Final Evaluation Report for USC iCoach-Teacher Teams Professional Development Program for Middle Schools

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I. Key Findings

1. The USC iCoach-Teacher Teams Professional Development Program for Middle Schools was excellently designed, planned, and implemented. The specific aspects of teachers and coaches learning, planning, and teaching together, teaching students in summer school and summer enrichment programs, and providing time for planning and reflecting were particularly valuable to the success of this institute.

2. Teachers and iCoaches were actively engaged throughout the institute. They learned content and skills that they will apply in their role as coach or teacher. What they gained at the institute sets them up for success with students in the classroom.

3. However, some teachers still need ongoing support to change their old ways. Some of them seem to slide back into their old ways (traditional ways) when time was short and teachers became uncomfortable. There continues to be a need for lots of practice, reassurance, support, strategies for handling challenges, problem-solving, and reflection.

4. Finally, there was a dramatic drop-off in participation on assessments over time. Strategies need to be implemented to improve this situation.

II. Introduction

The iCoach-teacher team professional development program for middle schools was designed to improve the science content knowledge and inquiry-based instruction of South Carolina middle school science and mathematics teachers. With this change in teacher content knowledge and classroom practice, the program also aimed to increase the content knowledge of middle school students in participating teachers' classrooms. Collaboration with the existing middle school iCoach program allowed sustained implementation of the professional development goals in 14 middle schools across 8 school districts. The instructional coach (iCoach) from each school teamed with participating teachers to learn and implement new strategies and content to improve student learning across the state. The project sought to:

- Provide a content-rich inquiry-based curriculum experience for the Middle School science and math teachers at iCoaching schools through participation in a two-week USC Summer Institute Professional Development Program
- Increase the iCoach teams confidence with content and pedagogy and increase the teachers' use of effective teaching strategies (e.g., POE, think-pair-share, inquiry, questioning skills, etc)
- Enable the iCoaches to act as agents of change, working with teachers to help them learn content through inquiry-based curriculum, reform-based instructional strategies, and reflective teaching skills.
- Extend the professional development program into the academic year with the iCoaches and USC faculty developing school-based professional learning communities to monitor and assess student learning

This program began with an intensive two-week (7 hours a day for 10 days) professional development workshop from June 16 to June 27, 2008 for 14 middle school instructional coaches and 42 teachers from the participating coaches' schools. To increase teacher content knowledge during the workshop, teachers were arranged in content area teams in which they participated in inquiry-based lessons from high quality science curricula. Standards-based science and math content was taught through interactive inquiry-based units that modeled effective instructional strategies that can be incorporated into the teachers' classrooms. Content area groups in Simple Machines, Ecology, Geology, Geometry, and Algebra were led by a University content expert (Ph.D. in science area) as well as an instructional faculty member from the College of Education or a local middle school teacher. These individuals assisted the iCoach-teacher teams in learning new science content and instructional techniques through lesson modeling and lesson content analysis. The content groups focused on the SC science and math standards/indicators identified as most needed by the iCoach, teachers, and their students.

After gaining a new understanding of the content in the South Carolina Science Standards, teachers used this knowledge to design/revise inquiry-based, technology infused science lessons aligned with standards. In small content group teams, the teachers taught their lessons to middle school students (enrolled in a summer science and math enrichment day camp) during the summer workshop. Content and pedagogy experts from USC assisted teachers in developing lessons and ensuring content is accurate and aligned with standards.

During the workshop, teachers spent time evaluating and reflecting on videotapes of their teaching of inquiry lessons as well as the videotaped instruction of the University faculty. Evaluation of both teacher and "expert" instruction was designed to help build a collaborative learning community among all participants. Critiques focused on positive exemplars as well as "missed opportunities" regarding specific pedagogical strategies (e.g., context, making meaning,

classroom management, student learning opportunities) seen in the videotaped lessons. The iCoach-teacher teams worked together to revise their lessons to meet the needs of their students.

The professional development experience continued with enactment of the inquiry-based curriculum and strategies with the teachers' middle school students during the academic year. The iCoaches served as mentors establishing professional learning communities within their schools to study the effectiveness of new strategies, diagnose further content and pedagogy remediation, and assess student learning gains. Three follow-up workshops, classroom observations, and in-classroom instructional support continued during the academic year to help iCoach-teacher teams implement instructional strategies and further strengthen their content knowledge.

The participating teachers and iCoaches were given a questionnaire before and after the summer institute and at the end of the academic year. The questionnaires were designed to determine the teachers' views of inquiry and their views of the workshop components. This evaluation report provides an analysis of responses to the questionnaires and synthesis of the results.

III. Analyses of Pre- and Post-Workshop, and Post-Teaching Questionnaires of iCoaches

During spring 2008 pre-workshop, post-workshop, and post-teaching questionnaires of the iCoaches were developed by the project team with assistance from the evaluator. The questionnaires were administered to participating iCoaches immediately prior to the start of the workshop, at the conclusion of the workshop and at the conclusion of the school year (after the iCoach-teacher teams had completed teaching the unit learned during the workshop).

A. Pre-Workshop Questionnaire Analyses

Responses to the pre-workshop questionnaire (eight questions) from 14 iCoaches were analyzed using content analysis. Following are the most common responses to each question (response offered more than once). In parentheses after each entry is the number of respondents who listed each topic followed by the percent of respondents who listed each topic.

Question 1: What are some of your beliefs about student learning in mathematics & science?

- Students learn best when:
  - the focus is on conceptual understanding; concept and skill development (6; 42.9%)
  - activities are hands-on/inquiry-based (5; 35.7%)
  - lessons are relevant to real life (5; 35.7%)
  - they are motivated by and engaged in activities (4; 28.6%)
  - connections are made between lessons and future careers in and outside of the discipline being studied. This increases student interest and retention (3; 21.4%)
  - there is a balance between inquiry and direct, guided instruction (3; 21.4%)
- A teachers role:
  - requires use of multiple instructional strategies (scaffolding) to meet the needs of all learners (5; 35.7%)
  - is as a facilitator that monitors and guides students using questioning and reflection (2; 14.3%)
- All students can learn (4; 28.6%)
- Students learn in different ways (2; 14.3%)
- Time is necessary (2; 14.3 %)
- Many students have a negative view of their ability (2; 14.3%), and
- An additional 13 responses were offered only once by iCoaches.

iCoaches provided a wide range of beliefs about student learning. The most common responses were related to the environment students learn best in and the role of the teacher. The 14 iCoaches provided a total of 55 responses to this question for a mean of 3.93 responses per iCoach.

Question 2: How might instructional strategies impact student learning?

- Instructional strategies:
  - can have a large/essential positive impact on all students' learning (8; 57.1%)
  - must be varied to suit the needs/learning styles of different students (7; 50.0%)
  - can increase student engagement/involvement (4; 28.6%)

    - are best when they involve exploration, collaboration, discussion, and reflection. These strategies engage and motivate students and show them the relevance of the lesson (4; 28.6%)
    - should provide opportunities for students to participate (2; 14.3%)
    - can increase understanding (2; 14.3%)
    - can provide a pathway to success (2; 14.3 %)
- An additional 6 responses were offered only once by iCoaches.

iCoaches were very specific about how instructional strategies impact student learning. The most common responses were positive about the impact of instructional strategies on student learning and are consistent with inquiry based strategies. The 14 iCoaches provided a total of 36 responses to this question for a mean of 2.57 responses per iCoach.

Question 3: How might teacher content knowledge impact student learning?

- Teachers must understand the content in order for students to learn (8; 57.1%)
- Increased knowledge gives teachers more options in the classroom (7; 50.0%)
- More content knowledge builds confidence which leads to more passion for the subject (6; 42.9%)
- More appropriate/accurate knowledge results in effective application of lessons (4; 28.6%)
- It is critical/important for teaching (3; 21.4%), and
- An additional 3 responses were offered only once by iCoaches.

iCoaches were very clear about how teacher content knowledge impacts student learning. The most common responses indicated that content knowledge is necessary for student learning and good teaching; the more content knowledge a teacher has the better. The 14 iCoaches provided a total of 30 responses to this question for a mean of 2.14 responses per iCoach.

Question 4: What factors do you consider when determining the instructional emphasis to place on vocabulary?

- Whether students have the context to apply ("plug-in") the word (7; 50.0%)
- Vocabulary is secondary to conceptual understanding (6; 42.9%)
- What background or prior knowledge might students already have about words, word stems (5; 35.7%)
- How critical the term or word is to conceptual understanding and communication (3; 21.4%)
- That vocabulary is a communication tool (3; 21.4%)
- That vocabulary is important but less so than I once thought (3; 21.4%)
- Lesson content (2; 14.3%)
- Student level of reading/vocabulary. Vocabulary is emphasized if level is weak. (2; 14.3%)
- An additional 2 responses were offered only once by iCoaches.

iCoaches were very clear about what factors are important when determining the instructional emphasis to place on vocabulary. The most common responses indicated that student readiness for new words is critical. Vocabulary words were viewed as an important tool but not as important as conceptual understanding and not as important as they used to be. The 14 iCoaches provided a total of 31 responses to this question for a mean of 2.22 responses per iCoach.

Question 5: What are some characteristics of an effective inquiry lesson? As you think back on effective inquiry lessons you've observed, what teacher and student actions are essential? What resources are essential?

- Teacher actions include the teacher:
  - as facilitator (9; 64.3%)
  - setting the focus or purpose with a probing question or "hook" (6; 42.9%)
  - planning questions and planning for questions (4; 28.6%)
  - providing background and connections to prior learning (4; 28.6%)
  - as observer (2; 14.3%)
  - using 5 Es (2; 14.3%)
- Student actions include:
  - having a clear role in the learning process; lessons driven by students (11; 78.6%)
  - exploring concepts, planning experimentation, collecting and analyzing data, looking for patterns, making discoveries (11; 78.6%)
  - being engaged (8; 57.1%)
  - discussing (6; 42.9%)
  - interacting with each other and the teacher (5; 35.7%)
  - reflecting (5; 35.7%)
  - working in cooperative groups/collaborating (4; 28.6%)
  - making connections (3; 21.4%)
  - internalizing concepts (2; 14.3%)
- Essential resources include:
  - manipulatives (5; 35.7%)
  - materials; tools, equipment, computers (3; 21.4%)
  - kits (2; 14.3%)
  - scientific data (2; 14.3%)
  - time to do lessons (2; 14.3%)
- An additional 8 responses were offered only once by iCoaches.

iCoaches offered many ideas about what contributed to an effective inquiry lesson. Teacher and student actions both reflected a belief in students taking an active role in lessons with teachers providing the support and prompts students need to be successful. The important resources that were viewed as necessary all support hands-on, inquiry-based investigation. The 14 iCoaches provided a total of 99 responses to this question for a mean of 7.07 responses per iCoach.

Question 6: In what kind of leadership activities (e.g., math/science groups, teacher research) do you participate in your school?

- At the department level:
  - interactions with and providing PD to teachers (9; 64.3%)
  - data team (2; 14.3%)
  - iCoach (2; 14.3%)
- At the school level:
  - providing PD to teachers (7; 50.0%)
  - participating in or facilitating professional learning community activities (6; 42.9%)
  - curriculum team (4; 28.6%)
  - cross disciplinary activities i.e. Math and Literacy Night (3; 21.4%)

    - leaders council (2; 14.3%)
- At the district level:
    - content area team (3; 21.4%)
    - provide PD to Middle and High school teachers (2; 14.3%)
- An additional 14 responses were offered only once by iCoaches.

iCoaches offered a wide variety of leadership activities they participate in. Most of the leadership the iCoaches engaged in was at the school level with some at the department and district level. No activity at the state or national level was indicated. The 14 iCoaches provided a total of 49 responses to this question for a mean of 3.5 responses per iCoach.

Question 7: In what ways has being a coach impacted your ability to engage in leadership activities?

- Being an iCoach has presented me with more opportunities to participate in leadership activities (11; 78.6%)
- I have been able to provide PD to others (6; 42.9%)
- I have had more time with other teachers in the classroom and participating in grade level/department meetings. This makes me better able to support teachers' needs (6; 42.9%)
- I have been able to attend more PD (4; 28.6%)
- I have been involved in decision making at the district level (3; 21.4%)
- I have been involved in decision making at the school level (2; 14.3%)
- It has increased my capacity to participate in leadership activities (2; 14.3%)
- It has made me more effective in the leadership activities I participate in (2; 14.3%)
- An additional 5 responses were offered only once by iCoaches.

iCoaches view their role as an iCoach as beneficial to their participation in leadership activities. They site being offered more opportunities and having more time as major contributors to their participation in leadership activities. The 14 iCoaches provided a total of 28 responses to this question for a mean of 2.0 responses per iCoach.

Question 8: In what ways has being a coach impacted the ability of teachers in your school to engage in leadership activities?

- It has increased their ability to engage in leadership activities (11; 78.6%)
- They are more confident/motivated/empowered to participate more in leadership activities (5; 35.7%)
- Ways they engage in leadership activities are by:
    - sharing their knowledge at the school level (5; 35.7%)
    - sharing their knowledge at the district level (4; 28.6%)
    - being more willing to participate in PD (4; 28.6%)
    - participating in district meetings (4; 28.6%)
    - participating in collaborative planning for instruction and assessment (2; 14.3%)
- An additional 5 responses were offered only once by iCoaches.

iCoaches view their impact on participation in leadership activities by teachers at their school as being very positive. They indicated that they have contributed to increased participation by teachers and that the teachers are more confident, motivated and empowered to engage in these activities. The 14 iCoaches provided a total of 40 responses to this question for a mean of 2.86 responses per iCoach.

Discussion

Overall, the responses to the items on the Pre-Workshop Questionnaire indicate that the iCoaches are knowledgeable about teaching and inquiry and the skills and knowledge teachers need to know in order to teach inquiry to students. They participate in a variety of leadership activities and view the iCoach experience as being beneficial for themselves and for their teachers with respect to their ability to participate in leadership.

B. Post-Workshop Questionnaire Analyses

Responses to the post-workshop questionnaire (10 questions) from 14 iCoaches were analyzed using content analysis. Following are the most common responses to each question (response offered more than once; except Question 6, or representing more than 10% of the responses). In parentheses after each entry is the number of respondents who listed each topic followed by the percent of respondents who listed each topic.

Question 1: What are some things you've gained from the institute that you will take back (apply) to your coaching position? (*personal learning*)

- Confidence, knowledge, and experience needed to work with teachers to implement inquiry-based instruction (7; 50.0%)
- Teaching strategies/ideas that work; including eliciting student prior knowledge, thinking, and understanding (5; 35.7%)
- Content knowledge (4; 28.6%)
- Experiencing inquiry in action with students (3; 21.4%)
- Experience reflecting with a group (3: 21.4%)
- Inquiry focused content training (2; 14.3%)
- Practicing coaching, i.e. planning and reflecting on lessons (2; 14.3%)
- The whole experience was invaluable (2; 14.3%)
- Inquiry-based activities/curricula (2; 14.3%)
- An additional 10 responses were offered only once by iCoaches.

iCoaches reported a wide variety of things they've gained from the institute that they will take back (apply) to their coaching position. They indicated that their confidence his improved and they have gained knowledge and experience needed to support teachers as they implement inquiry-based instruction. The 14 iCoaches provided a total of 40 responses to this question for a mean of 2.86 responses per iCoach.

Question 2: In what ways did the science/math content sessions engage you?

- They engaged me because the sessions:
    - were taught using inquiry (3, 21.4%)
    - provided me with the same content as the teachers received (3; 21.4%)
    - were taught at a high level (3; 21.4%)
    - introduced hands-on activities with real students doing the activities (2; 14.3%)
- An additional 4 responses were offered only once by iCoaches.

As you consider your content knowledge, what are some understandings you've gained from these sessions?

- The sessions increased my content knowledge very much (6; 42.9%)

- The importance of vertical articulation (connecting concepts from one level to the next) of the curriculum from middle school through high school and college (4; 28.6%)
- A better understanding of technology i.e. graphing calculator functions (3; 21.4%)
- A better understanding of my teachers' content knowledge (2; 14.3%)
- How inquiry methods relate to mathematics (2; 14.3%)
- An additional 4 responses were offered only once by iCoaches.

iCoaches indicated that the content sessions were engaging because they modeled inquiry instruction with real students, were taught at a high level, and the sessions were experienced by coaches with their teachers. They also stated that their content knowledge was increased in scientific, mathematic, and education domains. The 14 iCoaches provided a total of 36 responses to this question for a mean of 2.57 responses per iCoach.

Question 3: What are some new teaching strategies you've learned about during these two-weeks?

- Inquiry strategies related to:
    - questioning (11; 78.6%)
    - exploration (7; 50.0%)
    - problem based learning (4; 24.6 %)
    - cooperative learning (3; 21.4%)
    - reflecting (2; 14.3%)
- Strategies specifically focused on using new technologies (6; 42.9%)
- How to change objectives into guiding questions (2; 14.3%)
- How to scaffold questions (2; 14.3%)
- An additional 4 responses were offered only once by iCoaches.

iCoaches reported a wide range of teaching strategies they've learned during the institute. Most of the teaching strategies were related to learning inquiry strategies, and ways to use new technologies. The 14 iCoaches provided a total of 41 responses to this question for a mean of 2.93 responses per iCoach.

Question 4: What new teaching strategies will you encourage through your coaching?

- Strategies/lessons/activities that facilitate inquiry-based instruction:
    - content hooks (6; 42.9%)
    - collaborative learning (5; 35.7%)
    - wait-time (5; 35.7%)
    - reflecting (3; 21.4%)
    - formative assessments (2; 14.3%)
    - others (5; 35.7%)
- More questioning using driving, open-ended, probing questions (5; 35.7%)
- POE (3; 21.4%)
- Using interactive technologies (3; 21.4%)
- CER (2; 14.3%)

iCoaches provided a long list of teaching strategies they will encourage through their coaching. All of the teaching strategies offered will encourage more inquiry teaching in the classrooms of their teachers. Their list was very similar to the list of new strategies learned in the institute. The 14 iCoaches provided a total of 39 responses to this question for a mean of 2.79 responses per iCoach.

Question 5: What benefits have you experienced from learning teaching strategies and content alongside the teachers you will be coaching?

- A common experience that will lead to increased effectiveness in implementing inquiry (7; 50.0%)
- Increased professional collaboration (7; 50.0%)
- Improved rapport (4; 28.6%)
- A common language to discuss inquiry (2; 14.3%)
- An additional 3 responses were offered only once by iCoaches.

iCoaches provided a few benefits they have experienced as a result of learning with their teachers. All of the benefits provided imply an improved relationship between the iCoach and the teacher will result. The 14 iCoaches provided a total of 23 responses to this question for a mean of 1.64 responses per iCoach.

Question 6: During the reflection time you were exposed to two different approaches to reflection (led by USC instructors or led by you). What were some of the benefits of each approach to your growth as a coach? * all responses are provided for this item.

- No approach identified
    - Data that I collected was used (2; 14.3%)
    - Reinforcement that one good question can make a big difference (1; 7.1%)
    - I benefitted from the challenge of coaching teachers other than my own (1; 7.1%)
    - My ability to meet group needs (1; 7.1%)
    - Helped me to acquire new methods, questions, and strategies to use with different personalities (1; 7.1%)
    - I saw evidence of teacher learning (1; 7.1%)
    - An increased understanding of the coach's role by the teacher (1; 7.1%)
    - The understanding that the teacher role is as facilitator; student is responsible for learning (1; 7.1%)
    - It helped me be less controlling and allow teachers to control their growth (1; 7.1%)
- Whole group
    - Not beneficial (2; 14.3%)
    - Reflection instrument used by USC (RTOP) helped teachers identify what they want to implement (2; 14.3%)
    - Too many people/did not build rapport (1; 7.1%)
    - Report out on observations of coaches (1; 7.1%)
    - More superficial/peer reflection (1; 7.1%)
    - Written reflection provided the opportunity to learn the value of reflecting and journaling (1; 7.1%)
    - Too much focus on writing not talking (1; 7.1%)
    - Writing resulted in more in-depth reflecting (1; 7.1%)
- Small group
    - Teachers must figure inquiry out for themselves (2; %)
    - Focused on lesson, non-judgmental, allowed teacher to reflect on lesson and set goals for the next lesson (2; %)
    - Beneficial (1; 7.1%)

- Helped some teachers better understand inquiry process and expectations (1; 7.1%)
- Reflect on teacher impressions regarding inquiry (1; 7.1%)

iCoaches reported a wide range of both benefits and some negative effects from different approaches to reflection. Based on the responses, the evaluator is suspicious that most respondents did not understand the question or were not clear about the two approaches to reflection. The iCoaches did not define the approaches similarly to the USC faculty. The 14 iCoaches provided a total of 27 responses to this question for a mean of 1.93 responses per iCoach.

Question 7: In what ways do you plan to help teachers integrate the math and/or science learned over these past two weeks into their instruction?

- Through conversations about planning (10; 71.4%)
- By providing inquiry-based curricula and support materials (8; 57.1%)
- By observing instruction, collecting data, and reflecting on their practice in conversation with the teachers (5; 35.7%)
- An additional 3 responses were offered only once by iCoaches.

iCoaches were very focused in the ways they thought they would help teachers integrate what they had learned at the institute into their teaching. Most of the iCoaches viewed appropriate planning as the key to implementing the lessons. Providing teachers with useful curricula, lessons, materials, and feedback were also offered my many iCoaches. The 14 iCoaches provided a total of 26 responses to this question for a mean of 1.86 responses per iCoach.

Question 8: In what new ways do you anticipate working with your teachers when you return to your school?

- Focus more or continue to focus on implementing inquiry-based instruction using new or revised curricula/lessons and strategies (6; 42.9%)
- More coaching to help teachers understand what inquiry is, develop assessments, and guide reflection (4; 28.6%)
- By collecting the data they request during observations (4; 28.6%)
- By planning instruction together (3; 21.4%)
- By co-teaching more (3; 21.4%)
- An additional response was offered by one iCoach.

iCoaches plan to focus their efforts with their teachers on implementing and improving implementation of inquiry-based instruction. All of the responses indicated this intention. The 14 iCoaches provided a total of 21 responses to this question for a mean of 1.5 responses per iCoach.

Question 9: When you return to your school, what changes to your teachers' instruction do you anticipate will occur as a result of <u>your work with them</u> (<u>*teacher learning*</u>)?

- More inquiry-based teaching (5; 35.7%)
- More planning to encourage student engagement and discovery of content (4; 28.6%)
- An increased willingness to try inquiry-based instruction (3; 21.4%)
- An increased willingness to use more open-ended, probing questions (2; 14.3%)
- An increased willingness to use wait-time (2; 14.3%)

- Teachers will change their questioning strategies (2; 14.3%)
- Teachers will work together more to plan and co-teach (2; 14.3%)
- An additional 4 responses were offered only once by iCoaches.

iCoaches predicted several changes they expect to see in their teachers' instruction as a result of their efforts. The most common responses indicated an expectation that teachers will plan for, try, or use more strategies that support inquiry-based instruction. The 14 iCoaches provided a total of 24 responses to this question for a mean of 1.71 responses per iCoach.

Question 10: When you return to your school, what effects on *student learning* do you anticipate will occur as a result of your work with your teachers over these past two weeks?

- Increased student collaboration, motivation, excitement, and engagement (7; 50.0%)
- Improved instruction that results in:
    - improved student learning/understanding (6; 42.9%)
    - greater effectiveness (4; 28.6%)
    - improved student achievement (3; 21.4%)
- Increased test scores (3; 21.4%)
- An additional response was offered by one iCoach.

iCoaches predicted several changes they expect to see on student learning as a result of their efforts with teachers. The most common responses indicated an expectation that students will be more involved, and instruction and student learning will be improved. The 14 iCoaches provided a total of 24 responses to this question for a mean of 1.71 responses per iCoach.

Discussion

Responses to the questions on the Post-Workshop Questionnaire indicated that the iCoaches believe the USC program prepared them well to work with their teachers during the coming year. They learned both content and teaching strategies that will help them in their role as iCoach. Learning alongside their teachers was seen as a benefit that improved their relationship with their teachers. iCoaches identified specific ways they intend to help their teachers integrate content learned at the USC institute into their instruction when they return to school. They also described how they will work differently with their teachers to improve instruction through implementing inquiry. As a result, iCoaches predict that teachers will use more inquiry strategies in their classrooms that will result in more engaged, motivated students who learn and understand more resulting in improved achievement and test scores. One area for the institute providers to focus more on is the different types of reflection. iCoaches did not seem to recognize the different approaches they were exposed to, and therefore we not able to differentiate the benefits and challenges associated with each approach. In future institutes, USC faculty should make the different approaches more clear to the iCoaches so their ideas can be expressed more clearly.

C. Post-Teaching Questionnaire Analyses

Responses to the post-teaching questionnaire (ten questions) from 7 iCoaches were analyzed using content analysis. Following are the most common responses to each question (response offered more than once or representing more than 10% of the responses). In parentheses after each entry is the number of respondents who listed each topic followed by the percent of respondents who listed each topic.

Question 1: What are some of your beliefs about student learning in mathematics & science?

- Students understand more, retain more, make more connections, and are more engaged when taught using an inquiry or discovery approach (5; 35.7%)
- Teachers are responsible for creating an environment and providing appropriate activities that support inquiry learning (3; 21.4%)
- All students can learn (2; 14.3%)
- An additional 6 responses were offered only once by iCoaches.

How, if at all, were these beliefs influenced by the USC inquiry program?

- The institute reinforced my beliefs about the value and effectiveness of this (inquiry) approach (6; 42.9%)
- As a result of the institute, teachers collaborate more and implement more inquiry-based lessons (2; 14.3%)

iCoaches reported a variety of beliefs that they held about student learning in mathematics and science. Responses indicated that all coaches view inquiry as a viable way to teach students. In addition, iCoaches indicated that the institute reinforced their existing beliefs and had positive impacts on teachers. The 7 iCoaches provided a total of 24 responses to this question for a mean of 3.43 responses per iCoach.

Question 2: How might a teacher's instructional strategies and content knowledge impact student learning? Describe a specific example.

- Both appropriate instructional strategies and teacher content knowledge are necessary for students to learn (5; 35.7%)
- More content knowledge supports teachers' implementation of instructional strategies (5; 35.7%)
- Inquiry-based instructional strategies maximize student learning and retention (3; 21.4%)
- Teacher instructional strategies are the most important part of the teaching process (2; 14.3%)

iCoaches view both appropriate instructional strategies and teacher content knowledge as necessary for student learning, with each supporting student learning in different ways. The 7 iCoaches provided a total of 15 responses to this question for a mean of 2.14 responses per iCoach.

Question 3: What are some characteristics of an effective inquiry lesson?

- Student focused; teacher acts as a facilitator, **NOT** a dispenser of knowledge (4; 28.6%)
- A focus on a question, anomaly, or problem so that students begin to think as problem solvers (3; 21.4%)
- Excellent open-ended questions (3; 21.4%)
- The answer is not the focus, the process is the focus (2; 14.3%)
- Students are thinking (2; 14.3%)
- An additional 4 responses were offer only once by iCoaches.

As you think back on effective inquiry lessons you have observed this year, what teacher and student actions are essential?

- Student and teacher actions
    - reflect on results and meaning (3; 21.4%)

    - engagement (3; 21.4%)
    - apply learning to new situations (2; 14.3%)
- Teacher actions
    - prompt students with questions (2; 14.3%)
    - good monitoring skills, time management, pacing (2; 14.3%)
    - good planning for lesson including instructional strategies, content, management of students and resources (2; 14.3%)
    - plan and prepare in advance of teaching (2; 14.3%)
- Student actions
    - student interaction, i.e. exploring, sharing, testing and comparing ideas, teaching each other (4; 28.6%)
    - students use higher order thinking processes, i.e. exploring, making predictions, analyzing, making predictions (2; 14.3%)

What resources are essential?

- Manipulatives, hands-on materials, lab resources (6; 42.9%)
- Time to prepare and do the lessons (4; 28.6%)
- Informational resources; videos, computers, websites (2; 14.3%)
- Materials for record keeping, documentation, presentation (2; 14.3%)
- Depends on lesson content (2; 14.3%)

iCoaches reported a large number of responses to each component of this question. Overall, iCoaches have a good grasp on the characteristics of an inquiry lesson, know what actions teachers and students should take, and are clear on the resources necessary to instruct using inquiry-based lessons. The 7 iCoaches provided a total of 56 responses to this question for a mean of 8.0 responses per iCoach.

Question 4: How, if at all, did USC's inquiry program impact your coaching this school year? If possible, please describe a specific coaching example (no names please).

- I shared inquiry program materials with all of my teachers and encouraged them to give it a try (3; 21.4%)
- My teachers shared their experiences with others who did not attend (3; 21.4%)
- Teachers now collaborate more with me and share their successes, i.e. increased student learning (3; 21.4%)
- After the institute I had more opportunities to support my teachers because of our shared experience (3; 21.4%)
- Seeing and trying inquiry teaching with students made my teachers more willing to try more inquiry in their own classrooms (2; 14.3%)
- The institute resulted in me planning specific lessons with my teachers that I had in-depth experience with, i.e. I had observed, collected data on, reflected with teachers on so we could improve out inquiry-based lessons (2; 14.3%)
- Now I have evidence that inquiry-based instruction is a viable/effective option for teachers (2; 14.3%)
- An additional response was offered by an iCoach.

iCoaches described very positive impacts of the USC inquiry program on their coaching this school year. Overall, their coaching and opportunities to coach inquiry-based instruction improved, teachers were more open to their efforts, and interactive with each other. The 7

iCoaches provided a total of 19 responses to this question for a mean of 2.71 responses per iCoach.

Question 5: How did you facilitate teachers' use of the summer units at your school?

- I helped them plan lessons (5; 71.4%)
- I reflected on inquiry units/lessons with teachers (3; 42.9%)
- I videotaped/observed many lessons (3; 42.9%)
- I co-taught/assisted during labs (3; 42.9%)

How qualified or prepared did you feel to facilitate the units?

- Very qualified (2; 28.6%)
- Prepared in content and teaching strategies (1; 14.3%)
- Not always prepared in content but always prepared in teaching strategies (1; 14.3%)
- N/A no teachers (1; 14.3%)

iCoaches facilitated teacher use of institute materials by planning and reflecting with their teachers, and by observing them teach and assisting with instruction. The 7 iCoaches provided a total of 19 responses to this question for a mean of 2.71 responses per iCoach.

Question 6: What strengths and weaknesses did you observe in your teachers as they implemented the summer units with their students?

- Strengths
    - teachers are comfortable implementing and motivated to do real inquiry (5; 71.4%)
    - teachers are more sharing/collaborative with me and other teachers regarding efforts to improve instruction (4; 57.1%)
    - teachers see benefits of implementing inquiry (2; 28.6%)
- Weaknesses
    - teachers not completely invested in following through all aspects of inquiry, need to relinquish control, have students summarize learning, and reflect (3; 42.9%)
    - no whole units implemented (2; 28.6%)
    - teachers still invested in traditional approaches especially when inquiry-based instruction becomes challenging (2; 28.6%)

iCoaches reported more strengths than weaknesses in the efforts of their teachers as they implemented the summer units with their students. Teachers are making a laudable effort to implement inquiry-based units and lessons; however, there are still some aspects of this new approach to instruction that needs practice and strengthening. The 6 iCoaches who responded to this question provided a total of 18 responses to this question for a mean of 3.0 responses per iCoach.

Question 7: In what kind of leadership activities (*formally* such as team leader, math/science groups, coaching responsibilities, and *informally*, sharing with another coach about the institute, talking to your administrator about instruction) did you participate in during the school year?

- Formally
    - as a provider of professional development to other teachers (4; 57.1%)
    - as an iCoach to teachers (3; 42.9%)
    - as administrator of a school-wide PLC (2; 42.9%)

    - as a teacher leader/coach (2; 28.6%)
- Informally
    - I shared institute experiences with teachers, administrators, and district leaders at my school and at other schools (3; 42.9%)
    - I worked to improve rigor and provide resources to teachers (3; 43.9%)
    - I shared institute experiences with other coaches; discussed implementation ideas (2; 28.6%)
    - I coordinated science fair (1; 14.3%)
    - I worked on SACS team to ensure documentation showcased instructional strategies, student achievement, and supported literacy and technology use in the classroom (1; 14.3%)

iCoaches reported a wide variety of formal and informal leadership activities. The responses were balanced between formal (11) and informal (10) activities. The 7 iCoaches provided a total of 21 responses to this question for a mean of 3.0 responses per iCoach.

Question 8: In what ways, if any, has the USC program influenced your participation or engagement in leadership activities?

- Now I have more opportunities to participate in leadership activities (3; 43.9%)
- Now I participate with more back-up, passion, evidence, tools (3; 43.9%)
- It gave me more practical experience and confidence to be a leader (2; 28.6%)
- There was no influence; my participation in leadership activities is the same (3; 43.9%)

Of the 56% of iCoaches who reported an impact on their participation or engagement in leadership activities, they indicated that having more opportunities, support, and confidence has contributed to their involvement in leadership activities. The 7 iCoaches provided a total of 11 responses to this question for a mean of 1.57 responses per iCoach.

Question 9: In what ways has being a coach impacted the ability of teachers in your school to engage in leadership activities?

- Teachers are more willing to provide professional development to other colleagues (4; 57.1%)
- Teachers are becoming a collaborative team (3; 42.9%)
- Teachers more motivated to engage in leadership activities (3; 42.9%)
- Teachers are more confident to teach content/inquiry-based lessons (2; 28.6%)
- Teachers are using strategies in other subjects (2; 28.6%)
- An additional response was offered by an iCoach.

iCoaches reported a wide range of teaching strategies they've learned during the institute. Most of the teaching strategies were related to learning inquiry strategies, and ways to use new technologies. The 7 iCoaches provided a total of 15 responses to this question for a mean of 2.14 responses per iCoach.

Question10: If you attended the academic year workshops, how many did you attend?

- All of them; 3 (5; 71.4%)
- One (1; 14.3%)
- None (1; 14.3%)

What did you gain from them?

- More content knowledge/content application (5; 71.4%)

- Opportunities to share, collaborate, network, and plan (4; 57.1%)
- Insight into what the teachers were implementing (2; 28.6%)
- Insight into what worked and what did not (1; 14.3%)

Most (86%) of the iCoaches participated in the academic year workshops. These iCoaches gained content knowledge and improved understandings of content applications, opportunities to work with others, and insight into what teachers were implementing. The 6 iCoaches who attended academic year workshops provided a total of 12 responses to this question for a mean of 2.0 responses per iCoach.

Discussion

Responses to the Post-Teaching Questionnaire were provided by 7 of the 14 iCoaches (50%) participating in the USC program. After completion of teaching some or all of the activities in the unit from the USC institute, iCoaches viewed inquiry as a viable way to teach students. The USC institute reinforced their beliefs about student learning and had positive impacts on teachers' instruction. iCoaches recognized that teacher fluency in both instructional strategies and content are necessary for student learning. iCoaches reported a strong understanding of characteristics of an effective inquiry-based lesson, necessary student and teacher actions, and essential resources. iCoaches viewed the USC institute as having a positive impact on their coaching during the school year with improved opportunities to coach, and teachers who were more open and interactive. The coaches facilitated teacher use of the summer units primarily through planning and reflecting with the teachers. The coaches did indicate that they could be more prepared and qualified to facilitate the units. iCoaches identified teachers as being largely comfortable with and competent at implementing inquiry. Areas where some teachers continued to struggle are in relinquishing control, and allowing students to summarize learning and reflect, especially when inquiry-based instruction becomes challenging. iCoaches are very engaged in formal and informal leadership activities and attribute being an iCoach to improving their confidence and increasing opportunities to participate in leadership activities. In addition, the iCoaches view their role as a coach as being supportive of teacher participation in leadership activities. The academic year workshops were viewed as beneficial to the coaches in that they offered opportunities to gain additional content knowledge, content applications, and instructional strategies; work with others; and gain insight into what teachers were implementing.

D. Analysis of Common Items Across Questionnaires

By comparing iCoach responses to similar questions from the pre-workshop (PWS) questionnaire and the post-teaching (PT) questionnaire, we find 6 items in common. However, only 7 of the original 14 (50%) iCoaches provided responses to the PT questionnaire.

Question 1 (PWS & PT) was designed to elicit iCoaches' beliefs about student learning in mathematics and science. The most frequently offered responses at both time points were all inquiry related; they included the beliefs that students understand and retain more when they are engaged and making connections through inquiry-based learning, teachers create the environment that encourages and supports student learning, and all students can learn. The most obvious difference was that the PT responses are more focused with 2.29 responses per coach as compared to 3.93 PWS responses per coach.

Questions 2 and 3 (PWS) and Question 2 (PT) asked about the impact of instructional strategies and teacher content knowledge on student learning. At both time points iCoaches

viewed instructional strategies and content knowledge as necessary for student learning; neither was deemed more important than the other. The number of responses from PWS to PT was also very similar with PWS=2.57 and 2.14; PT=2.14 per coach for each set of questions.

Question 5 (PWS) and Question 3 (PT) inquired about effective inquiry lessons. During both time points coaches offered many responses. The most frequent responses on the PWS and the PT questionnaire included the teachers as a facilitator who sets the focus with a question or hook; lessons are student driven with students engaged, exploring, analyzing, discussing; and essential resources are manipulatives, materials to conduct investigations, and time. Additionally, the number of responses offered at each time point was high yet of a similar magnitude (PWS=7.07; PT=8.0).

Questions 6 (PWS) and 7 (PT) ask about iCoach involvement in leadership activities. Again there was little change in iCoach responses across the two time points. Coaches provided professional development to teachers, supported their inquiry-based instruction in the classroom, and worked to improve curricula and content knowledge. One additional leadership activity reported on the PT question was communicating with teachers and school and district administrators about inquiry-based instruction and the USC institute. There were 3.5 responses per coach on the PWS questionnaire and 3.0 on the PT questionnaire, similar response rates.

Questions 7 (PWS) and 8 (PT) ask about the impact of being an iCoach and involved in the USC institute on iCoach involvement in leadership activities. At both time points coaches stated that they had more opportunities to participate in leadership activities as a result of being a coach or participating in the USC institute. On the PWS questionnaire coaches also indicated that as a coach they had more time to participate on leadership activities as well. On the PT questionnaire, coaches cited having more tools, evidence, confidence and experience as ways the USC institute has impacted their leadership involvement. With 2.0 and 1.57 responses per iCoach on the PWS and PT questionnaires respectively, there was some reduction in responses over time possibly indicating coaches focusing more on the activities they were engaged in over the school year.

Question 8 (PWS) and 9 (PT) asks the impact of being an iCoach on teachers' ability to be involved in leadership activities. At both time points coaches perceive teachers to be more confident, motivated, empowered and willing to collaborate with and share with others (teachers) as a result of the coach's influence. This has resulted in more engagement in leadership activities by the teachers. There was a drop in the number of responses over time (PWS= 2.86; PT=2.14) possibly indicating that teachers' leadership activities were perceived as becoming more focused over the school year.

Overall, there was little change in iCoach perceptions from the summer USC institute until after teachers provided instruction using the units from the institute with the exception of coaches' beliefs about student learning. This indicates that iCoaches' thoughts and ideas are strongly established. A possible reason for no change could be the iCoaches' teaching philosophy is already well founded in inquiry-based instruction so there was no reason for it to change dramatically as a result of this professional development opportunity.

IV. Analyses of Pre- and Post-Workshop, and Post-Teaching Questionnaires of Teachers

A. Pre-Workshop Questionnaire Analyses

Responses to the pre-workshop questionnaire (eleven questions) from 41 teachers were analyzed using content analysis. Following are the most common responses to each question (response offered more than once). In parentheses after each entry is the number of respondents who listed each topic followed by the percent of respondents who listed each topic.

Question 1: What are some of your beliefs about student learning in mathematics & science?

- Learning should be hands-on/discovery-based (20; 48.8%)
- Student learning is enhanced by doing research/experiments/investigations/labs and collecting data/projects (15; 36.6%)
- It must relate to the real world/real life (12; 29.3%)
- All students can learn in their own way, at their own pace (11; 26.8%)
- Students' ability to apply concepts indicates understanding (7; 17.1%)
- Student learning is enhanced by:
    - a variety of learning opportunities (6; 14.6%)
    - materials/manipulatives/models (4; 9.8%)
    - more content/reading text books (3; 7.3%)
    - writing essays (2; 4.9%)
- Students do not think they are good at learning math/science (5; 12.2%)
- Students learn when interested (4; 9.8%)
- Learning should be fun (4; 9.8%)
- Learning should be interesting/engaging (3; 7.3%)
- Student learn should be built on prior knowledge (3; 7.3%)
- Learning requires teaching the same concept using many different strategies (2; 4.9%)
- Students' ability to solve problems indicates understanding (2; 4.9%)
- All students can learn through inquiry (2; 4.9%)
- Lessons should support different learning styles (2; 4.9%)
- Lessons should support diverse understandings (2; 4.9%)
- Math is the language of science (2; 4.9%)
- An additional 6 responses were offered only once by teachers.

Teachers provided a long list of beliefs about student learning in mathematics and science. Most of the responses indicate that the teachers valued inquiry-based approaches prior to the beginning of the institute and that students learn best when engaged in hands-on activity. The 41 teachers provided a total of 117 responses to this question for a mean of 2.85 responses per teacher.

Question 2: In what ways do you plan and implement units of study in your classroom?

- Planning units of study
    - with other teachers (16; 39.0%)
    - according to state standards (16; 39.0%) and
    - according to state pacing guides (10; 24.4%)
    - with my iCoach (6; 14.6%)

    - I use resource materials (books, websites) (5; 12.9%)
    - based on learning objectives (3; 7.3%)
    - a lot of detailed plans (2; 4.9%)
    - to make material understandable to students with different learning styles (2; 4.9%)
    - based on calendar/timing (2; 4.9%)
- An additional 6 responses were offered only once by teachers.
- Implementing units of study
    - activities (13; 31.7%)
    - notes with pictures; power point (4; 9.8%)
    - worksheets (4; 9.8%)
    - peer group teaching (4; 9.8%)
    - demos (4; 9.8%)
    - hands-on/inquiry (3; 7.3%)
    - labs (3; 7.3%)
    - lecture/teach content (3; 7.3%)
    - using kits (2; 4.9%)
    - note-taking sheets with blanks (2; 4.9%)
    - book work/reading (2; 4.9%)
    - projects (2; 4.9%)
- An additional 6 responses were offered only once by teachers.

What are some of your successful strategies for assessing student learning?

- Successful assessment strategies
    - quizzes (20; 48.8%)
    - tests (20; 48.8%)
    - projects (15; 36.6%)
    - questioning (8; 19.5 %)
    - exit slips (8; 19.5%)
    - lab reports (5; 12.2%)
    - activity sheets (5; 12.2%)
    - discussions (4; 9.8%)
    - worksheets (3; 7.3%)
    - games (3; 7.3%)
    - drawings (2; 4.9%)
    - self-assessments (2; 4.9%)
    - informational interviews (2; 4.9%)
    - portfolios (2; 4.9%)
    - white boards (2; 4.9%)
- An additional 12 responses were offered only once by teachers.

Teachers described many strategies for planning and implementing units of study and assessing student learning. Most of the planning efforts described were guided by state standards and pacing guides and were conducted with other teachers or iCoaches. Implementation of units of study included both traditional approaches (19) and more inquiry-based approaches (27). Student assessment was most commonly achieved through the traditional methods of quizzes, tests, and projects. The 41 teachers provided a total of 233 responses to this question for a mean of 5.68 responses per teacher.

Question 3: How might your instructional strategies impact student learning?

- By leading to better learning (36; 87.8%)
- By peaking interest/engage students (17; 41.5%)
- By matching instructional strategies to learning styles (14; 34.1%)
- By helping students learn (5; 12.2%)
- By helping students understand (5; 12.2%)
- By motivating students to learn (5; 12.2%)
- By helping students retain information (2; 4.9%)
- By helping students find success (2; 4.9%)
- By helping students see relevant connections with the real world (2; 4.9%)
- Instructional strategies may have a negative impact on student learning (5; 12.2%)
- An additional 5 responses were offered only once by teachers.

Teachers viewed most teaching strategies as having a positive effect on student learning i.e. leading to better learning, peaking student interest, and addressing a variety of learning styles. However, some teachers (5) acknowledged that instructional strategies can have a deleterious impact on student learning. The 41 teachers provided a total of 99 responses to this question for a mean of 2.41 responses per teacher.

Question 4: How might your content knowledge impact student learning?

- The more I know:
    - the greater depth I can teach to (9; 22.0%)
    - the better able I am to answer questions (7; 17.1%)
    - the better I can change misconceptions (6; 14.6%)
    - the more competent I appear to students (6; 14.6%)
    - the better I can engage students (6; 14.6%)
    - the better able I am a helping students make connections between concepts (5; 12.2%)
    - the better lessons/activities I can offer (4; 9.8%)
    - the better teacher I am (3; 7.3%)
    - the better I can guide student learning (2; 4.9%)
    - the more I can present (2; 4.9%)
- An additional 8 responses were offered only once by teachers.
- It can have a negative influence if I do not know enough content (3; 7.3%)
    - I can't teach/present lessons and activities (3; 7.3%)
    - I can't make students learn (2; 4.9%)
    - I can't help students go deeper or answer their questions (2; 4.9%)
- An additional 3 responses were offered only once by teachers.

Similarly to Question 3, teachers viewed more teacher content knowledge as having a positive effect on student learning because teachers can teach to a greater depth, answer questions better, change misconceptions, appear more competent to students, and engage students better, for example. However, some teachers also acknowledged that not knowing enough content knowledge can have a negative impact on student learning. The 41 teachers provided a total of 71responses to this question for a mean of 1.73 responses per teacher.

Question 5: What factors do you consider when determining the instructional emphasis to place on vocabulary?

- I teach it if it is directly related to/necessary for understanding content (17; 41.5%)
- If students have been exposed to vocabulary before/prior knowledge (9; 22.0%)
- Are the words district words (important to understanding standards) we are expected to teach (5; 12.2%)
- Will students encounter the word again (4; 9.8%)
- Student developmental level/learning level (3; 7.3%)
- Difficulty of words (2; 4.9%)
- Applicability of word to life and the lesson being taught (2; 4.9%)
- Student scores on MAP/RIT/PACT (2: 4.9%)
- The type of assessment that will be used (2; 4.9%)
- I do not consider any factors because vocabulary is essential for learning (8; 19.5%)
- An additional 3 responses were offered only once by teachers.

Teachers described several factors they consider when determining the instructional emphasis to place on vocabulary. Some viewed vocabulary as essential for learning, but most teachers offered specific criteria that must be met before teaching vocabulary. The 41 teachers provided a total of 57 responses to this question for a mean of 1.39 responses per teacher.

Question 6: What is the nature of your iCoach-teacher relationship? (Successes? Areas for improvement?)

- It is very positive (29; 70.7%)
    - my coach provides me with techniques/strategies (13; 31.7%)
    - my coach provides me with tools/materials (10; 24.4%)
    - my coach plans, observes, and reflects with me (8; 19.5%)
    - my coach provides me with emotional support (5; 12.2%)
    - we have a partnership to improve student learning (5; 12.2%)
    - we work together almost daily (4; 9.8%)
    - my coach provides me with content knowledge (3; 7.3%)
    - it is that of teacher/student (3; 7.3%)
    - my coach is helpful/assists me (2; 4.9%)
    - we have a common goal: student learning (2; 4.9%)
    - we have good communication (2; 4.9%)
    - An additional 3 responses were offered only once by teachers
- One teacher said the relationship was neutral; the coach only helps when needed
- It is negative (5; 12.2%)
    - My coach is spread too thin-throughout the school (3; 7.3%)
    - An additional 2 responses were offered only once by teachers
- I don't have a coach/don't work with the coach (6; 14.6%)

Most of the teachers (29; 70.7%) described a very positive, supportive, relationship with their coach. But 12 (29.3%) of the teachers indicated a neutral, negative, or no relationship with a coach. The 35 teachers who have an iCoach provided a total of 100 responses to this question for a mean of 2.86 responses per teacher.

Question 7: How has having a coach in your building influenced your teaching?

- It has helped me become a better teacher (10; 24.4%)
- It has helped me explore a greater variety of ways to teach (10; 24.4%)
- It has helped me gain confidence in my teaching (8; 19.5%)
- It has helped me stay on track/focus (5; 12.2%)
- It has helped me be more effective (4; 9.8%)
- It has helped improve my content knowledge (3; 7.3%)
- It has helped me be organized (3; 7.3%)
- An additional 4 responses were offered only once by teachers
- It has had little influence on my teaching (2; 4.9%)
- It has not influenced my teaching (4; 9.8%)
- I don't have a coach (3; 7.3%)
- No response (4; 9.8%)

Most teachers described very positive influences on their teaching as a result of having an iCoach. Although, 13 (32%) of the teachers stated that having an iCoach has had little or no impact on their teaching, they don't have a coach or they did not respond to the question. The 34 teachers who have a coach and gave a response provided a total of 53 responses to this question for a mean of 1.56 responses per teacher.

Question 8: What are some ways that you reflect on your own practice as a teacher?

- By analyzing student assessments (15; 36.6%)
- By talking to other teachers (11; 26.8%)
- By asking questions of myself; thinking in my own head (9; 22.0%)
- By thinking about possible improvements (6; 14.6%)
- With my iCoach (5; 12.2%)
- By journaling/writing ways to improve lessons/units (5; 12.2%)
- Based on the level of student involvement/engagement (4; 9.8%)
- By looking at student progress (3; 7.3%)
- Through peer observations/forms (3; 7.3%)
- Based on student reactions/feedback (3; 7.3%)
- By comparing how it went across classes (2; 4.9%)
- I don't reflect formally or deeply, only superficially (2; 4.9%)
- An additional 2 responses were offered only once by teachers.

Teachers described a variety of ways that they reflect on their practice as a teacher. Most of their responses were based on student performance on assessments or on the perceptions of others or themselves. The 39 teachers who indicated that they reflect on their practice provided a total of 68 responses to this question for a mean of 1.74 responses per teacher.

Question 9: What are some characteristics of an effective inquiry lesson?

- The lesson is based on a question that can be answered through inquiry and exploration (15; 36.6%)
- Students understand the relevance to the real world (4; 9.8%)
- Effective communication between teacher and student (4; 9.8%)
- Assessment (4; 9.8%)

- Lesson is student centered, encourages students to perform activities, gain knowledge, and reflect (4; 9.8%)
- Incorporates hands-on activities (3; 7.3%)
- Accesses/activates prior students' knowledge (3; 7.3%)
- Instructions are clear and detailed/expectations defined (3; 7.3%)
- An additional 5 responses were offered only once by teachers.

As you think back on effective inquiry lessons you've taught, what teacher and student actions are essential?

- Teacher actions:
    - teacher acts as a "guide on the side"/facilitator (25; 61.0%)
    - teacher is prepared/has a plan to support inquiry lessons/activities (7; 17.1%)
- Student actions:
    - Students are engaged/involved/interested (16; 39.0%)
    - Students act as problem solvers (14; 34.1%)
    - Students discover through hands-on exploration (13; 31.7%)
    - Students learn to draw conclusions from observations and discussions (11; 26.8%)
    - Students share information/ideas/questions (7; 17.1%)
    - Students work together in pairs or groups (4; 9.8%)
- An additional 2 responses were offered only once by teachers.

What resources are essential?

- Manipulatives/hands-on materials for experimenting (19; 46.3%)
- Prior knowledge (6; 14.6%)
- Reference materials (6; 14.6%)
- Time to do lessons (4; 9.8%)
- Internet (3; 7.3%)
- Computers (3; 7.3%)
- Technology (2; 4.9%)
- Materials for collecting data (2; 4.9%)
- An additional 3 responses were offered only once by teachers.

Teachers described several characteristics of inquiry lessons. The response offered by the most teachers was: effective inquiry lessons start with a question that can be answered through inquiry or investigation. Their responses indicated that they have a good understanding of inquiry and the actions and resources necessary to accomplish inquiry with students. The most essential teacher action is acting as a guide or facilitator when teaching. Students must be engaged, involved problem solvers who discover through hands-on exploration and learn to draw conclusions based on observations and discussions. The most essential resources are manipulatives and hands-on materials for doing investigations. The 41 teachers provided a total of 192 responses to this question for a mean of 4.68 responses per teacher.

Question 10: In what kind of leadership activities (e.g., team leader, math/science groups, teacher research) do you participate in your school?

- At the department level:
    - Team leader/coach for grade level (12; 29.3%)
    - Department chair/co-chair (8; 19.5%)
    - Department meetings (3; 7.3%)

    - Team meetings (3; 7.3%)
- At the school level:
    - academic committees/teams (19; 46.3%)
    - extracurricular activity coach/sponsor (12; 29.3%)
    - Science PLC (4; 9.8%)
    - School leadership team/council (4; 9.8%)
    - Math/science night planning team (2; 4.9%)
    - Academic tutor (2; 4.9%)
    - Involved in research project (2; 4.9%)
    - Teacher professional development activities (2; 4.9%)
- At the district/county/regional level
    - leadership activities (7; 17.1%)
    - Curriculum team member at the school/district level (5; 12.2%)
    - District level leadership group (2; 4.9%)
- Professional presentations at conferences (2; 4.9%)
- State and national level leadership activities (2; 4.9%)

Teachers offered a long list of leadership activities that they participate in. These activities occurred at the department, school, district, county, regional, state, and national levels. The 41 teachers provided a total of 91 responses to this question for a mean of 2.22 responses per teacher.

Question 11: How has having a coach in your building influenced your involvement in leadership activities?

- My coach encourages/motivates me to take a larger role in leadership activities (10; 24.4%)
- My coach informs me of leadership opportunities (3; 7.3%)
- My coach provides me with resources that support my leadership efforts (3; 7.3%)
- Makes me want to serve others (3; 7.3%)
- Facilitates making my leadership ideas a reality within our school (2; 4.9%)
- Now I have more time to engage in leadership activities (2; 4.9%)
- There is no effect/it has not influenced my involvement in leadership activities (17; 41.5%)
- My coach prevented me from taking on leadership activities (1; 2.4%)
- I don't have a coach (3; 7.3%)

Teachers offered only a few ways that having an iCoach at their school influenced their participation in leadership activities. Slightly over half (51%) of the teachers stated that there was no effect, they did not have a coach, or their coach prevented them for participating in leadership activities. The 38 teachers who had an iCoach in their building provided a total of 41 responses to this question for a mean of 1.08 responses per teacher.

Discussion

Overall, teachers' responses to the items on the Pre-Workshop Questionnaire indicate that they are knowledgeable about teaching and inquiry and the skills and knowledge they need to know in order to teach inquiry to students. The teachers value inquiry-based approaches. These values are more evident when planning and implementing units of study than when assessing students. Student assessment is most commonly accomplished using traditional methods. The

teachers do reflect on their teaching some but this can be developed more. The characteristics of an effective inquiry lesson, essential teacher and student actions, and necessary resources offered by teachers indicated a solid understanding of inquiry and what was needed to successfully conduct it. Teachers view their knowledge and instructional strategies as having important impacts on student learning, both positive and negative. Vocabulary is viewed as important but most teachers consider some factors when determining their emphasis on specific words. The majority of teachers have a positive relationship with their iCoach and view their coach as a positive influence on their teaching and participation in leadership activities. The teachers participate in a variety of leadership activities; iCoaches support the leadership activities of some teachers but other did not see any impact of having a coach on their participation in leadership activities.

B. Post-Workshop Questionnaire Analyses

Responses to the post-workshop questionnaire (ten questions) from 35 teachers were analyzed using content analysis. Following are the most common responses to each question (response offered more than once). In parentheses after each entry is the number of respondents who listed each topic followed by the percent of respondents who listed each topic.

Question 1: What are some things you've gained from the institute that you will take back (apply) to your classroom?

- Questioning methods (16; 45.7%)
- New inquiry teaching strategies (15; 42.9%)
    - Inquiry-based lessons (9; 25.7%)
    - CER-claim, evidence, reasoning (7; 20.0%)
    - POE-predict observe explain (7; 20.0%)
    - Wait-time (5; 14.3%)
    - 5-Es: engagement, exploration, explanation, extension, evaluation (4; 11.4%)
    - An additional 6 responses were offered only once by teachers.
- Content knowledge (8; 22.9%)
- Cooperative learning strategies (5; 14.3%)
    - Think (ink), pair, share (5, 14.3%)
    - Jigsaw method (3; 8.6%)
    - An additional 2 responses were offered only once by teachers.
- Use of manipulatives (3; 8.6%)
- Providing a real world context (2; 5.7%)
- Use of artifacts (2; 5.7%)
- To be a facilitator (2; 5.7%)
- New ideas for labs (2; 5.7%)
- Confidence (2; 5.7%)
- An additional 4 responses were offered only once by teachers.

Teachers described a wide variety of things they learned at the institute that they will apply in their classrooms. Questioning methods and inquiry teaching strategies topped the list. Overall, the institute seemed to offer a lot that teachers intend to implement. The 35 teachers provided a total of 109 responses to this question for a mean of 3.11 responses per teacher.

Question 2: In what ways did the science/math content sessions engage you?

- Content sessions engaged me through/by:
    - inquiry based instruction (7; 20.0%)
    - hands-on activities (2; 5.7%)
    - manipulatives (2; 5.7%)
    - providing an understanding of the role of content building; scaffolding (2; 5.7%)
    - providing information students need to know (2; 5.7%)
    - testing/trying lessons before teaching them (2; 5.7%)
- An additional 8 responses were offered only once by teachers.

As you consider your content knowledge, what are some understandings you've gained from these sessions?

- A lot of content (5; 14.3%)
- How to calculate the mechanical advantage of machines (5; 14.3%)
- How mid-level content builds for high school (4; 11.4%)
- Specific content details
    - Graphing (3; 8.6%)
    - Relationship of topographic maps to geologic features (2; 5.7%)
    - Geologic processes (2; 5.7%)
    - Deeper understanding of what in inside the earth (2; 5.7%)
    - An additional 16 specific content responses were offered only once by teachers.
- An additional 6 specific instruction-related responses were offered only once by teachers.

Teachers provided a long and varied list of how they were engaged by content sessions and the specific understandings they gained. Overall, teachers seemed to benefit in very individual ways from the content sessions. The 35 teachers provided a total of 70 responses to this question for a mean of 2.0 responses per teacher.

Question 3: What are some new teaching strategies you've learned about these two weeks?

- Inquiry-based teaching (12; 34.3%)
- Questioning/probing (11; 31.4%)
- POE (11; 31.4%)
- Wait-time (10; 28.6%)
- CER (8; 22.9%)
- Jigsaw (8; 22.9%)
- Phenomena first (6; 17.1%)
- Cooperative teaching methods (6; 17.1%)
- Questioning/driving (5; 14.3%)
- 5E's (5; 14.3%)
- Interactive technologies (4; 11.4%)
- Artifacts (4; 11.4%)
- Think-ink-pair-share (3; 8.6%)
- 3-2-1 (2; 5.7%)
- Four corners (2; 5.7%)
- Exit slips (2; 5.7%)
- An additional 9 specific teaching strategies were offered only once by teachers.

Teachers offered many new teaching strategies that they learned about during the institute. Inquiry-based teaching and questioning techniques were at the top of the list followed by many specific strategies. The 35 teachers provided a total of 108 responses to this question for a mean of 3.09 responses per teacher.

Question 3a: What new teaching strategies will you <u>use</u> in your classroom?

- Inquiry-based teaching (14; 40.0%)
- POE (12; 34.3%)
- Questioning/probing (9; 25.7%)
- Wait-time (9; 25.7%)
- CER (9; 25.7%)
- Jigsaw (8; 22.9%)
- Questioning/driving (5; 14.3%)
- 5E's (5; 14.3%)
- Phenomena first (5; 14.3%)
- Students create artifacts (5; 14.3%)
- Interactive technologies (3; 8.6%)
- Think-ink-pair-share (3; 8.6%)
- 3-2-1 (2; 5.7%)
- Four corners (2; 5.7%)
- Exit slips (2; 5.7%)
- Cooperative teaching methods (7; 20.0%)
- An additional 3 specific teaching strategies were offered only once by teachers.

The list of strategies teachers said they will use is well aligned with the list of strategies they learned about with the top six strategies on both lists being the same. The 35 teachers provided a total of 103 responses to this question for a mean of 2.94 responses per teacher.

Question 4: What benefits have you experienced from learning teaching strategies and content alongside your iCoach?

- Immediate feedback on my teaching-what worked/what didn't (6; 17.1%)
- Quality reflection sessions (5; 14.3%)
- Helped plan lessons (5; 14.3%)
- Provided guidance for and support in applying new knowledge to my classroom/students (5; 14.3%)
- Suggested resources (4; 11.4%)
- Coach made us aware of positive strategies (3; 8.6%)
- Coach made us aware of missed opportunities (3; 8.6%)
- Another perspective on material (3; 8.6%)
- Shared experience for reference (3; 8.6%)
- Provided guidance and support for specific personal challenges I encountered (3; 8.6%)
- Suggested ideas/strategies (2; 5.7%)
- Learned more content detail (2; 5.7%)
- I will use my iCoach more; I learned the value of an iCoach (2; 5.7%)

Some teachers did not participate in the institute with their iCoaches because:

- My iCoach was not at my session (5; 14.3%)

- My iCoach was not at the institute (3; 8.6%)
- I don't have an iCoach (3; 8.6%)

Teachers valued the opportunity and experience of participating in the institute with their iCoach. However, 11 teachers (31.4%) did not participate in the institute with their iCoach. The 24 teachers who did participate in the institute with their iCoach provided a total of 44 responses to this question for a mean of 1.83 responses per teacher.

Question 5: In what ways do you plan to integrate the math and/or science you learned over these past two weeks into your instruction?

- By integrating specific activities/lessons into my instruction (18; 51.4%)
- By using specific inquiry-based strategies/methods (17; 48.6%)
- I am now more comfortable with content; I will use specific content from the institute (15; 42.9%)
- Now I will use questioning more (10; 28.6%)
- By using specific materials/resources I received (3; 8.6%)
- By incorporating specific ideas from the institute (3; 8.6%)
- By interacting more/better with my students (3; 8.6%)
- By providing time for student reflection (2; 5.7%)
- By conduction pre- and post- instruction assessment (2; 5.7%)
- By accessing specific internet resources (2; 5.7%)

Teachers described lessons, strategies, and content learned at the institute that they intend to integrate into their teaching. The 35 teachers provided a total of 75 responses to this question for a mean of 2.14 responses per teacher.

Question 6: What was your area of greatest growth during the institute related to instruction?

- Learning the correct way to teach using inquiry-based lessons/methods/processes (10; 28.6%)
- Content knowledge details (8; 22.9%)
- Learning how to shift from a teacher-focused to a student-focused approach/classroom (6; 17.1%)
- Questioning techniques (5; 14.3%)
- More collaboration with fellow teachers and iCoach (4; 11.4%)
- My gain in confidence about my teaching ability (4; 11.4%)
- Learning to use more wait-time (4; 11.4%)
- Now I am more comfortable with play-time for discovery (3; 8.6%)
- Inquiry can be implemented in many ways using many materials (2; 5.7%)
- The importance of reflection/daily closure for students (2; 5.7%)
- An additional 2 responses were offered only once by teachers.

By far the area of greatest growth related to instruction offered by teachers was learning the correct way to teach using inquiry-based lessons, methods, and processes. The 35 teachers provided a total of 50 responses to this question for a mean of 1.43 responses per teacher.

Question 7: What will be your greatest challenge in teaching these inquiry-based instructional units in your classroom?

- Having enough time (11; 31.4%)
- The logistics of getting students to do inquiry/work together (6; 17.1%)
- Overcoming my old non-inquiry habits (6; 17.1%)
- Letting go of control (5; 14.3%)
- Taking time to plan (5; 14.3%)
- There are so many standards to cover (5; 14.3%)
- Fitting inquiry into the pacing guide (5; 14.3%)
- Getting students used to a new classroom culture/way of learning (5; 14.3%)
- Having the confidence that students will get where I want them to go (4; 11.4%)
- Getting/keeping students motivated (4; 11.4%)
- Knowing how much help/guidance/information to give to students (3; 8.6%)
- Being quiet so students can interact (2; 5.7%)
- An additional 2 responses were offered only once by teachers.

Teachers stated that having enough time, dealing with logistics, overcoming traditional habits, covering all the material they are expected to cover, and getting students used to a new of doing things would pose the greatest challenge to teaching inquiry-based units. The 35 teachers provided a total of 63 responses to this question for a mean of 1.8 responses per teacher.

Question 8: What changes to your instruction do you anticipate will occur as a result of working with your iCoach when you return to your classroom?

- Anticipated changes include:
    - I will implement more inquiry-based strategies/instruction (18; 51.4%)
    - reflection on my teaching based on observations by my iCoach (11; 31.4%)
    - more open-ended questioning (6; 17.1%)
    - I will use my iCoach more when planning (4; 11.4%)
    - my iCoach will help me implement lesson/activities that engage students (3; 8.6%)
    - my iCoach will help me implement more wait-time (3; 8.6%)
    - I will use my iCoach for inquiry lesson development (2; 5.7%)
    - I will discuss various teaching methods with my iCoach (2; 5.7%)
- An additional 5 responses were offered only once by teachers.
- No change is anticipated because:
    - I do not have an iCoach (8; 22.9%)
    - I already do this with my iCoach (2; 5.7%)

Teachers anticipate implementing more inquiry-based strategies and instruction, and reflecting more on their teaching with support from their iCoach as the most common changes to their instruction in the coming school year. However, 10 teachers (28.6%) did not anticipate any change to their instruction in the coming school year as a result of working with an iCoach. The 25 teachers who anticipated a change provided a total of 54 responses to this question for a mean of 2.16 responses per teacher.

Question 9: What effects on student learning do you anticipate will result from working with your iCoach when you return to your classroom?

- Anticipated effects on student learning include:
    - greatly improved learning/; this will be a positive academic experience (10; 28.6%)
    - students will be more engaged (8; 22.9%)
    - students will become more engaged in aspects of inquiry-based learning (7; 20.0%)
    - students will achieve greater understanding (5; 14.3%)
    - students will achieve greater academic success i.e. tests, PACT, higher grades, high school, college (4; 11.4%)
    - focus on depth and breadth will change (3; 8.6%)
    - I will be a better teacher (2; 5.7%)
- An additional 2 responses were offered only once by teachers.
- No effect on student learning is anticipated because:
    - I do not have an iCoach (8; 22.9%)
    - An additional teacher indicated that there was no expectation of change; no reason was given.

Teachers predicted students will learn and achieve more, and will be more engaged in learning as a result of the teachers' work with their iCoach during the coming school year. However, 9 (25.7%) teachers did not anticipate any effects on student learning in the coming school year as a result of them working with an iCoach. The 26 teachers who anticipated effects on student learning as a result of working with their iCoach provided a total of 41 responses to this question for a mean of 1.58 responses per teacher.

Question 10: During the reflection time you were exposed to two different approaches to reflection. What were some of the benefits of each approach to your growth as a teacher?

- I was unaware that there were two different approaches (4; 11.4%)
- Large/whole group
    - offers a wide range of feedback (5; 14.3%)
    - can see others' approach (5; 14.3%)
    - was coach lead-reflection went much deeper (4: 11.4%)
    - was coach lead-focused on what went well, what did not (3: 8.6%)
    - provided opportunities to see missed opportunities (3; 8.6%)
    - provided a written summary (3; 8.6%)
    - we were forced to think about what happened each day (3; 8.6%)
    - this is the best approach/liked it most (3; 8.6%)
    - it was too infrequent/not enough time to reflect (3; 8.6%)
    - not so personal (2; 5.7%)
    - more structured (2; 5.7%)
    - more pedagogically precise (2; 5.7%)
    - was coach lead-reflection was of great immediate benefit (2: 5.7%)
    - provided opportunities to see strengths of my teaching (2; 5.7%)
    - content and pedagogy are both important for reflection (2; 5.7%)
    - same thing day after day (2; 5.7%)
    - was not beneficial (2; 5.7%)

    - too much delay between instruction and reflection (2; 5.7%)
- An additional 2 responses were offered only once by teachers.
- Small group
    - More personalized (8; 22.9%)
    - Focus on personal growth (4; 11.4%)
    - More insightful (2; 5.7%)
    - Offers other perspectives on some material (2; 5.7%)
    - Got off track (2; 5.7%)
- An additional 2 responses were offered only once by teachers.

iCoaches reported a wide range of benefits and negative effects from different approaches to reflection. Based on the responses, the evaluator is suspicious that most respondents did not understand the question or were not clear about the two approaches to reflection.
Teachers described very positive impacts of the USC inquiry program on their coaching this school year. Overall, their coaching and opportunities to coach inquiry-based instruction improved and teachers were more open to their efforts. The 35 teachers provided a total of 76 responses to this question for a mean of 2.17 responses per teacher.

Discussion

Teachers seemed to value their experience at the USC program. They offered a wide variety of things they gained during the institute that they intend to apply in their classrooms. Content, lessons, and teaching strategies were gained and teachers plan to use this new knowledge and implement new strategies and lessons. Participating in the institute with their iCoach was considered to be a valuable experience for the teachers whose coach was there. Teachers did recognize that breaking away from their more traditional habits will be challenging. However, teachers predict that if they can make the changes they hope to, students will benefit by being more engaged and learning more.

C. Post-Teaching Questionnaire Analyses

Responses to the Post-Teaching Questionnaire (16 questions) from 15 teachers were analyzed using content analysis. Following are the most common responses to each question (response offered more than once). In parentheses after each entry is the number of respondents who listed each topic followed by the percent of respondents who listed each topic.

Beliefs

Question 1: What are some of your beliefs about student learning in mathematics & science?

- Students learn by seeing, feeling, doing, discovering, interacting, questioning, exploring (7; 46.7%)
- All students have the ability/potential to acquire knowledge and skills (5; 33.3%)
- Real world applications make learning more relevant/meaningful (4; 26.7%)
- Teaching strategies should accommodate student learning styles (3; 20.0%)
- The learning environment is critical for maximizing knowledge and skill acquisition (2; 13.3%)
- Students need time to research, plan, and perform labs, and reflect on learning (2; 13.3%)
- An additional 5 responses were offered only once by teachers.

How, if at all, were these beliefs influenced by the USC inquiry program?

- The USC program reinforced my beliefs (9; 60.0%)
- Now I am better prepared to implement my beliefs (5; 33.3%)
- The USC program instilled my current beliefs/changed my old beliefs about student learning (3; 20.0%)
- By having us teach students as part of the program, I saw for myself how effective inquiry-based teaching can be (3; 20.0%)

Teachers described beliefs that are aligned with inquiry-based teaching and learning. The USC inquiry program instilled, reinforced, and prepared teachers to implement their beliefs. The 15 teachers provided a total of 48 responses to this question for a mean of 3.2 responses per teacher.

Question 2: How do your instructional strategies and content knowledge impact student learning?

- Content knowledge and instructional strategies go together; to teach inquiry effectively, one must know content (8; 53.3%)
- Inquiry-based instruction results in more motivated/engaged students (2; 13.3%)
- Appropriate instructional strategies result in more confidence in problem solving skills (2; 13.3%)
- Instructional strategies need to be tailored to different learning styles/situations (2; 13.3%)
- Students learn more if teacher knows more (2; 13.3%)
- An additional 3 responses related to teaching strategies were offered only once by teachers.
- An additional response related to content knowledge was offered only once by a teacher.

Most of the teachers see instructional strategies and content knowledge as being linked. More responses related to instructional strategies than content knowledge, however. The 15 teachers provided a total of 20 responses to this question for a mean of 1.33 responses per teacher.

Question 3: Do you believe you can teach inquiry and still get through your content standards?

- Yes (12; 80.0%) *
- No (3; 20.0%)

If so, how do you do this?

- By picking and choosing which standards to teach using inquiry (5; 33.3%)
- With proper planning and the necessary time and resources (3; 20.0%)
- I struggle to do it (3; 20.0%)
- An additional 6 responses were offered only once by teachers.

If not, why not?

- Time is too limited to teach all standards using inquiry (6; 40.0%)
- Some concepts/vocabulary are hard to teach using only inquiry (4; 26.7%)
- Standards are designed to prepare students for state tests; inquiry does not adequately do that (2; 13.3%)

* Several participants answered "Yes" then gave reasons why not.

Most teachers believe they can teach inquiry and still get through their standards if they plan carefully and are choosy about which standards they teach this way. Time is always a limiting

factor when teachers consider teaching using inquiry based methods. The 15 teachers provided a total of 29 responses to this question for a mean of 1.93 responses per teacher.

USC Institute

Question 4: How did the USC summer institute and follow-up workshops influence your teaching this year?

- It gave me confidence in my content area (6; 40.0%)
- It gave me confidence to bring inquiry into my classroom (4; 26.7%)
- It reminded me to use more inquiry (4; 26.7%)
- It reminded me to reflect and plan (3; 20.0%)
- The support kept me going (2; 13.3%)
- Now I use specific inquiry-based strategies in my teaching (6; 40.0%)
- Now I collaborate and share more with others (3; 20.0%)
- An additional 3 responses were offered only once by teachers.

Teachers described very positive impacts of the USC inquiry program on their teaching this school year. Overall, their confidence was improved and they were reminded what they needed to do to stay on track. The 15 teachers provided a total of 31 responses to this question for a mean of 2.07 responses per teacher.

Question 5: What changes, if any did you make to your instruction and why did you make these changes?

- I use inquiry more because it is effective (5; 33.3%)
- I have incorporated specifics aspects of inquiry into my instruction and changed how I view "right" and "wrong" answers and discussion (5; 33.3%)
- When questioning, I asked for explanations and spent more time talking with students instead of assuming I knew what they meant (2; 13.3%)
- I allowed more time for student thinking and discussion (2; 13.3%)
- My role shifted to that of facilitator (2; 13.3%)
- I encouraged other teachers to use inquiry and began using it in other courses because students enjoy it more than the way I used to teach and it is more effective (2; 13.3%)
- An additional response was offered once by a teacher.

Now teachers use more inquiry and inquiry-based lessons in their instruction because it is effective. The 15 teachers provided a total of 19 responses to this question for a mean of 1.27 responses per teacher.

Question 6: Describe your classroom implementation of the summer unit. How much of the unit did you teach (entire unit, select lessons, etc.)?

- Select lessons (11; 73.3%)
- The whole unit (4; 26.7%)

Why did you choose to implement the unit as you did?

- Teachers implementing select lessons:
    - time is limited (7; 46.7%)
    - I chose certain lessons because they allowed students to POE, they were at the student's level, I could use them to introduce higher level material showing

students future applications of lessons, and they used certain resources I wanted to use (4; 26.7%)
    - the unit covers multiple levels/standards; I teach one level/one set of standards (2; 13.3%)
    - I didn't use the entire unit because some lessons were too similar to other lessons, and they were not completely aligned to the standards (2; 13.3%)
- Teachers implemented the whole unit because:
    - it gave me the opportunity to integrate material across the curriculum (1; 6.7%)
    - it was ALL aligned to the standards (1; 6.7%)
    - the material maintains student interest and accommodates all learning styles (1; 6.7%)
    - I was comfortable with the content and teaching it (1; 6.7%)

All of the teachers implemented at least some of the lessons from the summer unit. Time, possibility for skill development, and alignment with standards all impacted teachers' specific lesson choices. The 15 teachers provided a total of 19 responses to this question for a mean of 1.27 responses per teacher.

Question 7: Describe your students learning from this unit. Did you perceive a difference in your students learning during this unit in comparison to other units you teach?

- Yes (15; 100%)
- No (0; 0%)

Why or why not?

students were more engaged (9; 60.0%)

- students owned their work and defended their results (5; 33.3%)
- students exhibited a greater depth of understanding than in the past (4; 26.7%)
- students are better able to make connections between what they learn in school and other content and the real world (3; 20.0%)
- students interacted better with and learned from classmates (2; 13.3%)

All of the teachers stated that there was a difference in student learning during the unit from the institute as compared to other units they teach. They attributed this difference to the students being more engaged, having ownership of their work, achieving greater understanding, making connections with school learning and the real world, and interacting effectively with their classmates. All of these are intended outcomes of inquiry-based instruction. The 15 teachers provided a total of 23 responses to this question for a mean of 1.53 responses per teacher.

Question 8: If you attended the academic year workshops, how many did you attend?

- No (4; 26.7%)
- Yes (11; 73.3%)
    - Four (36.4%) teachers attended 2 academic year workshops
    - Seven (63.6%) teachers attended 3 academic year workshops

What did you gain from them?

- They helped me stay on track/reminded me about inquiry (6; 54.6%)
- Shared and received "tried and true" strategies/lessons/ideas with and from my colleagues (5; 45.5%)
- Obtained new content knowledge (5; 45.5%)
- Helped me realize others share my frustrations (2; 18.2%)

- Networking (2; 18.2%)
- An additional 4 responses were offered only once by teachers.

Teachers gained motivation, strategies and lessons, content knowledge, and developed camaraderie with other teachers and coaches. The 11 teachers responding "Yes" provided a total of 24 responses to this question for a mean of 2.18 responses per teacher.

Practice

Question 9: In what ways do you plan and implement new units of study in your classroom?

- I update and add more material annually (4; 26.7%)
- I plan with other teachers, review the standards, and then pull activities from a variety of sources (3; 20.0%)
- I look at the standards, then I create learning objectives based on PACT/PASS questions, then I conduct inquiry activities that meet the standards (2; 13.3%)
- I use books, the internet, and my own resources to find appropriate activities (2; 13.3%)
- I work with/share activities/materials with others from my school (2; 13.3%)
- I follow what I have done in the past (2; 13.3%)
- I think about lesson goals/focus questions (2; 13.3%)
- An additional 5 responses were offered only once by teachers; all of these responses described planning and implementing inquiry based instruction (5; 33.3%)

Teachers provided a variety of ways that they plan and implement units of study in their classroom. Updating what they have done in the past, working with other teachers, using available resources, and thinking about standards are all ways they accomplish this. The 15 teachers provided a total of 22 responses to this question for a mean of 1.47 responses per teacher.

Question 10: What are some characteristics of an effective inquiry lesson?

- Students are actively engaged in/involved in asking, then answering, questions (10; 66.7%)
- They start with a discussion about what students know or think (4; 26.7%)
- There is a lead or guiding question (3; 20.0%)
- There is a wrap-up activity or opportunity for sharing, providing feedback and/or summarizing what was learned (3; 20.0%)
- There is no right or wrong answer (2; 13.3%)
- An additional 3 responses were offered only once by teachers.

As you think back on effective inquiry lessons you've taught this year, what teacher and student actions are essential?

- Teacher actions
    - Giving up come control (5; 33.3%)
    - Planning ahead/practicing lesson implementation/adjusting activities (4; 26.7%)
    - Acting as a facilitator (3; 20.0%)
    - Offering effective open-ended questioning (3; 20.0%)
    - Providing opportunities so students can take risks (2; 13.3%)
- Student actions
    - Taking risks/exploring to learn (7; 46.7%)

    - Taking responsibility for/ownership of own learning (3; 13.3%)
    - Explaining/demonstrating what they learn (2; 13.3%)
    - Reaching valid conclusions (2; 13.3%)

What resources are essential?

- Materials (5; 33.3%)
- Time (4; 26.7%)
- Interactive programs, websites, activities, and manipulatives (3; 20.0%)
- Teachers are open-minded, flexible, and knowledgeable (3; 20.0%)
- Content books/lessons (2; 13.3%)
- It depends on the lesson (2; 13.3%)
- An additional 3 responses were offered only once by teachers.

All of the characteristics of an effective inquiry lesson provided by teachers indicate that they know what inquiry requires and the focus was on students. Teacher actions related to giving up control to allow students to take risks, explore, and take responsibility for their learning. The most stated essential resources were time and materials to do inquiry lessons. The 15 teachers provided a total of 78 responses to this question for a mean of 5.2 responses per teacher.

Question 11: What are some successful strategies for assessing student learning that you used in your classroom this year?

- Open-ended questioning (5; 33.3%)
- Good questions at the beginning, during, and at the end of a lesson to gauge student understanding (4; 26.7%)
- 3-2-1 (4; 26.7%)
- Tests (4; 26.7%)
- Exit/entrance slips (3; 20.0%)
- Assignments/projects graded with a rubric (3; 20.0%)
- KWL charts (2; 13.3%)
- Think-ink-pair-share (2; 13.3%)
- Closure through written or verbal feedback at the end of the lesson (2; 13.3%)
- An additional 12 specific inquiry-based strategies were offered only once by teachers.
- An additional 4 specific traditional strategies were offered only once by teachers.

How if at all were these influenced by the USC institute?

- The strategies I use were introduced or reinforced at the institute (8; 53.3%)
- An additional 2 responses were offered only once by teachers.

Teachers provided a long list of successful assessment strategies that they used in their classrooms this year with questioning being the most common strategy. Teachers attributed their use of these strategies to the USC institute. The 15 teachers provided a total of 45 successful strategies that they used for a mean of 3.00 responses per teacher.

Question 12: Please describe a specific example of how you reflected on your own practice as a teacher this school year.

- I reflected on ways to improve inquiry lessons/my teaching (8; 53.3%)
- I reflected with other teachers (3; 20.0%)
- I reflected on how I introduce new materials (3; 20.0%)
- I reflected with my i-Coach (3; 20.0%)

- I reflected as I compared test scores (MAPS) last year with this year across units (2; 13.3%)
- An additional 3 responses were offered only once by teachers.

Teachers described several ways that they reflected on their own practice over the past school year. Reflecting with other teachers and with their iCoach to improve instruction and student learning was their focus. The 15 teachers provided a total of 22 responses to this question for a mean of 1.47 responses per teacher.

Coach-Teacher Relationship

Question 13: In what way, if any, has the USC program changed the nature of your iCoach-teacher relationship?

- Our relationship is stronger; I am more comfortable with my iCoach (7; 46.7%)
- Attending together put us "on the same page" about inquiry (3; 20.0%)
- The nature of the relationship between my iCoach and me has not changed (4; 26.7%)
- I do not have an iCoach (4; 26.7%)

Seven (46.7%) of the 15 teachers indicated that their relationship with their iCoach had changed and this change was positive. All of these teachers reported a stronger, more comfortable relationship as a result of participating in the program together. These teachers provided a total of 10 responses to this question for a mean of 1.43 responses per teacher. The remaining 8 teachers reported either no change in their relationship with their iCoach or do not have an iCoach.

Question 14: How has having a coach in your building influenced your teaching? Your use of the summer unit? Your use of new instructional strategies?

- My iCoach encourages me/I have more confidence (5; 33.3%)
- My iCoach helps me think of/reflect on ways to do better (5; 33.3%)
- My iCoach helps me implement lessons (4; 26.7%)
- My iCoach is a resource for answering my questions (3; 20.0%)
- My iCoach gathers materials and resources for lessons (3; 20.0%)
- My iCoach helps me plan (3; 20.0%)
- My iCoach helps me use technology (2; 13.3%)
- My iCoach supports my efforts with administrators (1; 6.7%)
- No influence on my teaching by my iCoach (1; 6.7%)
- No iCoach (5; 33.3%)

Teachers offered a wide variety of ways having an iCoach has influenced their teaching, however six (40%) reported no iCoach or no influence from their iCoach. The 9 teachers (60.0%) who reported that their iCoach influenced their teaching, inquiry unit use, and instructional strategies provided a total of 26 responses to these questions for a mean of 2.89 responses per teacher.

Leadership

Question 15: What kind of leadership activities (*formally* such as team leader, math/science groups, teacher research and *informally*, sharing with another teacher about the institute, inviting a colleague to complete the unit with you, talking to your administrator about instruction) did you participate in during the school year?

- Formal leadership activities
  - Team leader (5; 33.3%)
  - Department chair (2; 13.3%)
  - Lead/participate in cohort group (2; 13.3%)
  - provide Professional Development (3; 20.0%)
  - an additional 4 responses were offered only once by teachers.
- Informal leadership activities
  - I share about the institute with other teachers (8; 53.3%)
  - I share about the institute at department meetings (7; 46.7%)
  - I share about the institute at grade level meetings (3; 20.0%)
  - I talk to administrators about the institute (3; 20.0%)
  - I created new lessons/reworked old lessons to make them more inquiry-based (3; 20.0%)
  - Others implement inquiry-based lessons I introduced to them (1; 6.7%)

In what ways, if any, has the USC program influenced these activities?

- Five unique responses were offered by teachers.

Teachers described several formal and informal leadership activities that they were engaged in over the past year. Five (33.3%) of the teachers indicated that the USC institute influenced these activities. The 15 teachers provided a total of 41 leadership activities that they participate in for a mean of 2.73 responses per teacher.

Question 16: How has having a coach in your building influenced your involvement in leadership activities?

- My iCoach makes being involved in leadership activities easier by guiding my efforts, modeling sharing with others, or encouraging others to ask me about my inquiry teaching (5; 33.3%)
- Having an iCoach has not influenced my involvement in leadership activities (5; 33.3%)
- My iCoach gives me more confidence to be a leader (3; 20.0%)
- I have always been involved in leadership activities (2; 13.3%)
- I do not have and iCoach (3; 20.0%)

In what ways, if any, has the USC program influenced these activities?

- I am more open to collaborating and working with others while offering what I know about inquiry-based teaching (3; 20.0%)

Seven teachers (46.7%) said having a coach in their building positively influenced their involvement in leadership activities. These seven teachers provided eight responses to how this occurred and three responses to what was the influence of the USC program for a total of 11 responses; 1.57 responses per teacher. Five teachers (33.3%) reported no influence on their leadership activities; two because they have always been involved in leadership activities. Three additional teachers (20.0%) indicated that they did not have a coach.

Discussion

Responses to the Post-Teaching Questionnaire were provided by 15 of the 41 teachers (36.6%). After teaching some or all of the activities in the unit from the USC institute, teachers viewed inquiry as a viable way to effectively teach knowledge and skills to learners with varying abilities and differing learning styles. These beliefs were instilled or reinforced by the USC institute. Teachers believe that knowledge of both content and instructional strategies is necessary to teach inquiry effectively. Most teachers also believe that they can teach inquiry and still address the content standards they are required to teach, but it is a challenge and time is a critical limiting factor.

The USC summer institute had a very positive impact on teachers' inquiry-based teaching. Teachers reported increased confidence in their teaching strategies and content knowledge, and ongoing motivation as a result of the summer institute and follow-up workshops during the school year. They taught more inquiry, their role in the classroom changed, and teachers encouraged others to use the unit and teach in an inquiry-based way because they saw this as a more effective way to teach all of their students. Even though most teachers did not teach the whole unit from the summer institute, all of them implemented at least some of the activities. As a result, teachers reported that students were more engaged, owned their work more, exhibited greater depth of understanding, and were better able to make connections to the real world as compared to other units taught differently.

Teachers' reported practices that are consistent with inquiry based instruction. Their approach to planning was fairly traditional but they did report interacting with other teachers as part of their approach to planning and implementing new units of study in their classrooms. Teachers have a strong understanding of the characteristics of an inquiry lesson with questioning and student engagement as critical pieces. Teachers also knew what they and their students should be doing to make an inquiry lesson work and that time and materials were necessary. Teachers reported that the USC institute introduced or reinforced the assessment strategies they used during the school year with questioning and other inquiry-based strategies outranking tests. Teachers also used reflection with their coaches and other teachers to improve lessons and instruction.

Overall, teachers who have iCoaches enjoy a positive, supportive relationship with them. The coaches are encouraging, help teachers reflect on their teaching, and help them prepare for teaching inquiry-based lessons in a variety of ways. Unfortunately, several teachers reported not having an iCoach at their school or in their building. These teachers are at a distinct disadvantage without this support.

Teachers reported many formal and informal leadership activities that they were engaged in during the past school year. iCoaches support teacher involvement in leadership activities by facilitating leadership opportunities, and encouraging and supporting teachers to become more active as leaders. The USC program has helped these teachers be more open to participating in leadership activities. Some of the teachers reported that they have always been involved in leadership activities; others said their coach has not influenced their involvement; and some do not have an iCoach.

D. Analysis of Common Items across Questionnaires

By comparing teacher responses to similar questions from the pre-workshop (PWS) questionnaire and the post-teaching (PT) questionnaire, we find 7 items in common. However, only 15 of the original 41 (36.6%) teachers provided responses to the PT questionnaire.

Question 1 (PWS & PT) was designed to elicit teachers' beliefs about student learning in mathematics and science. The most frequently offered responses at both time points were all inquiry related; they included the beliefs that learning should be hands-on or discovery-based, students learn best by doing, learning that relates to the real world is retained, and all students can learn. The most obvious difference was that the PT responses were more focused with 1.87 responses per teacher as compared to 2.85 PWS responses per teacher.

Questions 2 (PWS) and 9 (PT) asked about the ways teachers plan and implement units of study in their classrooms. The most frequently offered responses at both time points reveal that teachers plan with other teachers and base their planning on state standards and pacing guides, and implement using activities. On the PT, teachers also stated that they update and add new material to their old material. Again the most obvious difference was that the PT responses were more focused with only 1.47 responses per teacher as compared to 2.93 PWS responses per teacher, a reduction of half as many responses per teacher.

Questions 2 (PWS) and 11 (PT) asked what are some successful ways teachers assess student learning in their classrooms. At the PWS time point the top five strategies (in order of frequency) were: quizzes, tests, projects, questioning, and projects. At the PT time point the top five strategies (in order of frequency) were: open-ended questioning throughout the lesson, 3-2-1, tests, exit/entrance slips, and rubric grades projects and assignments. The PWS responses were more heavily weighted toward more traditional assessment strategies while the PT responses reflected assessments that would more likely be used to measure learning through inquiry. There were similar response rates at both time points with 2.76 responses per teacher on the PWS questionnaire and 3.00 on the PT questionnaire.

Questions 3 and 4 (PWS) and Question 2 (PT) asked about the impact of instructional strategies and teacher content knowledge on student learning. At the PWS time point teachers stated that their content knowledge and teaching strategies might impact student learning by providing them with more in-depth answers, leading to better learning, peaking student interest and engaging them, and matching instructional strategies to the learning styles of students. At the PT time point teachers viewed instructional strategies and content knowledge as both being necessary for student learning; neither was deemed more important than the other. The number of responses from PWS to PT was again reduced by approximately half (PWS=2.41 and 1.73; PT=1.33), indicating more focused responses by teachers after teaching the USC unit.

Question 9 (PWS) and Question 10 (PT) inquired about the characteristics of effective inquiry lessons. During both time points teachers offered many responses. The most frequent response on the PWS was lessons are based on a question that can be answered through inquiry and exploration. Responses to the PT questionnaire included students being actively engaged in asking then answering questions and lessons starting with what students know or think. Essential teacher actions focused on teachers as facilitators or guides at both time points. Student actions during the PWS time point focused on being engaged and focused problem-solvers who discover through hands-on exploration. During the PT time point the most frequently offered response was students take risks and explore to learn. The essential resources mentioned at both time points were manipulatives, materials to conduct investigations, and time. Additionally, the number of responses offered at each time point was high yet of a similar magnitude (PWS=4.68; PT=5.2).

Questions 10 (PWS) and 15 (PT) ask about teacher involvement in leadership activities. Again there was little change in teacher responses across the two time points. Teachers participated in both informal and formal leadership activities at the department, school, and

district levels. There were similar response rates at both time points with 2.22 responses per teacher on the PWS questionnaire and 2.73 on the PT questionnaire.

Questions 11 (PWS) and 16 (PT) ask teachers about the impact of having an iCoach on their ability to be involved in leadership activities. At the PWS time point teachers stated that their coaches encourage and motivate them, inform them of opportunities, and provide them with materials so they can participate in leadership activities. Similarly at the PT time point teachers said their coaches guided their efforts, modeled sharing with others, or encouraged other to seek them out to inquire about their experiences using inquiry in their classrooms. The response rate was almost identical with 1.08 responses per teacher at the PWS time point and 1.0 responses per teacher a the PT time point.

Overall, there was some variability in teacher perceptions from before the summer USC institute until after they provided instruction using the units from the institute. On three on the questions the average number of responses over this time frame decreased by approximately half. This indicate that as the teachers participated in the institute and tried out new approaches to teaching, their philosophies and ideas about effective instruction may have become more set therefore, resulting in more specific responses.

E. Analysis of Common Items across Groups

Questions asked of both iCoaches and teachers were compared. Three sets of questions were identified as being common to both groups (iCoaches and teachers) at the PWS and PT time points. The question asking about beliefs about student learning in mathematics and science elicited similar responses across both groups and time points. The only difference was that the iCoaches provided more responses than the teachers. When examining the questions regarding the impacts of instructional strategies and content knowledge on student learning there is a shift in teachers' responses over time which results in their responses aligning with those of the iCoaches at the PT time point. iCoaches did offer more responses than the teachers. The question that asked about the characteristics of effective inquiry lessons revealed very similar responses across both groups. The icoaches provided more responses to these questions; the teachers provided more developed and detailed responses.

One question was asked to both groups on the PT questionnaire only. This question asked about attendance at the academic year workshops and what was gained from them. For both groups most of the participants attended at least one academic year workshop (iCoaches=85.7%; teachers=73.3%) with a majority of both groups attending all of the workshops. Coaches gained more content knowledge and applications of the content learned, and opportunities to share collaborate, network, and plan. Teachers gained motivation to stay on track with inquiry, content knowledge and tested strategies, lessons, and ideas from colleagues. The number of responses per individual was very similar for each group (iCoaches=2.0; teachers=2.18).

Several (7) questions were asked of both the iCoaches and the teachers only at the post workshop (POWS) time point. These questions all pertained to the workshop and intentions to apply what was gained during the coming school year.

Question 1 for both groups asked what each group gained from the institute that they will take back and apply to their position. iCoaches cited confidence, knowledge and experience to work with teachers, teaching strategies and ideas that work, and content knowledge. Teachers cited questioning methods, new teaching strategies, and content knowledge. Much of what coaches and teachers gained was common to both groups. However, coaches were also focused

on what they had gained that will use when serving in their role as a coach. The response rate was similar with 2.86 responses per iCoach and 3.11 per teacher.

Question 2 for both groups asked what ways the content sessions were engaging. iCoaches and teachers both said the sessions were engaging because they were taught using inquiry. Understandings that were gained are also very similar for both groups: content knowledge; use of specific technology (coaches), specific mathematics calculations (teachers); the importance of connecting content from one level to the next. The response rate was higher for iCoaches with 2.57 responses per iCoach and only 2.00 per teacher.

Question 3 for both groups asked what new teaching strategies were learned during the institute. iCoaches listed inquiry strategies related to questioning, exploring, PBL, cooperative learning, and reflecting, and strategies focused on using new technologies. Teachers listed specific strategies: inquiry-based teaching, questioning, POE, wait-time, CER, and Jigsaw to name a few. The response rate was similar with 2.93 responses per iCoach and 3.09 per teacher.

Question 4 for iCoaches asked what new teaching strategies will you encourage while Question 3a asked teachers what new teaching strategies they will use. iCoaches listed content hooks, collaborative learning, wait-time, reflecting, questioning techniques, POE and interactive technologies. Teachers listed inquiry-based teaching, POE, questioning, wait-time, CER, and Jigsaw to name a few. These responses from both groups are similar but there is more similarity with what each group offered in the previous question. This indicates that coaches and teachers plan to encourage or use the strategies they learned at the institute. The response rate was similar with 2.79 responses per iCoach and 2.94 per teacher.

Question 5 for iCoaches asked what benefits they have experienced from learning alongside their teachers while Question 4 asked teachers what benefits they have experienced from learning alongside their iCoach. iCoaches will benefit from the common experience, increased professional collaboration, and improves rapport. All of these relate to the relationship between the coach and teachers. Teachers will benefit from feedback from their coach and many ways the coach can help and support them when teaching. These responses suggest the teachers are looking to the coach for what the coach can do for them. The response rate was similar with 1.64 responses per iCoach and 1.83 per teacher.

Question 9 for iCoaches asked what changes to teachers' instruction iCoaches anticipated would occur as a result of the coach's work with the teacher while Question 8 asked teachers what changes to their instruction did the teachers anticipate would occur as a result of working with their iCoach. iCoaches anticipated more inquiry-based teaching, more planning to encourage student engagement and content discovery, and in increased willingness by teachers to try inquiry-based instruction. Teachers anticipated implementing more inquiry-based strategies and instruction, reflecting on their practice with their iCoach, and more open-ended questioning. Both iCoaches and teachers were anticipating changes to instruction that were complementary. The response rate was fairly similar with 1.71 responses per iCoach and an increase to 2.16 per teacher.

Question 10 for iCoaches asked what effects on student learning iCoaches anticipated would occur as a result of their work with the teacher. Question 9 asked teachers what effects on students' learning did they anticipate as a result of working with their iCoach. iCoaches anticipated students would be more involved in learning, and learning and test scores would improve. Teachers anticipated students would learn and achieve more and be more engaged in learning. Both iCoaches and teachers anticipated similar impacts to student learning. The response rate was also very similar with 1.71 responses per iCoach and 1.58 per teacher.

V. Recommendations

1. The USC Inquiry Institute should continue as designed with only a few adjustments. These include;
    - Provide better definition of and discrimination between types of reflection,
    - Provide more experiences that address how inquiry can be implemented while addressing standards,
    - Continue to work on improving the relationship between coaches and teachers,
    - Continue to work on assuring that all teachers have an iCoach in their building and at the summer institute,
    - Continue to provide opportunities to teachers for lots of practice, reassurance, support, strategies for handling challenges, problem-solving, and reflection,
    - Continue to work with coaches and teachers to increase implementation of each component of summer units,
    - Continue to work with coaches and teachers to improve the level of implementation of inquiry to ensure inquiry is fully implemented.
2. There was a dramatic drop-off in participation on assessments. Some strategies to improve this situation may include:
    - Making assessments shorter (< 10 questions)
    - Developing different question formats that will take less times to answer
    - Providing greater incentives for completing assessments,
3. Within the responses to each item on the questionnaires there is detail of interest to individual instructors. All instructors should be given copies of the assessments for the iCoaches and teachers they taught in hopes that the instructors will read the responses from teachers and iCoaches in their groups and benefit from the detailed responses provided.