Coaching for Sustainability: Distance-Based Peer Coaching Science Inquiry

**Subject/Problem**

To improve teachers’ capacity in teaching science, professional development (PD) is required to successfully integrate inquiry knowledge and skills into effective classroom practices. (Banerjee, 2010; National Research Council, 2000, 2001). Results from a recent national science teacher survey showed that teacher inquiry knowledge and use of specific inquiry teaching strategies is lacking in classrooms, despite the fact that teachers view such strategies as important to students learning science (Author, 2011). This lack of inquiry knowledge and experience likely inhibits inquiry-based teaching and places serious limitations on teachers’ ability to plan and implement lessons (Blanchard, Southerland, & Granger, 2009; Capps & Crawford, 2013).

One of the obvious reasons science teachers do not retain and transfer the knowledge and skills they gain in professional development sessions is the lack of continuing support for them to incorporate changes in their classroom practices (Vanossdall, 2007). The national science teacher survey results also indicate the lack of support following PD, indicating the need for long-term sustainable support (Author, 2011). The present study aims to establish sustainable support for the teachers in rural schools in order to help improve science inquiry knowledge and skills. The study will identify key aspects of follow-up PD to retain and improve teachers’ skills in inquiry-based instruction over PD that the same teachers attended. Two core interventions, 3-day summer institute and peer-coaching practice during the school year, are applied for the science teachers who participated in PD in the prior year from Nebraska rural schools.

**Theoretical Background**

**Instructional and Peer Coaching**

An effective way to provide follow-up support is through instructional coaching by expert or peer teachers (Bransfield, Holt, & Nastasi, 2007; Cantrell & Hughes, 2008; Cornett & Knight, 2009; Showers & Joyce, 1996; Tobin & Espinet, 1989). Research has shown that teachers successfully implement new teaching strategies learned in the most common professional development format, a summer workshop, about 15% of the time; however, if the professional development includes coaching in transferring reform into the classrooms, the success rate of implementation reaches 85% (Cornett & Knight, 2009). Likewise, the influence of peer coaching in transferring reform into the classrooms has been much more effective than other PD without peer coaching (95% vs. 25%) (Joyce & Showers, 2002). However, although extensive research has been carried out on instructional coaching in the areas of literacy or mathematics, only few studies in science have been conducted (Bransfield et al., 2007; Kretlow, Cooke, & Wood, 2012; Tobin & Espinet, 1989).

**Distance-Coaching System in Rural Schools**

Teachers in rural areas are likely to be isolated and do not have easy access to PD opportunities (Kenny, Seen, & Purser, 2008). The in-service needs of rural and remote teachers cannot be addressed simply through the provision of more PD funding, there is substantial evidence for the need to develop more innovative approaches to providing effective in-service for rural teachers (Lyons, 2008). Distance-coaching can play a role in PD for teachers by improving access to colleagues and information particularly when schools are located in rural and remote areas (Kenny et al., 2008; Lyons, 2008). Thus, within rural educational settings, technology-mediated ongoing support through distance-based coaching for teachers could be one way to provide support in an efficient and cost-effective manner despite the distance. By
applying distance-based peer coaching, this study examines key aspects of the practice that supports not only teachers’ implementation of inquiry instruction, but also their students’ science learning and inquiry skills.

**Study Context**

Funded by a state funding agency, this present study has provided PD and peer-coaching science inquiry to 16 teachers in the state rural schools. The 16 teachers were recruited from 48 science teachers who participated in a larger federally funded project at a Midwest university in the U.S. with a 2-week summer workshop on the knowledge and skills for how to deliver inquiry-based science instruction in 2012. During the previous school year, the 16 teachers received approximately 8–12 coaching sessions over a 6–8 week period from experienced instructional coaches. Capitalizing on these experiences, in this present study, the summer institute focused on training teachers for transforming a traditional science lesson into a guided inquiry instruction and practicing the distance-based coaching with the necessary technologies. During the following 2013–2014 school year, when teachers implemented their developed inquiry lesson plans they received three distance-based peer coaching sessions by a partnered peer teacher.

**Research Questions**

This study aimed to sustain the PD effects, to improve teachers’ competency in developing science inquiry lessons, and to expand the coaching model effectively across the state. The following research question was addressed throughout this study:

What is the value added effects of follow-up PD and peer-coaching practice over a previous PD on teachers’ inquiry knowledge and inquiry-based instruction, and their student inquiry knowledge and attitude?

This study proposes an innovative idea to establish sustainable support for teachers in rural schools to improve their knowledge and skills in science inquiry. The distance peer-coaching model will demonstrate the effects on middle and high school science teachers’ improvement of science knowledge and skills to teach students science inquiry in accordance with the national and state standards.

**Design/Procedure**

**Participants**

Out of 16 teachers, eleven teach high school science, and the other five, middle school science, including physical science, chemistry, life, and earth science. The teachers brought one lesson plan to transform into a guided inquiry lesson to the summer institute. The content that they worked on are varied e.g., wave, motion, bacteria, matter, periodic table, and etc. They were paired for peer-coaching according to the grade level and content of the lessons that they worked on during the summer workshop.

**Interventions**

This study includes two major interventions for the 16 science teachers: (1) 3-day summer institute and (2) peer-coaching practice during the following school year. First, during the summer institute, teachers learned critical elements of guided inquiry instruction, spent time to transfer one of their lessons into a guided inquiry lesson (see Figure 1). They presented the
developed inquiry lessons and received feedback from peer teachers and project staff. In addition, they practiced peer-coaching with their assigned teachers by using WebEx video conferencing software. Second, the developed lessons implemented in their classroom during a 2-4 week period in the school year 2013-2014 and 3-12 lessons were video recorded for teacher self-reflection and peer-coach review. Each teacher participated in six distance-delivered coaching sessions (3 as a coach and 3 as a coachee) by using WebEx videoconferencing software, where the paired teachers jointly discuss successes and challenges to more successfully implement the inquiry model of instruction in their classrooms.

Figure 1 Example a part of lesson plan flipped by a participant teacher during the 2013 summer institute

Data

Data from the teachers include the following: (1) 83 video-recorded classroom instructional sessions, (2) inquiry instruction assessment data coded by 3 different observational protocols, (3) pre- and post- teacher inquiry knowledge and attitude surveys, (4) pre- and post-student inquiry knowledge and state standardized science achievement practice tests, (5) peer-coaching protocols completed by teachers, and (6) interviews with 6 teacher participants regarding the summer institute and peer coaching process. Teacher outcomes were assessed at three time points: pre summer PD, post summer PD, and post peer-coaching by using the instruments developed or used in the CSI study. The teachers also completed a student inquiry rubric, which assesses each of their students on the skills necessary to do scientific inquiry as specified in the standards (NRC, 1996). In addition, all peer-coaching sessions were recorded by using WebEx and coded by the project staff to evaluate the peer coaching process. Students of the teachers participating in this study were assessed via a project-developed inquiry knowledge test, a standardized inquiry practice exam, and a student science attitude questionnaire that includes measures of self-efficacy and science attitude. Data collection also occurred at three times.

Results

Teacher outcomes: All the attitudinal instruments are 5-point Likert scale surveys administered in the beginning of summer institute, post summer institute, and after the lesson implementation with peer-coaching. Teachers’ confidence in both developing inquiry lesson plans and peer-coaching significantly improved (p < .01) right after the summer institute and their confidence maintained throughout the 2013-1014 school year. Teachers’ inquiry knowledge significantly improved (59.6% to 68.75%, p < .01) after 2012 CSI summer institute and maintained throughout 2012-2013 school year (68.75% to 65.87, p > .05). Of the teachers from the first year CSI PD, both the teachers who were in this present PD and teachers who were not in this PD have sustained their inquiry knowledge
level. However, the teachers’ inquiry knowledge in the CSI control group in 2012 decreased (61.14% to 56.16%, \( p > .01 \)). Teacher confidence in implementing guided-inquiry also significantly improved (80.38% to 93.29%, \( p < .01 \)) after 2012 CSI summer institute and maintained throughout 2012-2013 school year (93.29% to 94.79%, \( p > .05 \)). In addition, the teachers’ confidence in teaching science as inquiry significantly improved (94.79% to 98.63%, \( p < .05 \)) throughout 2013-2014 school year again while the teachers who were not in this project from CSI treatment group have maintained their confidence level (92.13% to 91.15%, \( p > .05 \)). However, the teachers in the CSI control group in 2012 have not shown any improvement in their confidence in guided-inquiry instruction.

**Student Outcomes:** Although it is not significant, the student inquiry knowledge test results showed a clear trend of students’ improvement in both middle (62.29% to 65.57%, \( p > .05 \)) and high school (69.46% to 72.06%, \( p > .05 \)) inquiry knowledge tests throughout the school year. In the high school state standardized science practice tests, both students in this study showed significant improvement (46.80% to 50.58%, \( p < .05 \)) while the students in the control group did not improve significantly (44.57% to 46.46%, \( p > .05 \)).

**Summary and Conclusions**

As shown in the results of quantitative and qualitative data, the teachers’ science inquiry knowledge, confidence in inquiry instruction, and self-efficacy for developing inquiry instruction and peer-coaching improved significantly after the summer institute and was maintained throughout the school year with receiving coaching support from one of their peer teachers. These changes led the teachers’ continuing implementation of guided inquiry instruction throughout the 2013-2014 school year not just for the target group of students but all the students they taught. The results also showed that this study demonstrated how a follow-up PD and distance-based peer coaching play roles in a PD for teachers particularly when schools are located in rural and remote areas. In addition, the teachers developed the skills of being a peer instructional coach to develop other science teachers with much more reflective on their own instructional practices. This model of coaching as a form of instructional support is a more sustainable and alternative than dedicated instructional coaches and this model has potential to be replicated for pre- and in-service science teachers in school districts or education institutes. For example, another science inquiry project in the state is currently providing PD for science teachers across the state as part of a granted PD project. Overall, we conclude the value-added benefits of distance-based peer-coaching from the results below:

- Continued implementation of guided-inquiry instruction throughout the second school year
- Sustained inquiry knowledge level increased after the first year summer institute throughout the second school year
- Improved confidence & self-efficacy in teaching science as inquiry
- Formed and continued teacher community with sense of belonging in rural schools
- Equipped systematic self-reflective practice on teaching and student learning
- Improved students’ scientific inquiry knowledge and science achievement

In addition, the example teacher comments from the interviews and surveys showed the effective self-reflective on their teaching and student learning with this peer-coaching practice.

“As a coach I enjoyed looking critically at another person’s teaching because it made me think about my own as well as the whole process of inquiry. As a
teacher I appreciated reflecting on my own teaching as I watched my own videos and hearing another’s perspective about things happening in my classroom.”

“As a teacher it helped me to see what I was missing in the inquiry process and helped me to realize that I need to work on more in depth questions. As a coach it helped me to see what I could do better myself and it was just nice to see someone else model the process.”

“The greatest benefit that I received from the coaching role was the ability to observe a teacher implementing an inquiry lesson and having the opportunity to objectively analyze the lesson. This objective analysis helped me reflect on my own teaching and identify areas of improvement. In the teacher role I benefited from having another science professional to brainstorm ways to improve or modify parts of the lesson.”

**Contribution to Science Teacher Education and the Interests of NARST Members**

With the idea of sustainable support for science teachers for improving science inquiry knowledge and skills by using the distance-based peer coaching model, this present study would be most interesting to science teachers, faculty members in teacher education, developers of teacher PD programs, and curriculum developers. By implementing a distance-based peer coaching model, science coaching experiences can continue without the ongoing need for an external coach. These ongoing coaching experiences provide the needed follow-up support to better ensure that teachers maintain and potentially increase their skill in implementing guided scientific inquiry within their classrooms. For the long term, the distance peer coaching model can also be replicated by other school districts. One of the long-term goals of this project is to incorporate this distance-supported peer coaching system into existing state or national educational structures (e.g., metropolitan or rural school districts) by providing sustainable and credible resources and developing a pool of science instructional coaches. An outcome of this study will be a tested and effective distance-based peer coaching model, which will connect teachers from several school districts across a state or states. This distance-based peer coaching model will enhance teachers’ collaboration with peer teachers, science educators, or faculty members at the K-12 and higher education levels.

**Select References**

Author (2011).
Suggested Citation:


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