TECHNOLOGY-BASED SUPPORT FOR RURAL TEACHERS' SCIENCE CLASSROOM INSTRUCTION

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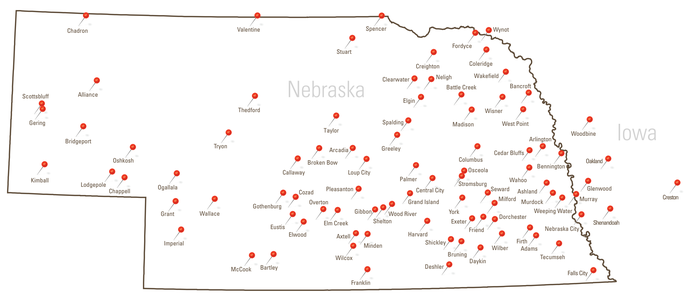
ABSTRACT

Geography routinely poses challenges for teachers in accessing ongoing instructional supports through high quality professional development. Further, science teachers in rural middle and high schools often are isolated from professional colleagues as one teacher could be solely responsible for delivering science education to all students in grades 6-12 in a school building. The **CSI: Coaching Science Inquiry in Rural Schools** research study is currently investigating the use of technology to provide ongoing support through coaching to rural science teachers throughout Nebraska and into Iowa. In this study, coaching was delivered via distance technology approximately twice a week for 6-8 weeks during the school year. Coaching followed an 8-day high quality professional development summer institute. During the summer institute, teachers learned and practiced guided inquiry-based instructional strategies, and the follow up coaching sessions facilitated teachers' translation of newly learned instructional skills into their classrooms. The study design involved teachers being randomly assigned either to a treatment group (n=47) in which they participated in the summer institute and received follow-up coaching or a control group (n=43). Multiple technologies were used in this study: Cisco WebEx Web-based videoconferencing for the coaching sessions, GoPro video cameras to record classroom instruction, and digital Dropbox to share the videos and other electronic documents. Benefits and challenges associated with each of these technologies are presented, as well as teacher and coach perceived benefits and challenges of using technology as the vehicle for ongoing teacher support in rural schools.

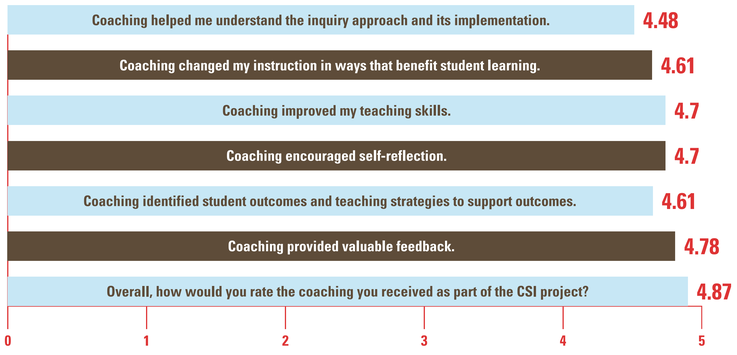
RESEARCH STUDY

The **CSI: Coaching Science Inquiry in Rural Schools** study (IES, Grant # R305C090022) is being conducted through the National Center for Research on Rural Education (R²Ed), which is housed within the Nebraska Center for Research on Children, Youth, Families and Schools (CYFS) at the University of Nebraska-Lincoln's College of Education and Human Sciences. Research conducted through R²Ed contributes to data-based understanding of what works, for whom, and under what conditions within the rural context. Specifically, research studies focus on instruction, professional development for teachers, and using coaching as a support for teachers in translating the content of professional development to authentic classroom contexts. CSI is a large-scale randomized trial investigating effects of professional development in guided science inquiry and science coaching delivered to teachers via distance technology. CSI professional development targets Nebraska state standards for science inquiry, science inquiry instructional strategies, supports for classroom implementation, and student engagement in science inquiry.



119 science teachers **109** schools in Nebraska & Iowa **~4000** students in grades 6-12

Teacher Evaluation of Coaching Process

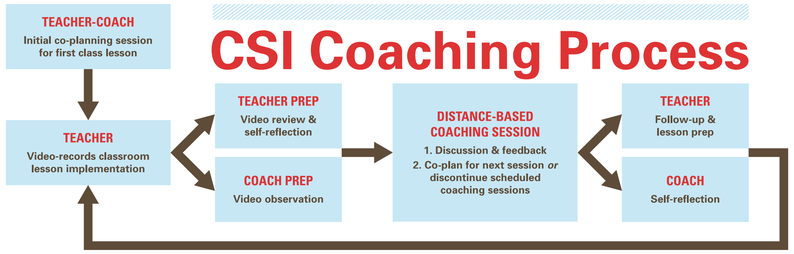


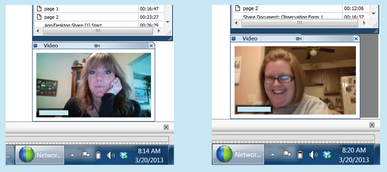
National Center for Research on Rural Education (R²Ed)

CYFS

DISTANCE-BASED, TECHNOLOGY-DELIVERED COACHING

- Provides ongoing teacher support to supplement professional development
- Coach-teacher relationship is viewed as a partnership
- Sessions are teacher-driven: The teacher decides what to present in each lesson and what student outcomes to target
- Coach's role is to support positive skill acquisition, help the teacher implement lessons in the classroom, and provide valuable feedback
- Built around pointing out specific positive skills that teachers demonstrate and designed to help teachers recognize and modify areas for improvement
- Coach supports and guides teachers to engage in reflective practices that allow them to truly master skill sets and be able to consistently apply them in the actual situations





This side-by-side screen shot of an active technology-delivered coaching session shows what the teacher sees (left) and what the coach sees (right)

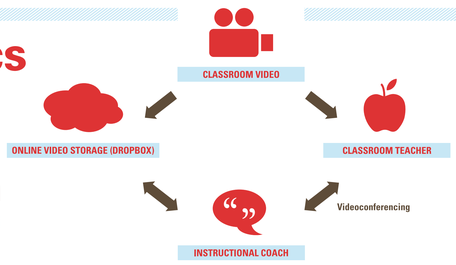
The visual and audio capacities of WebEx videoconferencing make it feel as though the teacher and coach are in the same place, thereby promoting trust, respect and enhanced interaction

CSI COACHING

- Delivered via WebEx , a Web-based videoconferencing application that allows the teacher and coach to view classroom videos simultaneously, share desktops or electronic files, and video-record coaching sessions
- Sessions typically last 45-60 minutes
- Includes positive feedback from the coach, a review of student outcomes observed by the teacher and coach, a snapshot of student skills by the teacher with feedback from the coach, and a detailed discussion of the lesson – what worked well and why, what didn't work and why, how the students were impacted by lesson implementation, and directions for the next lesson
- During each coaching session, the teacher and coach:
  - follow a protocol as a guide
  - share video clips of specific teacher behaviors and strategies that led to desired student outcomes
  - use teacher and student inquiry rubrics to assess the lesson and plan the next one
  - identify areas that can be improved and exchange ideas about strategies to support improved implementation that are likely to lead to desired student outcomes
  - plan for the next lesson and schedule the next coaching session
- Begins with an initial session to practice the technology and co-plan the first classroom lesson implementation
- Teacher implements and video-records the classroom lesson and uploads file to the shared folder on Dropbox
- Teacher and coach independently review the classroom video to prepare for the coaching session
- They engage in a coaching session discussion based on the video-recorded classroom lesson implementation
- They co-plan for the next classroom lesson implementation and schedule the next coaching session
- Teacher follows up with any preparation needed for the next class implementation, and the coach engages in coach self-reflection for the coaching session
- Process loops back to the teacher, who implements and video-records the next classroom lesson; the process continues for 1-2 coaching sessions per week over a period of 6-8 weeks
- The coach and teacher mutually decide when to discontinue the regularly scheduled coaching sessions

CSI Logistics

Teacher-Coach Technology Connection



- Sample scenario:
  - Monday: Coaching session to co-plan classroom lesson implementation
  - Tuesday: Teacher video-records classroom lesson implementation and uploads video to digital Dropbox to share with the coach; teacher and coach independently view the video and prepare for the next coaching session
  - Wednesday: Coaching session to review recorded implementation and to co-plan for the next coaching session
  - Thursday: Teacher video-records classroom lesson implementation and uploads video to digital Dropbox to share with the coach; teacher and coach independently view the video and prepare for the next coaching session

TECHNOLOGY USED	BY WHOM	PURPOSE(S)	ADVANTAGES	DISADVANTAGES	WHAT'S WORKING WELL	BUGS OR GLITCHES
GoPro camera	Teachers	Video-record classroom lessons for coaching session; data collection for teacher & students outcomes	Small size (about 3" square); easy to use & place; no tripod; relatively unobtrusive; connects to computer to upload video; large storage card; low cost (~$250); wide viewing angle; USB interface	Has to be charged; can't record while charging; controls are small, making it easy to select incorrect recording mode	With practice, teachers are using them well & love them as classroom recording devices	A few cameras have failed (faulty equipment)
Azden lavalier microphones	Teachers	Recording teacher classroom audio	Good sound quality; low interference; adequate range; LED connection indicators; multiple frequency; reasonable cost (~$150)	9V batteries need to be replaced every 10 hours	Easy to hear teacher & students in close proximity to teacher	Occasional teacher problem with seating plug into camera microphone input
WebEx videoconferencing	Teachers & coaches	Coaching sessions	Stable platform; Web-based software; ability to record & share desktop & files (including video); relatively low bandwidth requirements; no cost for teachers; allows for multiple users; easily integrates with Outlook Calendar	Requires software installations on computers; periodic WebEx server downtime; free account limited in storage; not fully functional with all mobile devices (e.g., iPad)	After initial installation, minimal effort to connect; recording session is preset; includes chat function within interface	Recorded sessions require special player to view (available free from WebEx); initial setup for teachers requires installation privileges on teacher machine; service blocked by some local networks (schools); occasional bandwidth issues
Dropbox	Teachers & project manager	Transfer large video files to coach	Transfer large video files (~3 GB per hour of recording); shared folder capability with multiple users; no cost for basic account with 3-5 GB storage; larger storage required for study (~$750 per year for 1 TB and 5 users)	Time to transfer large files dependent on internet traffic & bandwidth availability; interrupted transfers do not automatically restart; limited space available on free accounts; transfer rate slower with more simultaneous users	Files generally transfer with good fidelity & in reasonable amount of time; Dropbox works well with project-developed script to copy files to server & delete original from teacher Dropbox to free up space	File upload interruption can lead to file corruption or failure to upload; teacher machines cannot go into sleep mode when upload in progress; access blocked by some school networks
Videos of classroom sessions	Teachers, coaches & data coders	Reflection on lesson by teacher & coach; coding by coaches & data coders	Teaching artifact to document growth; powerful tool in observing positive teaching strategies; useful in the coaching process to address areas for improvement	Students can be distracted by camera & microphone setup (usually diminishes within a short period of time); initial recording process can be cumbersome; teachers do not always review the video	Video facilitates teacher reflection & shows positive practices to build teacher confidence; reviewing problem areas allows teacher & coach to co-develop ways to improve student learning	Teachers do not always watch the videos & reflect on their instruction
Digital videos of WebEx session	Coaches, data coders & teachers	Reflection on coaching session by coach; fidelity coding by data coders	Artifact for coach & teacher reflection	Viewing of WebEx videos requires the download of a special player	Recordings provide training tool for coaches to improve their skills & reflect upon teacher growth	WebEx chats within video sessions are not recorded