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Coaching for Sustainability: Distance-Based Peer Coaching Science Inquiry in Rural Schools[1]

Soon Chun Lee, Gwen Nugent, Gina Kunz

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Introduction

The need for science teachers to improve their capacity and efficacy in secondary science teaching has demanded professional development (PD) to help teachers successfully integrate science inquiry knowledge and skills into effective classroom practices (Banerjee, 2010; National Research Council, 2000, 2001). Results from a recent science teacher survey showed that teacher inquiry knowledge is lacking and that use of specific inquiry teaching strategies is also lacking in their classrooms despite the fact that teachers view such strategies as important to students learning science (Nugent, et al., 2011). This lack of inquiry knowledge and experience likely puts a barrier for inquiry-based teaching and serious limitations on teachers' ability to plan and implement lessons (Blanchard, Southerland, & Granger, 2009; Capps & Crawford, 2013).

Although there are many science curriculum and training programs to enhance science teachers' inquiry skills, their impact on teacher and student behaviors has not been clearly demonstrated in secondary science classrooms (Asay & Orgill, 2010; Kazempour, 2009). One of the most obvious reasons science teachers do not retain and transfer the knowledge and skills gained in professional development sessions is the lack of continuing support for them to incorporate changes in their classroom practices (Vanosdall, 2007). Research has shown that PD models involving longer duration are likely to be more effective than individual PD sessions. They enable greater opportunities for the teachers to try new ideas, to observe and be observed, to discuss outcomes and to obtain feedback from colleagues (Asay & Orgill, 2010). The Nebraska science teacher survey results also indicate the lack of support following PD indicating the need for long-term sustainable support (Nugent, et al., 2011). This present study aims to establish sustainable support for the teachers in Nebraska rural schools for improving science inquiry knowledge and skills. The purpose of this study is to identify key aspects of follow-up PD to retain and improve teachers' skills in inquiry-based instruction over a PD that the same teachers attended. Two core interventions, 3-day summer institute and peer-coaching practice during the school year, are applied for the16 science teachers who participated in a 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; Kohler & Crilley, 1997; Murray, Ma, & Mazur, 2009; Showers & Joyce, 1996; Tobin & Espinet, 1989). In order to implement changes in a sustained manner, teachers need effective self-reflective practices with follow-up assistance from an instructional coach to provide feedback, support, and advice on how to incorporate changes into the context of the classrooms (Asay & Orgill, 2010; Tobin & Espinet, 1989). One of the most important lessons that researchers have learned was that it is difficult for teachers to diagnose their own weaknesses (Tobin & Espinet, 1989). Therefore, in order to implement changes in a sustained manner, the teachers need to do effective self-diagnoses and need to have follow-up assistance of a coach to provide feedback, support, and advice on how to incorporate changes into the context of the real classroom (Cantrell & Hughes, 2008; Murray et al., 2009; Showers & Joyce, 1996; Thijs & van den Berg, 2002; 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 (Cornett & Knight, 2009). However if the professional development includes coaching in transferring reform into the classrooms, successful 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). In science education, however, although extensive research has been carried out on instructional coaching in the areas of literacy or mathematics, only few studies have has rarely been tried, both in Nebraska and nationally (Bransfield et al., 2007; Kretlow, Cooke, & Wood, 2012; Tobin & Espinet, 1989).

Distance-Coaching System in Rural Schools

According to the Nebraska Department of Education, about 91.4% public schools are located in rural areas (923 out of 1,010) (NDE, 2012). Teachers in rural areas are likely to be isolated and do not have easy access to PD opportunities (Adams et al., 2008). The in-service needs of rural and remote teachers cannot be addressed simply through the provision of more PD funding. The National Survey data provided substantial evidence of the need to develop more innovative approaches to providing effective in-service for rural teachers (Lyons, 2008). Distance-coaching system can play the role in the PD and follow-up support for teachers by improving access to colleagues and information particularly when schools are located in rural and remote areas (Kenny, Seen, & Purser, 2008). The portion of schools in Nebraska rural areas demand an effective distance-coaching system to improve teachers' confidence in using it, accessibility, and the availability of the equipment and system that offers the potential of being a helpful means of maintaining ongoing networks of teachers engaged in various internet-based activities (Kenny et al., 2008). Thus, within rural educational settings, technology-mediated ongoing support through distance-based coaching for teachers could be one way to provide support in a reasonable manner despite the distance. By applying distance-based peer coaching, this study examines key aspects of the practice that support not only teachers' implementation of inquiry instruction but also their students' science learning and inquiry skills.

Study Context

The project funded by Nebraska's Coordinating Commission for Postsecondary Education (CCPE) 2013, *Coaching for Sustainability: Peer Coaching Science Inquiry in Rural Schools,* will provide additional PD and peer-coaching science inquiry to 16 teachers in Nebraska Rural Schools. This project is designed to aim at improving the teachers' inquiry knowledge and skills and expanding its impacts more widely in Nebraska rural areas. The 16 teachers were recruited from 48 science teachers who participated in the federally funded *CSI: Coaching Science Inquiry in Rural Schools* (CSI) project at UNL with a 2-week summer workshop on the knowledge and skills for how to deliver inquiry-based science instruction in 2012. During the following school year 2012 – 2013, the teachers implemented inquiry lessons in their classrooms, while receiving intensive, on-going, technology-supported instructional coaching from CSI-based science coaches.

However, it has been recognized that teachers need to acquire skills in developing their own inquiry-based lessons through the CSI study. This need was clearly evident from the evaluations

of the CSI Summer Institute in 2012. In open-ended comments on the post evaluations, 20% of the teachers stated that they would like the opportunity to learn how to translate their own lessons into inquiry lessons. Thus, in this presented study, we aimed to develop the teachers' ability to transform a traditional science laboratory lesson into a guided inquiry-based science lesson during the 2013 summer institute. During the previous school year, the 16 teachers received approximately 12-16 coaching sessions over a 6 – 8 week period from the CSI instructional coaches. Capitalizing on these experiences, in this project, we paired teachers with other teachers to continue the coaching using a peer-coaching model instead of an expert coach. This present study will examine key aspects and the effect of this peer-coaching model that has the potential to extend science coaching more widely in Nebraska, without hiring a cadre of expert coaches.

Research Questions

This previous study, *CSI: Coaching Science Inquiry in Rural Schools,* provided the basis of the presented study, *Coaching for Sustainability: Distance-Based Peer Coaching Science Inquiry*, which aims 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 questions will be addressed through this presented study:

1. What are the key aspects of follow-up PD that improve teacher competency in developing and implementing guided inquiry lessons?
2. What are the key aspects of a peer-coaching practice that support teachers' implementation of the guided inquiry lessons?
3. What is the value added effects of follow-up PD and peer-coaching practice over a previous PD on student inquiry knowledge and skills?

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

Method

Participants

16 teachers in CSI study were approached at the proposal stage based on recommendation from the CSI instructional coaches who worked with the teachers in the previous school year. With the teachers' confirmed interest, the school administrators provided letter of support and commitment. There was no specific selection process but CSI teachers' willingness to participate and coaches' recommendation based on their experiences with the teachers. Once all participating schools/teachers are identified, teachers will be paired with another teacher according to the grade and content area as a peer coach and teacher.

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 received instruction and practice on how to transform traditional science laboratory lessons into guided inquiry-based science lessons. In addition, each participating teacher was paired with one other teacher according to subject area and grade level to develop their own inquiry lessons as a co-developer and a co-teacher. They presented the developed inquiry lessons and received feedback from their peer partners during the distance-based peer coaching practices. After the presentation and peer coaching practice, teachers received practical feedback about the lesson and coaching science inquiry from the CSI instructional coaches and University education faculty. Second, during the school year 2013-2014, each teacher will have three sessions as the teacher receiving the peer coaching and three sessions as the coach. The distance-based peer-coaching will occur after the teachers implement the lesson that the teachers developed in the summer institute.

Data Collection

Data will be collected from the teachers including: (1) approximately 3-6 video-recorded classroom instructional sessions, (2) teacher inquiry knowledge and attitudes, (3) teacher assessment of student inquiry skills, (4) peer-coaching protocols completed by teachers, and (5) surveys and interviews of teacher participants regarding the summer institute and peer coaching process. Teacher outcomes will be 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 will also complete 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). All peer-coaching sessions will be recorded by using WebEx and viewed by the project staff to evaluate the peer coaching process. In addition, teachers will complete short surveys regarding their experiences with the follow-up PD and peer-coaching experiences.

Students of the teachers participating in this study will be 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 will also occur at three times, with different instruments being completed at each time point. The project-developed inquiry knowledge test will be administered at the beginning of the school year and after the teacher has completed the designated inquiry instructional unit.
To answer the first research question, the teachers' data of this present study will be analyzed and compared with the data from the same 16 teachers collected after the summer PD in the CSI study. The data will include teacher surveys, interviews, and classroom observations. For the second research question, the teacher data completed right after 2013 summer institute will be analyzed and compared with the data that will be completed after their peer coaching practice. Lastly, to answer the third question, student data of this present study will be compared with the data from the last year students of the same teachers. The student data include student inquiry knowledge, state science standardized tests, teachers' assessment of student inquiry skills, and student attitudinal surveys.

Contribution to Science Teacher Education

With the idea of sustainable support for science teachers for improving science inquiry knowledge and skills after a PD by using distance peer-coaching model, this present study would be most interesting to science teachers, faculty members in teacher education, developers of teacher PD programs, or curriculum developers. This study will demonstrate the contribution to improving the Science Teacher Education both regionally in the short-term and nationally in the long-term. For the short term, this study will provide the skills necessary for 16 Nebraska rural science teachers to increase their proficiency and efficacy to improve approximately 1,000 students' science content knowledge and inquiry skills in Nebraska rural areas in 2013-2014 alone. By implementing a 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 insure 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 school districts not only in a state but also throughout the states with the identified key aspects resulted from this study. One of the long-term goals of this project is incorporating 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

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