing thinking as it happens) while demonstrating a skill or activity</td>
<td>7.33 (0.94)</td>
</tr>
<tr>
<td>Explain benefits of being aware of one’s thought processes</td>
<td>6.11 (2.08)</td>
</tr>
<tr>
<td>Engage students in discussion about their thought processes</td>
<td>5.89 (2.23)</td>
</tr>
<tr>
<td>Have students complete written reflections</td>
<td>4.44 (2.45)</td>
</tr>
<tr>
<td>Conduct formative assessment of learning (formal or informal)</td>
<td>6.56 (2.50)</td>
</tr>
<tr>
<td>Encourage students to reflect on homework or assessment results</td>
<td>5.89 (2.08)</td>
</tr>
<tr>
<td>Encourage students to transfer skills or learning strategies to other areas</td>
<td>6.56 (1.57)</td>
</tr>
<tr>
<td>Help students connect content across chapters or subjects</td>
<td>6.00 (1.76)</td>
</tr>
<tr>
<td>Use cooperative learning activities (peer teaching)</td>
<td>5.33 (2.11)</td>
</tr>
<tr>
<td>Assign multiple-draft activities (having students reflect on and make changes to previous work)</td>
<td>4.00 (2.54)</td>
</tr>
<tr>
<td>Have students plan their work or activities</td>
<td>3.67 (2.40)</td>
</tr>
<tr>
<td>Have students monitor skill use</td>
<td>5.89 (1.97)</td>
</tr>
<tr>
<td>Have students monitor performance</td>
<td>6.56 (1.17)</td>
</tr>
<tr>
<td>Have students monitor progress</td>
<td>6.89 (0.99)</td>
</tr>
<tr>
<td>Have students evaluate and critique their own work</td>
<td>6.78 (1.13)</td>
</tr>
<tr>
<td>All behaviors</td>
<td>5.86 (0.89)</td>
</tr>
</tbody>
</table>

*Note.* For all items, 1 = Never, 2 = Once a semester, 3 = Several times a semester, 4 = Once a month, 5 = Several times a month, 6 = Once a week, 7 = Several times a week, 8 = Daily
indicated that the average frequency of 15 general behaviors related to teaching metacognition (i.e., General Behaviors section of the survey, see Table 2) was between

Table 3

 Means (and Standard Deviations) for Survey Items from the Teaching Techniques Section

<table>
<thead>
<tr>
<th>How often do you...</th>
<th>Teach Benefits of</th>
<th>Provide Direct Instruction of</th>
<th>Prompt</th>
<th>Model</th>
<th>All Techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem solving strategies</td>
<td>5.67 (2.16)</td>
<td>5.78 (2.15)</td>
<td>5.22 (3.05)</td>
<td>5.56 (2.06)</td>
<td>5.56 (1.92)</td>
</tr>
<tr>
<td>Self-monitoring of thinking, learning or performance</td>
<td>5.89 (2.23)</td>
<td>5.78 (2.15)</td>
<td>5.56 (2.54)</td>
<td>5.11 (2.60)</td>
<td>5.58 (2.00)</td>
</tr>
<tr>
<td>Self-assessing understanding of a concept</td>
<td>5.33 (2.26)</td>
<td>5.33 (2.26)</td>
<td>4.89 (2.85)</td>
<td>5.11 (2.56)</td>
<td>5.17 (2.00)</td>
</tr>
<tr>
<td>Studying techniques</td>
<td>5.44 (2.22)</td>
<td>5.33 (2.26)</td>
<td>4.67 (2.71)</td>
<td>5.67 (1.70)</td>
<td>5.28 (1.77)</td>
</tr>
<tr>
<td>Taking complete notes</td>
<td>4.33 (2.49)</td>
<td>5.11 (2.64)</td>
<td>4.44 (2.95)</td>
<td>4.67 (2.58)</td>
<td>4.64 (2.49)</td>
</tr>
<tr>
<td>Reading comprehension techniques</td>
<td>5.22 (2.35)</td>
<td>4.89 (2.42)</td>
<td>4.89 (2.81)</td>
<td>4.44 (2.41)</td>
<td>4.86 (2.40)</td>
</tr>
<tr>
<td>Determining when to ask for help</td>
<td>5.78 (2.35)</td>
<td>5.11 (1.85)</td>
<td>4.67 (2.79)</td>
<td>5.33 (2.16)</td>
<td>5.22 (1.82)</td>
</tr>
<tr>
<td>Creating graphic organizers (representing information visually)</td>
<td>4.89 (2.56)</td>
<td>4.44 (2.31)</td>
<td>4.67 (2.67)</td>
<td>4.78 (2.39)</td>
<td>4.69 (2.39)</td>
</tr>
<tr>
<td>Creating mnemonics (novel tricks to remember information)</td>
<td>4.89 (1.45)</td>
<td>4.44 (1.50)</td>
<td>4.00 (2.26)</td>
<td>4.56 (2.06)</td>
<td>4.47 (1.64)</td>
</tr>
<tr>
<td>All strategies</td>
<td>5.27 (1.81)</td>
<td>5.14 (1.72)</td>
<td>4.78 (2.59)</td>
<td>5.02 (2.02)</td>
<td></td>
</tr>
</tbody>
</table>

Note. For all items, 1 = Never, 2 = Once a semester, 3 = Several times a semester, 4 = Once a month, 5 = Several times a month, 6 = Once a week, 7 = Several times a week, 8 = Daily. Survey items were phrased “How often do you [column header] of [row header]?” For example, “How often do you teach students benefits of using problem solving strategies?” “Teach Benefits of” and “Direct Instruction” are forms of explicit instruction. “Prompt” and “Model” are forms of implicit instruction.
several times a month and once a week ($M = 5.86, SD = SD = 0.89$). Instructional practices used at least once a week included thinking aloud ($M = 7.33, SD = SD = 0.94$), explaining the benefits of being aware of one’s thought processes ($M = 6.11, SD = SD = 2.08$), having students monitor their performance ($M = 6.56, SD = SD = 1.17$), having students monitor their progress ($M = 6.89, SD = SD = 0.99$), and having students evaluate and critique their own work ($M = 6.78, SD = SD = 1.13$). Practices used once a month or less included assigning activities that require multiple drafts ($M = 4.00, SD = 2.54$) and having students plan their work ($M = 3.67, SD = 2.40$).

Responses indicated that participants used the different instructional techniques with fairly similar frequency (see Table 3 for means and standard deviations). Participants reported teaching benefits between several times a month and once a week ($M = 5.27, SD = 1.81$), and they reported providing direct instruction nearly several times a month ($M = 5.14, SD = 1.72$). Participants reported modeling several times a month ($M = 5.02, SD = 2.02$), and they reported prompting between once and several times each month ($M = 4.78, SD = 2.59$). Participants reported using explicit instruction (i.e., teaching benefits and direct instruction) more frequently than implicit instruction (i.e., modeling and prompting).

There was more variation across individual strategies than there was across instructional techniques. The individual strategies taught the least were note taking ($M = 4.64, SD = 2.49$), graphic organizers ($M = 4.69, SD = 2.39$), and mnemonics ($M = 4.47, SD = 1.64$), with their means indicating all were taught between once per month and several times per month. Problem solving strategies ($M = 5.56, SD = 1.92$) and self-monitoring of thinking, learning, or performance ($M = 5.58, SD = 2.00$) were instructed
most frequently with instruction typically taking place between several times per month and once per week.

The previously described process of classifying teachers as either high- or low-frequency metacognition instructors revealed that core teachers tended to report a higher frequency of metacognition instruction than non-core teachers. That is, three core teachers and one non-core were classified as high-frequency metacognition instructors, whereas four non-core teachers were classified as low-frequency metacognition instructors. Trends across sections of the survey as well as individual strategies for teachers in each subject area (i.e., core and non-core) were also considered. Of the different instructional techniques, core teachers reported providing direct instruction—a form of explicit instruction—the least frequently at a rate of approximately once per week ($M = 6.11$, $SD = 1.50$), and they reported prompting—a form of implicit instruction—the most frequently at a rate of several times per week ($M = 7.06$, $SD = 0.73$). As for individual strategies, core teachers reported providing instruction related to mnemonics least frequently, at a rate of once per week ($M = 6.06$, $SD = 0.94$). The most frequently instructed strategies for core teachers were using graphic organizers ($M = 7.00$, $SD = 0.91$) and note taking ($M = 7.06$, $SD = 1.03$), with both being instructed at a rate of several times per week.

For non-core teachers, the least frequently used instructional technique reported was prompting, a form of implicit instruction, at a rate slightly below several times per semester ($M = 2.96$, $SD = 2.07$). The highest average frequency of instructional techniques reported by non-core teachers was actually for the General Behaviors section, which was a heterogeneous group of teaching practices related to teaching metacognitive
knowledge and skills. Non-core teachers reported using these practices an average of between several times per month and once per week \((M = 5.48, SD = 1.02)\). With regard to individual strategies, non-core teachers provided instruction related to note taking the least frequently, at a rate slightly less than several times a semester \((M = 2.70, SD = 1.43)\). They most frequently provided instruction related to problem solving \((M = 4.75, SD = 2.00)\) and self-monitoring of thinking, learning, or performance \((M = 4.65, SD = 2.19)\). Both strategies were instructed between once a month and several times a month.

To summarize, each specific strategy (e.g., self-monitoring of thinking, learning, or performance) is taught using one of the four teaching methods (e.g., direct instruction) between once a month and once a week on average (as shown in Table 3). Overall, participants reported using explicit instruction slightly more frequently than implicit instruction.

**Observations.** Five individuals participated in the Observation Phase. Sampling selection for this phase was based on maximum variation: participants represented a variety of subject areas and both high- and low-frequency metacognition instruction. That is, two participants were high-frequency, core teachers; one was a high-frequency non-core teacher (a music teacher); and two were low-frequency, non-core teachers (one of which was a music teacher).

**Coding.** The process of coding observations had two distinct components: immediate coding that supported quantitative analysis, and delayed, detailed coding that supported qualitative analysis. Immediately after observing, I reviewed the running record and assigned quantitatively-oriented single-letter codes that corresponded to the instructional techniques (i.e., prompting, modeling, discussing benefits, and direct
in Section 3 of the observation instrument. For example, a teacher asking a student, “how did you get your answer?” was coded “P” for prompt because the teacher’s question prompts the student to reflect on the steps used to get the answer. Similarly, a teacher thinking aloud as he worked through a math problem on the whiteboard was coded “M” for model because the teacher was modeling his thought processes for students. These codes provided a way to track the number of times each participant used each instructional technique to foster metacognition. Codes were counted for each participant, summed, and compiled in Table 4.

**Findings.** Codes from section 3 of the observation instrument reveal that teachers primarily foster metacognition through implicit instruction. Over the 10 observations (5 teachers with 2 observations each), a total of 379 codes were assigned. Each code was assigned at least once for each observation, except for the code “O” (for “other”), which was not assigned during one of the observations. Figure 5 shows the number of time each instructional technique was used by each teacher. More than two-thirds of all codes corresponded to instances of implicit instruction (260 instances, 67.5% of all codes). More specifically, participants used prompts 150 times (39.6% of all codes), and there were 106 instances of modeling (28.0% of all codes). Explicit instruction made up only 17.7% of events that fostered metacognition. More specifically, participants used direct instruction 55 times (14.5% of all codes), and they discussed benefits of metacognition only 12 times (3.2% of all codes). The remaining 14.8% of codes indicated participants did or said other things that foster metacognition. Individual participants had a total of between 45 and 108 coded events across both observations ($M = 75.8, SD = 27.89$). Because observations varied in length, ratios of coded events to minutes of instruction
Table 4

Number of Quantitative Codes per Instructional Technique during Classroom Observations of Five Teachers

<table>
<thead>
<tr>
<th>Subject Area</th>
<th>Reading</th>
<th>Math</th>
<th>Orchestra</th>
<th>Small Group Music</th>
<th>Physical Education</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Classification</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implicit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instruction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prompt</td>
<td>40</td>
<td>28</td>
<td>22</td>
<td>32</td>
<td>28</td>
<td>150</td>
</tr>
<tr>
<td>Model</td>
<td>17</td>
<td>22</td>
<td>12</td>
<td>42</td>
<td>13</td>
<td>106</td>
</tr>
<tr>
<td>Explicit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instruction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct</td>
<td>12</td>
<td>3</td>
<td>6</td>
<td>31</td>
<td>3</td>
<td>55</td>
</tr>
<tr>
<td>Instruction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>Benefits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>22</td>
<td>26</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>56</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>82</td>
<td>45</td>
<td>108</td>
<td>49</td>
<td>379</td>
</tr>
<tr>
<td>Minutes of</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instruction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>104</td>
<td>90</td>
<td>93</td>
<td>86</td>
<td>100</td>
<td>473</td>
</tr>
<tr>
<td>Codes per</td>
<td>0.91</td>
<td>0.91</td>
<td>0.48</td>
<td>1.23</td>
<td>0.49</td>
<td>0.81</td>
</tr>
<tr>
<td>Minute</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Each teacher was observed for two separate class periods.

time were also calculated. Participants ranged from 0.48 to 1.23 coded events per minute, and the ratio across all observations was 0.81 coded events per minute.

Data gathered through observations was somewhat consistent with the self-report data collected via the surveys. The two core teachers who were classified as high-frequency metacognition instructors based on survey responses both recorded 0.91 coded events per minute during observations. The non-core teacher who was classified as a low-frequency
metacognition instructor recorded 0.49 coded events per minute—a little more than half of the high-frequency core teachers’ rate. The observation data for the two music teachers was inconsistent with their survey data. The music teacher who was classified as a low-frequency metacognition instructor had the highest rate of coded events at 1.23 per minute, whereas the high-frequency music teacher had the lowest rate among all participants at 0.48 coded events per minutes. This discrepancy between the music teachers’ survey and observational data is explored later in the general discussion.

Teachers’ self-reports of implicit versus explicit metacognition instruction were not consistent with observation data. As described above in the survey results section,
teachers reported using each of the four instructional techniques with similar frequency. However, observations revealed that teachers use prompting and modeling more frequently than direct instruction or teaching benefits (as shown in Figure 5). In fact, approximately two-thirds of teachers’ metacognition instruction was implicit. Survey-to-observation comparisons were not conducted in further detail due to the narrowness of some the survey items and the incongruity of many items with non-core subject areas, physical education in particular. This limitation is also addressed in the general discussion.

**Qualitative Findings: Observations and Interviews**

Data analysis for qualitative research is an on-going, constructive process that is ideally conducted concurrently with data collection (Merriam, 2009). It involves immersing oneself in the data and sifting through them in order to reveal similarity, differences, and patterns among participants that emerge as the study progresses. The process is a step-by-step abstraction of the data that begins with the raw data (in this case, observation notes and interview transcriptions), and moves to more general codes, and eventually to a small number of abstract topics or categories referred to as themes (Creswell, 2002). Qualitative research generally involves in depth study of a small number of participants, so it is improper to generalize findings beyond the studied sample.

Data from observation and interviews were considered together during qualitative analysis because using multiple methods to collect data helps the qualitative researcher build a deeper and more credible understanding of what is being studied (Merriam, 2009). In this study, both observations and interviews provided insight into the methods,
beliefs, and efforts these teachers used to foster metacognition. Therefore, data from observations and from interviews with all four teachers were used together as a collective case study to create the themes described below in the subsection labeled themes.

The two core teachers and the two music teachers participated in the Interview Phase. Below in the subsection labeled themes, the four teachers are identified by the subject or type of class they were observed teaching (i.e., the math teacher, the reading teacher, the small-group music teacher, and the orchestra teacher; see Table 1 for all demographic information). These two pairs of teachers provided opportunity to examine a greater variety of ways music teachers and core teachers foster metacognition in the classroom as well as any training or education they have had that is related to fostering metacognition. At times these teachers are discussed as pairs (i.e., core teachers and music teachers). This grouping was specific to this sample and is not meant to suggest that teachers can or should be grouped into these broad categories.

**Coding Observations.** After all observations were completed, running records and single-letter codes from each observation were reviewed again. Detailed codes that expanded on the single-letter codes were recorded on the transcripts. These codes were created using terminology that was as consistent as possible with the theoretical framework of metacognition (Figure 2), the taxonomy of metacognition instruction (Figure 3), and the wording from the survey (Appendix A). For example, one teacher asked his class, “What did you not understand in this passage?” This was first given the single-letter code “P” to indicate he had used a prompt and was later given the detailed code “prompt, self-assessing understanding.” These detailed codes provided a more complete picture of classroom events than the single-letter codes and allowed analysis to
go beyond simple counts of events like the results reported above in the quantitative results. Furthermore, it made it possible to see what aspects of metacognition (e.g., self-monitoring, declarative knowledge) were being addressed within the classroom.

Coding and Analyzing Interviews. Each transcribed interview was analyzed separately. The initial coding process primarily consisted of assigning what Morse and Richards (2002) refer to as topic codes. These codes were generated to reflect and categorize the comments of participants and to detect topics and recurring ideas in participants’ comments. Interviews were read and reread before I generated codes. Codes were generated for each interview before analyzing the next interview. Following the initial coding process, codes were reviewed and modified to eliminate overlapping and redundant codes and to create greater consistency when necessary. Next, codes for each interview were compiled into separate spreadsheets, and codes were grouped into categories that represented larger, more abstract patterns in the data such as “changes throughout the year” and “relevant training”. After categories were generated for all four interviews, all observation and interview data were examined together. The five holistic and parsimonious themes that emerged are described below.

Themes. The five themes presented below summarize recurrent ideas among the participants. Unless otherwise indicated, all quotations come from participant interviews.

Teachers foster both metacognitive knowledge and metacognitive skills primarily through implicit metacognition instruction. Both the observations and interviews revealed that participants used the implicit instruction techniques of prompting and modeling as primary tools in fostering metacognition. The ways prompting and modeling were used varied across participants, and they were used to engage several
different aspects of students’ metacognition. Prompts were frequently presented in the form of a question. In the math teacher’s class, for example, students were frequently asked, “How did you get your answer?” Similarly, in the reading teacher’s class, questions about the passage that required inferences were almost always followed up with the question, “How do you know?” Both of these questions prompt students to use metacognition by reflecting on their thoughts and then articulating the processes they went through to arrive at their answers.

Prompt questions were also used in the music classes, but in a slightly different way. The orchestra teacher explained that he prefers to use questions to help students discover similarities and differences in the music that can then be used to make decisions in how they play the piece. During the interview, he discussed the idea of when to apply a skill, which is an example of conditional knowledge:

I help them figure out when to apply certain skills by just simply asking a question: “How is measure 35 like measure 12?” It might be a dynamic level...and so if I can ask those thinking questions and let them analyze what is similar, what is different, hopefully, then they’ll make that application of “Oh, they’re both forte, so I need to use the same bow strokes.” ...Another way is to develop an awareness. Maybe I’m asking the cellos, “What do you have at 35? Who else had that?” And, by modeling. I’ll have my cello out and I’ll model for them, “Okay, in that application you had it here, but what about this passage of music?” I’ll play the passage and ask, “Similar or different?” and they will realize it is a
different articulation. And then I’ll ask, “How are we going to treat that
differently based on the difference?”

While observing the small-group music teacher I saw that one of the primary
methods she used to foster metacognition was prompting students to control their
attention by providing cues so that her students knew where to direct their focus while
playing. Controlling attention is metacognitive because it is a way to regulate cognition.
Her use of attention cues increases the likelihood that students will learn how they should
be controlling their attention while playing.

The reading teacher described in his interview the connection between being a
model and prompting students to engage in metacognitive thinking:

For a long time now, we’ve done the think-alouds, the “this is how I
process,” where the teacher does the think-aloud. But now it’s really
trying to engage the kids more in the same sort of activity. We’re asking
them more specifically, “How did you come up with that answer?” We’re
not necessarily giving it the terminology of, “This is metacognition,” but
working on, “This is what you’re doing. I want to know how you got
there.”

In the reading teacher’s classroom, students are first exposed to metacognitive skills
through teacher modeling and later they are prompted to practice those skills both with
other students and individually.

In some cases, the responsibility of modeling was shifted from teacher to students.
For example, the math teacher described how he regularly selects a student to explain to
the rest of the class how an answer was derived. The student then has to articulate the
steps he went through to solve the problem, and other students are able to hear a strategy they may or may not have used. The math teacher then lets other students share the different ways they solved the same problem. This activity likely fosters metacognition in two ways: First, students must practice self-monitoring in order to recall and communicate the steps used to solve the problem. Second, students have the opportunity to build metacognitive knowledge because they are exposed to a greater variety of strategies that can be used to get the same correct answer to the same problem.

Prompts and models are both ways to provide implicit metacognition instruction. Although implicit instruction can encourage students to think metacognitively, explicit instruction might be more beneficial for short-term student outcomes (Kistner et al., 2010). Explicit instruction did take place during all of the observed classes during this study, but as quantitative observation results revealed, it happened much less frequently than did implicit instruction. However, it is possible that explicit instruction took place more frequently earlier in the school year. For example, the math teacher explained how his use of strategy-based warm-up exercises changes from first to second semester:

We did [the warm-up activity] mostly, like once or twice a week for the first semester… it’s something that I do more the first semester because second semester, with state testing, our warm ups tend to concentrate on the kinds of lessons and skills that are not part of our curriculum but are part of the test.

This teacher was aware that his use of explicit instruction decreased during the school year. It is possible that I would have observed more explicit instruction during the first semester, at least in this classroom.
**Teachers’ attempts to foster metacognition are dynamic and respond to changes in students’ ability level and level of prior knowledge.** All four participants who were interviewed indicated that the way they foster metacognition varies among students, across lessons, throughout the school year, and, in some cases, according to grade level. The teachers try to engage and increase students’ metacognitive knowledge and skills.

For example, the small-group music teacher taught beginning musicians in fourth, fifth, and sixth grade to play string instruments. She described how she uses music-marking strategies differently in different grades:

I’ll tell them, “That’s an F sharp there, let’s mark that,” or any sort of accidental that happens outside the key signature or just one that you’re liable to miss. I do that more in sixth grade. With fourth and fifth graders, fourth graders for sure, I’m stating exactly what we need to be doing, but we do more marking as we work more on orchestral music. So it’s mostly a sixth grade thing for me.

Prompting students to use this strategy is an example of implicit instruction because it leads students to use a strategy and provides conditional knowledge related to the strategy’s use. The reading teacher also described how his metacognition instruction changes during the school year:

[I use] a lot of modeling, especially at the beginning of the year. Later we do more partner work, group work, practicing those skills, and just asking them to think more about why they have that answer, and then to support it.
The reading teacher provided implicit instruction by modeling metacognitive skills at the beginning of the year and by designing activities that prompted students to practice those skills as the year went on. The observations for this study took place toward the end of the school year, and at that time the reading teacher had his students doing several reading comprehension activities with partners. During one class, the students worked in pairs to answer a small number of higher-order thinking questions about their text (e.g., “What is the author’s point of view about the space program and what in the text helps you determine that?”). Students worked together to come up with an answer and then explained why they came up with that answer using supporting text evidence. Citing text evidence requires students to use epistemological cognition (a subcomponent of knowledge of cognition) to justify their inferences and interpretations of the text. Students seemed comfortable with this activity and appeared to have little trouble articulating their thoughts as to why their answer was correct.

The teachers did not provide static, one-size-fits-all metacognition instruction for their students. Rather, they varied their metacognition instruction in order to help students build metacognitive knowledge and skills.

*Teachers intentionally engage students’ metacognition, believe it is important to do so, and see it as part of their responsibility as a teacher.* All of the teachers who were interviewed indicated that they intentionally try to foster metacognition while teaching. The reading teacher described how teaching students how to think metacognitively involves intentional instruction over several lessons:

First, [I use] a think-aloud, usually, anyway. It’s going to be a think-aloud, and modeling, a lot of modeling, and then giving them an opportunity on a
smaller scale to practice that same thing. We practice [the strategy] several times, and sometimes we’ll share with a partner, or share within a small group, or share within a large group. ...Once they’ve had a few opportunities to practice [the strategy], then I’ll have them get together, compare answers, and then combine their answers into one really good answer. That way they learn from each other. And even the less-able students, perhaps, have something to offer to those who are more able.

He also commented on the importance of teaching students how and why to use strategies. The reading teacher said, “Giving them those tools or showing them how they can use the different tools to their benefit in answering these questions really is a biggie.”

One way that the math teacher intentionally engages students’ metacognition during his classes is through semi-structured warm-up exercises. During the interview, he gave an example of these warm-up exercises that his classes do several times a week. He presents the class with a brief problem, such as, “What is 25 times 19?” Students must solve the problem mentally, and then raise their hand when they have an answer they believe is correct. He explained the discussion that takes place once everyone has generated an answer:

I say, “Okay, share with somebody sitting near you how you got your answer. Do you think it is right?” And then I have the kids share all the different ways we have. And some kids will say, “Well, 25 times 20 is one way, and then they subtract 25 from that.” And another person will say, “Well I think of quarters, and four quarters makes a dollar so 19 quarters makes this much money, and I just change it.”
This exercise involves both implicit and explicit metacognition instruction. It prompts students to recall the strategy they used and verbalize the steps they followed to solve it. Being aware of the steps and recalling them requires self-monitoring, and verbalizing the steps requires students to make procedural knowledge explicit. The explicit discussion of strategies is a type of direct instruction because students are hearing a step-by-step explanation of strategies used for a particular math problem. Additionally, the math teacher explained that this activity reveals the number of strategies students use, and it also exposes students to a wide variety of strategies they may not have previously encountered:

It’s amazing how many ways the highest level classes have of coming up with an answer and how few ways the lowest level classes come up with. They have one way. They’re trying to multiply and carry and keep track of those layers of numbers in their heads and give an answer. And that may be the only way they know how. And then when they learn another way it’s like, “Oh, I didn’t know you could do that.” They just don’t naturally go to that point.

Seeing that some students do not have declarative knowledge of strategies is one reason why the math teacher has made fostering metacognition one of his main priorities in the classroom as evidenced through observation and interview. He explicitly stated his belief about doing so:

That [fostering metacognition] is something that I think is really important for a teacher to do. The most important thing you can learn in my class is how to think—not how to get an answer, because anybody can look in the
back of the book and copy them out of there. But learning how you think, that’s my goal.

Helping students learn how to control thinking involves regulation of cognition, and helping them understand how they think involves knowledge of cognition. The math teacher indicated that his ability to get students to think metacognitively is largely based on the way he prepares his lessons. In his view, the degree to which a lesson involves metacognitive thinking is dependent on how the teacher thinks about the lesson while planning it. The math teacher explained, if a teacher spends time “thinking deeper about what [he is] going to be teaching,” he can design questions and activities that lead students into metacognitive thinking.

For the small-group music teacher, a major part of her role is to help her young musicians learn how to self-monitor. She purposefully uses implicit instruction in the form of questions and prompts that help students learn where to direct their attention while playing:

My role as a music teacher is to get them to be...critical thinkers, and listen critically, and work critically, and enhance their listening and their perception and their ability to recognize. I mean, this starts in fourth grade when we start learning the difference between F sharp and F natural or even when we start putting fingers down. “That didn’t sound quite right, can you fix that?” Some can and long about January of fourth grade I start hearing some of my students fix notes that are incorrect and I, of course, I jump on that right away and say, “you fixed that, that’s great! That’s exactly what we want you to do! When you hear something that’s wrong,
move your finger and fix it.”... I’m getting them to consciously play. In other words, be in the moment; be focused on what you’re doing.

For her, prompts are sometimes unplanned responses to natural classroom events. Other times, she designs formative assessments so that students have the opportunity to practice evaluating themselves and others. She explained:

They have benchmark songs they have to play and they have to play them without a mistake in order to get the sticker on the front of their folder. So when we first start out the process, one kid plays the line and then I ask the others, “How did he do? Did he make any mistakes?” And if they did, in fact, make a mistake, I say to the student, “Do you know where you made the mistake?” and if they can tell me where they made the mistake, I give them the sticker anyway. So I start that very early on with them.

This use of stickers allows the small-group music teacher to reward both accurate performance and accurate self-monitoring and evaluation. She also explained that she makes a point of talking to her students about the progress they make during the school year. She periodically asks them questions such as, “Do you remember what this piece sounded like when we first started playing it a few months ago?” This type of question prompts students to evaluate present performance in light of past performance.

The orchestra teacher also has his music students monitor and evaluate their performance regularly. He especially does this during the first class period following a concert. This encourages students to be reflective about and critical of their performance, and it also allows them to hear how others in the orchestra assessed performance. He explained:
Monday, right after concerts, I think that’s one of our best times to listen to recordings of the concert and find out what they learned over the course of six weeks of rehearsals. I ask them, “Okay, evaluate. You be the judge. You be the teacher.” On Monday we watched our concert, and I asked, “What do you see and what do you hear?”... At the middle school level, I have not tried, but I should, I have not tried any kind of written assessment. It’s always discussion. It’s a discussion with many levels. One is an aesthetic discussion of “what did people tell you about the concert,”.... Then we get into more of the analytical level. “Okay, we know the music the best. What did go well? And what didn’t go well? Because we’ve lived what didn’t go well for the past two months. Did we fix most of that or did some of it come back and haunt us?”

The orchestra teacher uses these post-concert assessments after every concert, which happens only a few times a semester. On a day-to-day basis, he makes a point of asking his students questions rather than relying on didactic instruction. His approach is similar to that of the small-group music teacher. Both direct students’ attention through questions rather than statements. For example, the orchestra teacher gets students to listen to each other and adjust their playing by asking, “Violins, can you hear the violas?” rather than directly instructing the violins to play softer. This question implicitly instructs the musicians to use attentional control listen specifically for the sound of the other instruments and make adjustments in their playing.

These four teachers all indicated that they intentionally attempt to foster metacognition while teaching. It was clear that they see metacognition as a critical mental
faculty, and they believe that teachers can and should help students develop their metacognitive knowledge and skills.

**Core teachers have more training related to fostering metacognition than do music teachers.** All four teachers who were interviewed were asked about sources of training that have helped them foster metacognition while teaching. Both core teachers indicated they had received training related to fostering metacognition through school district programs or through graduate education courses. Interestingly, neither the reading teacher nor the math teacher mentioned any training from their pre-service education programs. In fact, the reading teacher explicitly stated that he received no training on metacognition in his pre-service education program. His training had come from the districts where he has worked. His present district had recently changed the curriculum and started using a reading series that incorporates metacognitive elements into lessons. He explained how the district provided training to help teachers incorporate metacognition instruction:

> Through our district and the district meetings that go along with this new reading series, they specifically tell us, “these are places where you can teach the kids how they’re thinking and how best to organize their thinking.” And when we did the training last summer and last fall for this reading series, they were pointing out places where we could certainly incorporate, and should incorporate, metacognition into our instruction.

For the reading teacher, the district provided training in fostering metacognition that was specifically related to the curriculum. In contrast, the math teacher did not mention any curriculum-based training, but he did learn about fostering metacognition through
graduate education courses. He was part of a graduate program dedicated to teaching middle school math, and his master’s thesis involved helping students become metacognitive. As a continuation of his studies and research, the math teacher has presented at multiple teaching conferences on the topic of how teachers understand what students are thinking as they solve math problems. This topic is dependent on metacognition because it involves getting students to describe their thought processes and strategies while solving problems.

The music teachers, however, reported far less training than core teachers in fostering metacognition. In fact, neither could remember courses or workshops that primarily covered metacognitive topics. The orchestra teacher took part in two different workshops that touched on the idea of fostering metacognition. One workshop was about asking students “higher-level” questions, and the other was about letting music students be more in charge of their learning. When asked about any relevant training or support, the small-group music teacher only mentioned the training she received in her teacher-education program over 30 years ago. She explained that when she was a pre-service music teacher she had to shift from being a musician to teaching others how to be musicians, and a part of that training involved teaching strategies and self-monitoring. However, she had not received any additional training throughout her many years of teaching. Both music teachers’ experiences seemed to be tangentially related to metacognition as opposed to the core teachers’ training that was more directly related to metacognition.

*Core teachers seem to be more comfortable and familiar with the language of metacognition than music teachers.*
During my interviews with these four experienced teachers, it was evident that they varied in their use of terms like metacognition, self-monitoring, or strategies. The two core teachers seemed to use the metacognition terminology more often and more naturally than the music teachers. It also was evident that the music teachers were uncertain about the meanings of these terms. The orchestra teacher mentioned his uncertainty about what is and is not metacognition. He said, “If I get off base, if I’m not addressing metacognition, please correct me or steer me back. And the reason is honestly, on a day to day basis with students and even with colleagues, I don’t use the term.” Later he commented about the difference between how teachers and researchers talk about teaching. He said, “I absolutely believe that music does it [fosters metacognition], a lot, we do it a lot, we just don’t call it by some of the same words.”

In contrast, the core teachers showed less hesitation than music teachers when talking about how students use metacognitive knowledge and skills in their classrooms. For example, both the math teacher and the reading teacher used informal definitions of metacognition (e.g., “being aware of their thinking”) and descriptions of components of metacognition (e.g., “knowing how to organize their thoughts”) throughout the interview. Their use of relevant terminology makes sense in light of the previously discussed training and research involvement that these two teachers have had.

The confusion or incomplete teacher knowledge about what is and is not metacognition in the music classrooms should not be considered a gross or unusual flaw in their teacher training. The amount of research and theory related to metacognition in music learning is much less than that in other areas of learning, and most scholars focus on metacognition during activities like reading, writing, and problem solving. In fact,
searching *PsychInfo* for the words “metacognition” and “music” returns less than 20 articles in peer reviewed journals. In contrast, searching “metacognition” and “reading” returns over 450 articles in peer reviewed journals. It is, therefore, unsurprising that teachers would have a less than perfect grasp of how metacognition manifests in a music classroom.

**General Discussion**

The following discussion connects the study’s findings to the six research questions presented earlier (see Figure 4 for full questions), describes instructional implications, and addresses limitations and recommendations for future research.

**The Question of Prevalence**

Overall, it appears that teachers’ efforts to foster metacognition might be underestimated in the research literature. This is most likely because many studies have examined a single, narrow component of instruction related to metacognition and have not considered the variety of ways teaching can influence metacognition. For example, Kistner and colleagues (2010) reported that, on average, teachers provided less than three metacognitive strategy instructions per lesson, and they concluded that little instructional time is spent promoting metacognition. Three instructions per lesson might seem low to some, but metacognitive strategy instructions are only one of several ways that metacognition can be made salient to students in the classroom. Discussions related to and instruction of metacognitive knowledge are also likely to build students’ metacognition, but such events are not measured in a study focusing only on metacognitive strategy instructions. In order to accurately estimate the degree to which teachers foster metacognition, we must consider the wide variety of methods that might
be used to do so, including both implicit and explicit instruction. This study attempted to do just that by gauging the extent to which middle school teachers in one small Midwestern city foster metacognition during normal class activities. This was accomplished by taking a broad view of what it means to foster metacognition, using both qualitative and quantitative methods and by employing a three-pronged approach to data collection that included a survey, classroom observations, and interviews.

Present findings indicated that the long-held belief that teachers rarely teach students to be metacognitive may be inaccurate. This study’s taxonomy of metacognition instruction included both implicit and explicit instruction that could be used to foster the many facets of metacognition, and it was apparent that multiple teachers intentionally encouraged students to engage in metacognitive thinking. In the present study, most teachers reported using multiple approaches to foster metacognition, and many of those approaches were used at least once a week. Quantitative observation data indicated that teachers’ instruction encourages students to be metacognitive multiple times throughout a single class period, with events that foster metacognition happening approximately every one to two minutes. It would be prudent for researchers to reexamine this topic with a broader view of how metacognition is fostered.

**The Question of Validity**

Present findings suggest that teachers might not be fully aware of how their teaching practices relate to metacognition, especially those teachers who have had little education and training related to fostering metacognition. Teachers who had training related to metacognition were generally more accurate when self-reporting, but all teachers tended to misestimate their use of practices related to fostering metacognition.
Explicit instruction was most frequently overestimated, with many teachers reporting high frequencies of explicit instruction when observational data indicated rather low frequencies of explicit instruction. To my knowledge, this study is the first to compare researcher observation with teacher self-report of specific techniques that can foster metacognition. Although teachers’ self-reports were generally valid for differentiating between high- and low-metacognition instructors, teachers’ self-reports were not valid for accurately estimating how frequently teachers use specific techniques. Previous research has also found discrepancies between self-report data and observational data, and it has been suggested that this discrepancy means that teachers’ self-report of metacognition instruction might not be entirely valid (Dignath-van Ewijk et al., 2013; Kistner et al., 2010). It is usually more efficient and convenient for researchers to collect self-report data than observation data, but gains in efficiency might not be worth sacrifices in accuracy.

The Question of Techniques

Findings revealed that these teachers were more likely to foster metacognition via implicit instruction than explicit instruction, which is consistent with previous research (Kistner et al., 2010). In the present study, approximately two-thirds of the observed instances of metacognition instruction were implicit instruction. Methods of implicit instruction considered in the present study were (a) modeling and (b) prompting. Methods of explicit instruction were (a) direct instruction of metacognition and (b) teaching the benefits of using metacognition. Implicit instruction can be beneficial for students when they have acquired skills but need to be reminded to use them. However, implicit instruction might not be sufficient if students are not taught how to use specific
strategies or metacognitive skills explicitly. For example, in the opening scenario Mr. Brown provided implicit instruction on how to use the matrix organizer that he provided, and his students were probably able to use the organizer to learn from that chapter. However, his failure to provide explicit instruction decreases the likelihood that his students will use the strategy independently in the future, unless the students had learned the strategy previously. Prior research has found that only explicit instruction is related to gains in student achievement (Kistner et al., 2010), so it is important for teachers to include adequate explicit metacognition instruction.

The Question of Congruity

Metacognition instruction in the present study was somewhat congruent with recommendations for instruction in the literature. Many of the recommendations are for explicit instruction (Pintrich, 2002; Schraw, 1998), but observations revealed that teachers in the present study heavily favored implicit instruction. However, it is also recommended that teachers model and prompt metacognition (Joseph, 2009; Moos & Ringdal, 2012), so the use of these implicit techniques is also in line with recommendations. With regard to Veenman’s three general principles for metacognition instruction (Veenman et al., 2006; Veenman, 2013), teachers did embed instruction into authentic learning contexts, and they used informed training (i.e., teaching benefits of using metacognition) occasionally. As for the final principle, prolonged training, survey and interview data indicated that metacognition instruction is used throughout the school year, but it is not entirely clear how frequently or consistently instruction takes place.

The Question of Intentionality
These teachers intentionally fostered metacognition while teaching. Interviews revealed that they viewed metacognition instruction as a critical part of their responsibilities as a teacher, and they used certain activities for the specific purpose of fostering metacognition. In some cases metacognition instruction was a focused, extended activity like the orchestra teacher’s post-concert assessments. Other times teachers foster metacognition by intentionally asking questions in a way that prompts students to use metacognition, like how the small-group music teacher used questions to direct students’ attention to certain features of their performance.

**The Question of Influences**

The most commonly mentioned influence on the use of metacognition instruction was education and training, but teachers reported considerable differences in the amount of training they had received. The two music teachers who were interviewed had not received any training specifically related to fostering metacognition, whereas the two core teachers who were interviewed had received relevant education and training. Because this research question was explored qualitatively and findings were derived from only four teachers, it is not possible to determine if the difference in training between core and music teachers is unique to this group of teachers, or if it is a reflection of a larger trend. Implications for teacher training are next.

**Implications for Teacher Training**

Observations revealed that these teachers provided considerably more implicit instruction of metacognition than explicit instruction. Although teachers using implicit instruction might get students to use metacognition regularly, students are not necessarily learning how, when, and why they should intentionally be metacognitive while learning.
If the goal is to produce strategic students who are able to use metacognition to maximize their learning, it is important to provide explicit instruction so that they can use their skills and knowledge independently and appropriately. The teachers in the present study with training related to metacognition indicated that it influenced how they fostered metacognition. Presumably, education and training programs could help teachers increase the amount of explicit metacognition instruction that takes place in their classrooms. Teachers’ understanding of metacognition is related to their beliefs about what constitutes effective metacognition instruction (Wilson & Bai, 2010), so teacher training should include information about what constitutes metacognition as well as how teachers can foster it. This type of training would be useful for both pre-service and in-service teachers and it should be available for teachers in all subject areas. All teachers interviewed in this study indicated they intentionally take steps to foster metacognition, but some had little to no training in doing so. A lack of training might be why teachers provide so little explicit instruction. Providing teachers with information about providing explicit instruction seems worthwhile because it could help them make more of their metacognition instruction explicit.

Although it is not possible to determine if the observed subject area differences were due to differences in the types of training available to teachers in different subject areas, this possibility should not be ignored. Metacognition can be used by students in all classrooms, and training in fostering metacognition is relevant for teachers in all subject areas. In the present study, music teachers had less metacognition instruction training than the core teachers. Like other subjects, music has the potential to engage students’ metacognition in different ways. While learning to play instruments, students ideally self-
monitor mental and physical skills, evaluate the sound of their instrument in comparison to others, and use a variety of strategies for reading music, practicing, and performing. Music is a subject area that requires metacognition and has the potential to be used as a “non-traditional” setting for building and practicing metacognitive knowledge and skills. Music teachers should not be overlooked when it comes to training related to fostering metacognition. Access to education and training should be provided for them because, as findings of this study indicate, teachers in core and non-core curriculum classrooms strive to help their students engage in metacognition and become more independent in their learning.

Research has shown that metacognition is positively related to academic achievement (Labuhn et al., 2010; Pintrich, 2002; Schraw, 1998; Swanson, 1990; Veenman et al., 2004; van der Stel & Veenman, 2010; Veenman & Spaans, 2005; Veenman et al., 2006; Wang et al., 1990) and that metacognition instruction can improve students’ metacognitive abilities (Hilden & Pressley, 2007; Huff & Nietfeld, 2009; Moely et al., 1992; Pape et al., 2003; Ramdass & Zimmerman, 2008; Veenman, 2013). Schools should invest in metacognition instruction training for teachers because such training has the potential to impact students’ academic achievement. Furthermore, teacher preparation programs should provide training in metacognition and metacognition instruction so that all teachers have knowledge of how to foster metacognition when they begin teaching.

Research Limitations and Recommendations

The present study had limitations related to the sample, the survey’s design, and the observations’ timing. First, the sample was small and not representative of the larger population of middle school teachers. Although this was not problematic for the
qualitative portion of the study, it was problematic for the quantitative portion of the study. The small sample size restricted the ability to conduct quantitative analysis. No generalizations to teachers outside of the present sample can or should be made, especially generalizations related to teachers’ subject areas. A larger sample size in the first phase of the study would have made it possible to use inferential statistics that would have made a number of interesting analyses possible. For example, a larger, more representative sample would have made it possible to look for relationships among instructional techniques used and teachers’ subject areas. Additionally, the sample used was not representative of all teachers. Not all subject areas were represented, and music teachers were overrepresented in this sample. They comprised one third of all participants who completed the survey phase. Furthermore, participants in this sample did not include anyone with a medium amount of teaching experience. About half of the participants had 10 or fewer years of experience, the other half had 25 or more years of experience, and no participants had between 10 and 25 years of experience. It is possible that teachers’ use of metacognition changes throughout their careers, but such a trend would only be detectable if the sample includes many teachers with varied amounts of experience. It is recommended that future quantitative studies use larger and more representative samples to determine the general trends and differences among teachers in different subject areas or among teachers with different amounts of experience. It is also recommended that future qualitative studies focus on teachers in different subject areas and with different levels of experience in order to provide a richer understanding of how a variety of teachers foster metacognition.
Second, the survey used for this study was designed as a general survey for teachers in all subject areas, but some items were not entirely appropriate for certain subject areas. For example, one survey item addressed multiple draft activities that require students to evaluate and revise written work. It would be unusual to include this sort of activity in a physical education class, so it seems logical that a physical education teacher would respond “never” for that particular item. This misalignment between the survey and the specific characteristics of some subject areas probably decreased the accuracy of survey scores for some participants. Future studies needs a self-report instrument that is general enough that it is appropriate for teachers from various subject areas but can still detect domain-related differences between classrooms. Third, all observations were conducted in the middle of the spring semester. During the interviews, many participants indicated that their use of metacognition instruction changes throughout the year, so it is likely that conducting observations at different points throughout the school year would provide a more complete picture of how teachers foster metacognition throughout the school year. It is also possible that only two observations per teacher is not enough to account for the considerable variability in activities and instructional practices that take place over the course of an entire week, month, or school year. Future research should include a greater number of observations per teacher that are distributed across the school year. More and regular observations would provide a more complete picture of the change in teachers’ attempts to foster metacognition throughout the school year.

Conclusion
In the opening example, the American history teachers varied considerably with regard to the amount of metacognition instruction they provided. Ms. Andrews used explicit instruction that provided students with the procedural and conditional knowledge they would need to use the matrix-learning strategy for the present assignment and for future assignments too. This study found that in real classrooms, this level of explicit instruction is not seen as frequently as implicit instruction (like that of Mr. Brown), but teachers do use both implicit and explicit instruction while teaching. The discrepancy between recommended use of explicit instruction and actual use of explicit instruction highlights the need for teacher training related to fostering metacognition through explicit instruction. This study also provides evidence that teachers’ use of metacognition instruction has been underestimated by previous research and that teachers’ self-reports of metacognition instruction are not a valid substitute for researcher observations. Continuing to use both quantitative and qualitative methods might help researchers more accurately determine how much metacognition instruction actually takes place in classrooms.
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Appendix A

Survey of Teachers’ Metacognition Instruction

Demographic Information

1. What grade level(s) do you teach? Please select all that apply.
   (Options: 6th, 7th, 8th)

2. What subject(s) do you teach? Please select all that apply.
   (Options: Art, Business/Computer applications, Language arts, Mathematics, Music, Physical education, Science, Special education, Social studies, Other)

3. How many hours of college credit do you have beyond your bachelor’s degree?

4. How many years have you been teaching?

5. How many years have you been teaching your current curriculum?

6. Approximately how many students do you have per class?

General Behaviors

For the following questions, please think about the events of a single class period over the course of a semester. (The same activity taking place during multiple sections of the same class should be considered as a single instance.)

How often do you do each of the following?

(Options for all: Never, Once a semester, Several times a semester, Once a month, Several times a month, Once a week, Several times a week, Daily)

1. Think aloud (verbalizing thinking as it happens) while demonstrating a skill or activity

2. Explain benefits of being aware of one’s thought processes

3. Engage students in discussion about their thought processes
4. Have students complete written reflections
5. Conduct formative assessment of learning (formal or informal)
6. Encourage students to reflect on homework or assessment results
7. Encourage students to transfer skills or learning strategies to other areas
8. Help students connect content across chapters or subjects
9. Use cooperative learning activities (peer teaching)
10. Assign multiple-draft activities (having students reflect on and make changes to previous work)
11. Have students plan their work or activities
12. Have students monitor skill use
13. Have students monitor performance
14. Have students monitor progress
15. Have students evaluate and critique their own work

**Teaching Techniques**

For the following questions, please think about the events of a single class period over the course of a semester. (The same activity taking place during multiple sections of the same class should be considered as a single instance.)

How often do you teach your students about the **benefits of** the following learning strategies?

(Options for all: Never, Once a semester, Several times a semester, Once a month, Several times a month, Once a week, Several times a week, Daily)

1. Problem solving strategies
2. Self-monitoring of thinking, learning or performance
3. Self-assessing understanding of a concept
4. Studying techniques
5. Taking complete notes
6. Reading comprehension techniques
7. Determining when to ask for help
8. Creating graphic organizers (visual charts/tables to organize information)
9. Creating mnemonics (novel tricks to remember information)

How often do you provide your students explicit instruction on how to use the following learning strategies?

(Options for all: Never, Once a semester, Several times a semester, Once a month, Several times a month, Once a week, Several times a week, Daily)

1. Problem solving strategies
2. Self-monitoring of thinking, learning or performance
3. Self-assessing understanding of a concept
4. Studying techniques
5. Taking complete notes
6. Reading comprehension techniques
7. Determining when to ask for help
8. Creating graphic organizers (visual charts/tables to organize information)
9. Creating mnemonics (novel tricks to remember information)

How often do you prompt your students to use the following learning strategies?

(Options for all: Never, Once a semester, Several times a semester, Once a month, Several times a month, Once a week, Several times a week, Daily)
1. Problem solving strategies
2. Self-monitoring of thinking, learning or performance
3. Self-assessing understanding of a concept
4. Studying techniques
5. Taking complete notes
6. Reading comprehension techniques
7. Determining when to ask for help
8. Creating graphic organizers (visual charts/tables to organize information)
9. Creating mnemonics (novel tricks to remember information)

How often do you model the use of the following learning strategies?

(Options for all: Never, Once a semester, Several times a semester, Once a month,
Several times a month, Once a week, Several times a week, Daily)

1. Problem solving strategies
2. Self-monitoring of thinking, learning or performance
3. Self-assessing understanding of a concept
4. Studying techniques
5. Taking complete notes
6. Reading comprehension techniques
7. Determining when to ask for help
8. Creating graphic organizers (visual charts/tables to organize information)
9. Creating mnemonics (novel tricks to remember information)

Understanding of Metacognition

To what degree do you agree with the following statements?
(Options for 1 and 2: Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly agree)

1. I understand what metacognition means.

2. My instruction regularly encourages students to think metacognitively.

3. Please briefly describe your understanding of “metacognition”.
Appendix B

Observation Instrument

Section 1 – Basic Information

Date: Time: Teacher:

Activity:

Other:

Room description:

Section 2 – Running Record

Section 3 – Coding Grid

Teachers may prompt (P), model (M), provide direct instruction (I), discuss benefits (B), or other (O)

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<th>Regulation of Cognition</th>
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Appendix C

Planned Interview Questions

1. Tell me about the role metacognition plays in [teacher’s subject area]

2. What role do you see teachers playing in helping students...

   become more metacognitive musicians? (for music teachers)

   or

   increase their use of metacognition? (for core teachers)

3. Do you intentionally incorporate metacognition instruction into your classroom?

   If yes, what has led you to do this?

4. How do you feel your students respond to the metacognition instruction?

5. Have you had any training in teaching students to use metacognition in the classroom?

6. What do you think is the most valuable thing you do to help your students become more metacognitive toward their learning?