Evaluation of the Quality Elementary Science Teaching (QuEST) Discovery Research K–12 Grant: Annual Report for Year 4

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Introduction

The **Quality Elementary Science Teaching (QuEST)** program is designed to deliver high-quality professional development (PD) in science content to elementary school teachers. QuEST includes both content and pedagogical instruction combined with a controlled teaching experience situated within a larger professional development context. The design of the PD is meant to provide meaningful and sustained changes in teachers' knowledge and practice, in turn leading to improvements in student learning. Through better understanding of how various settings for teacher learning give rise to different kinds of knowing, the aim of the QuEST project is to develop a scalable model for implementing situated PD.

The overarching goals of this four-year National Science Foundation–funded Discovery Research K–12 project include the following:

1. Implement a high-quality situated PD model for K–6 teachers in science.
2. Conduct a comprehensive and rigorous program of research to study the impacts of this model on teacher and student learning.
3. Disseminate project outcomes to a variety of stakeholders to produce broader impacts.

Description of the QuEST Project

The QuEST project runs through three yearlong cycles of PD, each starting with a summer institute, from summer 2014 through spring 2017. Each summer institute has had a different physical science content focus (magnetism, electrical circuits, properties of matter). For the research design, a total of 28 initial schools were recruited from across 7 school districts in Missouri. Within each district, participating schools were randomly assigned to conditions, including Treatment 1 (controlled teaching experience PD), Treatment 2 (no controlled teaching experience PD), and a group of comparison schools. The 2016 summer institute was attended by fifth-grade teachers from 19 of the Treatment 1 and 2 schools across the original 7 school districts. Teachers from the comparison schools were offered a two-day summer workshop in July of 2016.

The design of the summer institute each year is intended to investigate the effects of a controlled teaching experience that occurs during the second week of the two-week institute. In 2016, both Treatment 1 and 2 groups participated in the same Week 1 activities of the summer institute, including the focus science content knowledge and introductions to the use of the 5E model of instruction and Universal Design for Learning (UDL) in the classroom. However, in Week 2 only the Treatment 1 group participated in the controlled teaching experience, implementing the lessons and practices they learned in Week 1 with students who enrolled in the Kids QuEST program. In order to ensure both groups received equivalent hours of PD, the Treatment 2 group participated in similar activities during Week 2, focused on applying what they learned in Week 1 to designing instruction—but those activities did not extend to actual implementation with students. Treatment 2 teachers engaged in identifying key concepts in the Missouri Grade Level Expectations (GLEs); discussing professional literature related to the 5E, formative assessment, and UDL; critically evaluating sample lessons in terms of content accuracy and the appropriateness of instruction and assessment; and, using UDL as a framework, adapting activities and assessments for a wide range of learner interests, needs, and abilities. To ensure the main difference between the treatment groups was the controlled teaching experience, all teacher participants were invited to attend four full-day Saturday follow-up sessions during the academic year.

QuEST Evaluation Design

The Educational Policy Improvement Center (EPIC) is serving as the grant evaluator, focusing on the meta-level functioning of QuEST and the progress made toward achieving its three overarching goals: implementation of a high-quality situated PD model (Goal 1), comprehensive rigorous research on the model's impacts (Goal 2), and dissemination of project outcomes (Goal 3). The first step in the evaluation included a meeting with the project staff in November of 2013 to review project timelines, strategies, and milestones, serving to provide structure to the evaluator's final plans for monitoring and assessing the project. Year 1 evaluation activities also included instrument development, Advisory Board attendance, and coordination with the project researcher on the research design. Years 2 and 3 evaluation activities included evaluation of the summer institutes and follow-up PD sessions, and review of school-level achievement data. Year 4 evaluation activities included all activities in Years 2 and 3 plus presentation of evaluation activities to the Advisory Board.

Year 4 Evaluation Activities

This report focuses on the evaluation activities in Year 4 of the grant, which began with the observations of the 2016 summer institute and concludes with the end-of-year teacher survey in April and May 2017.

Professional Development Implementation (Goal 1)

The evaluation question for this component asks to what extent the QuEST project has achieved its goal within the expected timetables using the stated principles and processes (summer PD, situated PD experience, quarterly follow-up sessions). EPIC evaluators examined the factors that facilitate or hinder implementation plans and the ways in which the project staff managed and overcame barriers. To determine the extent to which the PD implementation achieved its goals, the following data collection efforts occurred:

- **Observations of Summer PD Events:** The evaluation team observed almost all days of professional development during the summer institute of 2016. Researchers modified and used an observation protocol based on Learning Forward's Standards for Professional Learning[1] to determine the extent to which the PD sessions incorporated the standards of best practice in teacher professional development. EPIC evaluators used the structured protocol on best practices in teacher professional development across a total of 18 QuEST professional development sessions held during the weeks of July 11–22, 2016. A session here is defined as either a morning period of time or afternoon period of time, in which a particular learning activity took place. The observations occurred on all days of the first week of the institute and on days 1–4 of the second week.
- **Teacher Focus Group Interviews:** EPIC evaluators conducted focus groups with teacher participants in the QuEST summer institute during the second week of the 2016 summer institute. To gain a deeper understanding of the professional development participant experience, focus groups were held with three groups of institute attendees. Teacher focus group participants were selected to obtain equitable representation from the districts and schools involved. Focus groups were structured based on the participants' role in the QuEST project: Treatment 1 (situated PD treatment) members, Treatment 2 (content training but no situated PD treatment) members, and preservice teachers. All focus groups were held between July 20 and 22, 2016, and conducted by an EPIC evaluation team member. EPIC evaluation team members developed a focus group protocol designed to achieve the following:
    - Gauge teacher satisfaction with professional learning.
    - Determine whether teachers mastered new knowledge and skills.
    - Gather teacher perceptions on how applicable the new knowledge and skills will be to their classroom.

[1] See http://learningforward.org/standards#.VaiCS7cS2bg

- Focus group sessions were audio recorded. All participants provided oral consent to participate and be recorded. Audio recordings were transcribed, and responses then were organized and thematically analyzed using NVivo qualitative software. Once themes were identified, data were summarized by participant category.
- **Project Stakeholder Interviews:** Following the summer institute, EPIC evaluation team members conducted debriefing sessions with groups of individuals involved in the institute. The sessions were conducted via WebEx conferencing. Debriefing sessions were structured by the role that individuals played during the summer institute: principal investigators, the faculty/teacher instructional staff, graduate research assistants (GRAs), and the project support staff. Individuals were asked to provide feedback on the summer institute in terms of what went well, what challenges were encountered, and recommendations for future institutes. Recordings of the debriefing sessions were summarized across and within participant categories.
- **Observations of Quarterly PD Follow-up Events:** EPIC evaluators attended one of the four Saturday follow-up sessions in academic year 2016–17, on April 8, 2017. The same observation protocol used in the summer institute was used to provide feedback on best practices in teacher PD.
- **Teacher Survey:** A teacher survey was developed in conjunction with the QuEST staff and administered during the final follow-up PD session on April 8, 2017, to assess the outcomes of participation in the QuEST project, including perceived impact on teacher science content knowledge, pedagogical content knowledge, and classroom practice.

  Other ongoing activities that occurred throughout the year include the following:

  - Review of QuEST project artifacts (e.g., reports, internal communications regarding project progress, and agendas and minutes of key planning meetings)
  - Review of QuEST products (e.g., PD materials, ConcepTests, and other PD resources)
  - Regular check-in meetings with project principal investigators

Research (Goal 2)

The evaluation questions for this component ask to what extent the QuEST project research phases are implemented as proposed and to what extent the implemented research plan has answered the four identified research questions. Evaluators examined factors that facilitate or hinder the research program and how the project staff managed and overcame barriers. Data collection activities included the following:

- **Project Stakeholder Communication:** A combination of formal interviews and regular informal phone conference meetings was used to check on progress toward project goals throughout the year.
- **Advisory Board Meeting:** EPIC evaluators attended and presented at the final advisory board meeting on May 18, 2017.
- **Review of QuEST Project Artifacts:** The QuEST staff and EPIC evaluators both had access to and used the project management tool Asana in order to share and review relevant assessment tools and the data associated with the development and implementation of the tools.
- **Proximal Data Review:** EPIC evaluators reviewed project research data collected by the QuEST project staff on an ongoing basis, both at the teacher level (i.e., teacher data from MOSART, ULC instrument, UDL test, observation protocols, lesson plan tasks/ interviews, CoRE and PaPeRs data) and the student level (i.e., ConcepTest results). The purposes of these reviews include spot-checking research findings, assessing reliability of observations, and incorporating the project research data into the evaluation data sets to assess progress toward objectives.
- **Distal Data Review:** EPIC evaluators worked in conjunction with the QuEST staff to retrieve and review the analysis of Missouri Assessment Program (MAP) school- and grade-level results in science (Grade 5), mathematics, and reading. (Note: In school year 2013–14, a revised assessment system was implemented in Missouri, aligning with the Smarter Balanced test design and blueprints.)

Dissemination (Goal 3)

The evaluation question for this component asks to what extent the project team is successful in disseminating the QuEST model and findings. Evaluation includes a review of project reports, manuscripts, articles, presentations, doctoral dissertations, and products (e.g., PD materials, assessments, and other resources). Summer institute attendees are asked to complete a follow-up survey the spring following their participation to assess the extent to which they have used materials and new learning in their professional development activities. Evaluators also will assess the rigor and reach of publication or presentation venues (e.g., peer-reviewed scholarly journals, practitioner-focused publications, and peer-reviewed presentations). Interviews with key stakeholders, journal impact indices, journal subscription figures, presentation and colloquia audience attendance, and reviews of relevant research data are used to determine the extent to which the project is likely to be sustainable, scalable, and of high impact.

Summative Evaluation Activities

Project evaluation activities in the upcoming year will include a summative review and analysis of project data from all years, across the evaluation questions, summarized as follows:

Professional Development Implementation (Goal 1)

- Observations of all summer institutes, summer 2014–2016
- Teacher focus group interviews, summer 2014–2016
- Project stakeholder interviews, summer 2014–2016
- Observations of quarterly PD follow-up events, 2014–2017
- Teacher surveys, spring 2015–2017
- Observation of extended project activities, Summer Writer's Retreat, and QuEST PD for comparison group, 2017

Research (Goal 2)

- Project stakeholder interviews, summer 2014–2016
- Review of QuEST project artifacts, 2014–2017
- Proximal data review, teacher and student levels, 2014–2017
- Distal data review, student level, 2014–2017

Dissemination (Goal 3)

- Final summative review of project reports, manuscripts, articles, presentations, doctoral dissertations, and products (e.g., PD materials, assessments, and other resources), 2014–2017
- Teacher surveys, spring 2015–2017

Year 4 Evaluation Findings

This section details the findings from the evaluation of the fourth year of the QuEST DRK–12 grant, starting in May 2016 through June 2017.

Professional Development Implementation Evaluation

This section provides a summary of the findings from the evaluation activities related to the QuEST professional development implementation.

Summer Institute 2016

The evaluation data collected at or immediately following the 2016 summer institute include observations, focus groups, and interviews.

Week 1 Professional Development Observations

The evaluation team began observing on Day 1 of the first week of the institute. Morning observations included all institute participants engaging with the science content learning curriculum. The afternoon sessions Monday through Thursday included all institute participants in sessions focused on instructional design and pedagogy, including Universal Design for Learning, the 5E model, and the use of conceptual storylines in lesson planning. The afternoon session on Day 5 began with all institute participants, then members of the Treatment 1 and Treatment 2 teams separated into their working groups to begin planning for Week 2. Treatment 1 teachers and preservice teachers were tasked with lesson planning for the first day of Kids QuEST. Treatment 2 teachers were asked to think about resources they might want to bring back with them, specific to their school/lessons, to use in their lesson analysis and planning in Week 2. During the morning and afternoon sessions, facilitators were on hand at all times to present materials, answer questions, and circulate among the participants. Whole class, small group, and individual work was observed within each session. The overall level of participant involvement was high (more than 75% on task throughout the observation).

The following tables summarize the observations conducted by the evaluation team. Table 1 includes observed professional development standards from Week 1, separated by morning and afternoon sessions. Table 2 includes observed professional development standards from Week 2, separated by Treatment 1 and Treatment 2 sessions. Given the continuous nature and design of the two-week institute, individual standards and/or indicators may not have been observed within every session; the tables summarize whether or not each standard/indicator was observed at all during the observation period.

Table 1. ***Summary of Observed Professional Development Standards – Week 1***

Standard/*Indicator*	AM Session	PM Session
Selection and Organization of Content		
Clearly stated the purpose of the instruction	●	●
Defined the target audience and necessary prerequisite skills	●	●
Clearly defined expected outcomes	●	●
Formulated a limited number of goals and/or objectives	●	●
Developed a conceptual framework to highlight major ideas to be presented and to organize the content	●	●

Standard/*Indicator*	AM Session	PM Session
Research		
Described the research, evidence, theory, or reports from practitioners that supported the content	●	●
Avoided conjecture and lots of personal opinion, but included valid alternate opinions to help the participants make their own judgments	●	●
Fully cited all references and research, where and as appropriate	●	●
Identified professional standards or content standards where applicable (e.g., CCSS, NGSS, GLES)	●	●
When possible, cited evidence of effectiveness of practices presented in the training or presentation	●	●
Principles of Adult Learning		
Drew upon and honored learners' prior knowledge and experience	●	●
Provided opportunities for learners to connect new learning to their own work	●	●
Designed and used problem-centered activities	●	●
Provided strategies, tools, and techniques that participants could begin to use immediately	●	●
Provided 5E model tools to target teachers' difficulties in implementing the 5E model	●	●
Provided formative assessment strategy training to increase teachers' assessment literacy	●	●
Discussed the concept of seamless assessment strategies and how to align them to the 5E model	●	●
Provided Universal Design instruction and strategies for use to increase teachers' knowledge of UDL principles to use with diverse learners	●	●
Offered opportunities for participants to assume responsibility for their own learning (i.e., to be as self-directed as appropriate given content)	●	●
Community of Learners		
Encouraged dialogue and sharing among participants	●	●
Encouraged dialogue and sharing between participants and PD staff/content experts	●	●
Incorporated opportunities for team building and collaboration during sessions and in designed follow-up	●	●
Considered structures and practices that connect participants across time	○	○
Encouraged risk taking	●	●
Provided for celebration of small successes and learning from failures	●	●
Practice		
Incorporated opportunities for participants to practice new skills in a safe workshop environment and to receive feedback from facilitator and colleagues	●	●
Designed follow-up activities	●	●

Standard/*Indicator*	AM Session	PM Session
Included structures to track participants following the professional development	●	○
Encouraged peer classroom observations when appropriate	○	○
Developed capacity of individuals at site to provide leadership for follow-through	●	●
Diversity		
Established norms of respect, openness, and listening through both the content and process	●	●
Used language and media elements that were respectful of and appropriate to all	●	●
Planned for an inclusive approach (i.e., used strategies to engage all individuals)	●	●
Provided opportunities for educators to share knowledge, skills, and strategies for involving families or other stakeholders appropriately	●	●
Process Design		
Incorporated a variety of presentation strategies and activity formats	●	●
Included media elements that appropriately support the content	●	●
Ensured that participants have opportunities to develop or review related knowledge base	●	●
Varied learning activities, interspersing didactic with active, hands-on learning	●	●
Designed for all learning styles: the visual, auditory, kinesthetic	●	●
Structured daily activities and kept on task so that adequate time was available for instruction, activities, and reflection	●	●
Self-Assessment		
Ensured that participants were clear about expectations for their own learning and change	●	●
Allowed for practice and assessment of all stated outcomes	●	●
Encouraged participants to identify and build on their individual strengths	●	●
Provided opportunities for participants to identify barriers to change	●	●
Evaluation		
Built in debriefs at critical points in the training (e.g., at the end of a day)	●	●
Sought participant feedback throughout the formal learning experience – both formally (e.g., quick feedbacks at day's end) and informally (e.g., by asking participants to signal how it's going for them at intervals throughout the learning experience)	●	●
Scheduled ample time for end-of-session evaluation	●	●

Week 2 Professional Development Observations

On Days 1 and 2 of the second week of observations, one EPIC evaluator observed Treatment 2 teachers in the lesson analysis/planning sessions throughout the day. The other evaluator divided time in each of the Kids QuEST rooms, observing the implementation of the Kids QuEST in the mornings and in Treatment 1 teachers' planning sessions that occurred each afternoon.

Kids QuEST (Treatment 1). In the mornings, small teams of Treatment 1 teacher and preservice teacher participants taught their newly developed *properties of matter* lessons to groups of local students who had registered for the Kids QuEST camp. During the morning Kids QuEST class, facilitators and staff members were available but did not participate in the instruction. They observed the instruction in different classrooms and provided support and materials to their assigned groups as needed. In the afternoons, the teams of teacher participants reflected on the morning instruction and planned instruction for the next day.

Lesson Analysis and Planning (Treatment 2). The full-day sessions in Week 2 were designed to allow time for Treatment 2 teacher participants to dig deeper into the materials learned in Week 1. The goal of Week 2 was to analyze the science content curriculum from Week 1 and design fully developed lessons for their own science units. Three facilitators were in attendance. Participants worked in school/district groups with the science curriculum and materials from Week 1. All facilitators circulated throughout the entire session, observing participant progress, posing and answering questions, and providing support and materials as needed. During the session, evaluators observed whole class, small group, and individual work. The overall level of participant involvement was high (more than 75% on task throughout the observation).

Table 2. ***Summary of Observed Professional Development Standards – Week 2***

Standard/*Indicator*	Situated PD (Tx1)	Lesson Analysis & Planning (Tx2)
Selection and Organization of Content		
Clearly stated the purpose of the instruction	●	●
Defined the target audience and necessary prerequisite skills	●	●
Clearly defined expected outcomes	●	●
Formulated a limited number of goals and/or objectives	●	●
Developed a conceptual framework to highlight major ideas to be presented and to organize the content	○	●
Research		
Described the research, evidence, theory, or reports from practitioners that supported the content	○	●
Avoided conjecture and lots of personal opinion, but included valid alternate opinions to help the participants make their own judgments	●	●
Fully cited all references and research, where and as appropriate	○	●
Identified professional standards or content standards where applicable (e.g., CCSS, NGSS, GLES)	●	●
When possible, cited evidence of effectiveness of practices presented in the training or presentation	○	●
Principles of Adult Learning		
Drew upon and honored learners' prior knowledge and experience	●	●
Provided opportunities for learners to connect new learning to their own work	●	●

Standard/*Indicator*	Situated PD (Tx1)	Lesson Analysis & Planning (Tx2)
Designed and used problem-centered activities	●	●
Provided strategies, tools, and techniques that participants could begin to use immediately	●	●
Provided 5E model tools to target teachers' difficulties in implementing the 5E model	●	●
Provided formative assessment strategy training to increase teachers' assessment literacy	●	●
Discussed the concept of seamless assessment strategies and how to align them to the 5E model	●	●
Provided Universal Design instruction and strategies for use to increase teachers' knowledge of UDL principles to use with diverse learners	●	●
Offered opportunities for participants to assume responsibility for their own learning (i.e., to be as self-directed as appropriate given content)	●	●
Community of Learners		
Encouraged dialogue and sharing among participants	●	●
Encouraged dialogue and sharing between participants and PD staff/ content experts	●	●
Incorporated opportunities for team building and collaboration during sessions and in designed follow-up	●	●
Considered structures and practices that connect participants across time	○	●
Encouraged risk taking	●	●
Provided for celebration of small successes and learning from failures	●	●
Practice		
Incorporated opportunities for participants to practice new skills in a safe workshop environment and to receive feedback from facilitator and colleagues	●	●
Designed follow-up activities	●	●
Included structures to track participants following the professional development	●	●
Encouraged peer classroom observations when appropriate	○	○
Developed capacity of individuals at site to provide leadership for follow-through	●	●
Diversity		
Established norms of respect, openness, and listening through both the content and process	○	●
Used language and media elements that were respectful of and appropriate to all	●	●
Planned for an inclusive approach (i.e., used strategies to engage all individuals)	●	●
Provided opportunities for educators to share knowledge, skills, and strategies for involving families or other stakeholders appropriately	●	●

Standard/*Indicator*	Situated PD (Tx1)	Lesson Analysis & Planning (Tx2)
Process Design		
Incorporated a variety of presentation strategies and activity formats	●	●
Included media elements that appropriately support the content	●	●
Ensured that participants have opportunities to develop or review related knowledge base	●	●
Varied learning activities, interspersing didactic with active, hands-on learning	●	●
Designed for all learning styles: the visual, auditory, kinesthetic	●	●
Structured daily activities and kept on task so that adequate time was available for instruction, activities, and reflection	●	●
Self-Assessment		
Ensured that participants were clear about expectations for their own learning and change	●	●
Allowed for practice and assessment of all stated outcomes	●	●
Encouraged participants to identify and build on their individual strengths	●	●
Provided opportunities for participants to identify barriers to change	●	●
Evaluation		
Built in debriefs at critical points in the training (e.g., at the end of a day)	●	●
Sought participant feedback throughout the formal learning experience – both formally (e.g., quick feedbacks at day's end) and informally (e.g., by asking participants to signal how it's going for them at intervals throughout the learning experience)	●	●
Scheduled ample time for end-of-session evaluation	●	●

Teacher Focus Groups

Focus group members were asked to provide feedback about the summer institute in terms of the following themes: a) communication of objectives, b) organization and delivery of material, c) facilitator qualities, d) applicability to classroom instruction, and e) experience with the professional development. This last category was modified depending on the team to which the focus group member belonged. Additionally, focus group members were asked to consider and provide separate answers to the prompts in each category based on the week of the institute (i.e., Week 1 activities versus Week 2 activities).

Treatment 1 (Situated PD)

Objectives. Treatment 1 teachers varied in their understanding of the summer institute objectives prior to Week 1. Some Treatment 1 teachers heard about QuEST through an administrator who also provided links to additional information, such as QuEST program reviews. Other teachers shared details they learned from colleagues who previously attended QuEST. Most teachers had a basic understanding of QuEST project logistics, but were unsure of what exactly they would do. Many focus group members knew that the institute would entail lesson planning and learning about science and matter, but acknowledged they were not aware of the teaching component in Week 2. Teachers also noted they were surprised by the

intensity of the 5E Learning Model and UDL educational frameworks that were covered during the summer institute. They wished that they had been informed that these topics would be explored in depth so that they could have prepared before arriving at the institute. Others mentioned that their lack of prior knowledge about UDL made them more enthusiastic and motivated to participate in QuEST, because they recognized the opportunity to learn something new. All Treatment 1 teachers understood the objectives of Week 1 once it began.

Materials. Treatment 1 teachers appreciated the materials they received in their teacher kits and affirmed that they were high quality. As one teacher who had participated in QuEST before conveyed, "They've always given quality materials as far as our tubs go. It's like they think outside the box. . . . Who would have known that there was some such thing as density rods or density blocks and all that to be beneficial in our classrooms?" Other teachers valued the curriculum and its layout, which includes guiding questions, noting how these materials informed the questions they posed to their students as well.

Delivery and Organization. The hands-on nature of the morning sessions and the ability to be in a learner's role was cited by many Treatment 1 teachers as the most beneficial aspect of QuEST. As one teacher stated, "I felt like I learned a lot, and also me just being a learner, it's going to help me make the lessons for my kids. It makes me feel more confident, and also being prepared. One of the reasons I haven't liked science is because you always have a kid or two who will ask me a question I don't know. Just experiencing it as a student helps with that. I feel like since I understand it deeper, then I'm not as nervous when I get those questions because we can just start with what we know and break it down." Another teacher reported, "When you go to PD all the time, you never get those opportunities. Usually you're sitting there, and you're listening to somebody feed you all this information. You never get the time to actually do it." Other teachers spoke of how the group structure was differentiated: "I really liked how we got to work with our same team, starting every morning. Because then we got to build relationships within that team, and then we had time to meet other people, too, throughout." Several Treatment 1 teachers did note how full the day felt and reported feeling "saturated." They suggested either shortening the workday, condensing the information, or breaking up the activities.

Facilitators. Many Treatment 1 teachers appreciated the different areas of expertise represented by the QuEST staff, ranging from experts in science instruction and special education to those working on their doctorate in physics. Several teachers referenced the cohesiveness of the facilitators collectively and their openness in incorporating teacher feedback into the institute. As one teacher stated, "My overall feeling with this whole experience is that we're all in it together, that there's no gulf between instructors or facilitators, and we as students. That everybody is in this equally together." The willingness of the facilitators to help guide the teachers through any confusion made the participants feel comfortable asking questions and taking risks.

Applicability. Several Treatment 1 teachers described the usefulness of the step-by-step format of the organization of the 5E. "In the classrooms that I've worked in, and the kids I've had encounters with, that seems to be the most important, that you're really establishing that structure and that organization with them." Another teacher described connections between UDL and differentiation: "There are great things to get from the differentiation standpoint, then there's great things to get from the UDL standpoint. I'm going to figure out how to incorporate both of them in my classroom because I think there's great things about both, then there's things that I may not use from, as well."

Preparation. Treatment 1 teachers felt prepared to implement UDL in their classrooms, noting connections to modifications and differentiation of instruction to which they are already accustomed. Similarly, several teachers connected their backward planning process with the conceptual storyline. One teacher shared appreciation for the conceptual storyline chart as a tool to help organize planning. The primary constraint raised by Treatment 1 teachers around the implementation of what they learned during Week 1 was a limited amount of scheduled class time, which they felt might not facilitate a pace at which students can come to understand concepts. Several teachers raised the need for buy-in or support from principals or superintendents. As stated by one teacher, "When you're constantly being told, 'We need to get to this and

this and this,' and then to spend one day on an engage [activity] is difficult . . . even though I know that's what they need. That's how they learn."

Professional Development Experience. Treatment 1 teachers differentiated the engaging and hands-on nature of QuEST as superior to previous PD they had received. "Unfortunately a lot of PD is staying and listening to a little lecture. This is not at all that. It's way more hands-on." Another teacher described it, "Without the practice of questioning, I don't think it would have been. . . . I would maybe have remembered, 'Oh yeah. I should be questioning and not giving them the answers.' It's things like that that we learned last week, but then practicing them right away this week, it'll stick. I'll carry [the things that we learned] through the year instead of just being told that it's a good practice."

Treatment 1 teachers made the following comments in response to the focus group prompt, *Elements of this professional development experience from which I learned most*:

> *I've learned the most in our planning conversations that we've had with Delinda and Dante. They're very straightforward with us in saying that this is not an easy concept. This is not something [where] . . . a light bulb's going to go off immediately, snap-of-the-fingers type thing. It's something that you're going to have to plan for, put into practice, see how it works. What's good, what's bad, make those changes, and really be thinking about it. Not only in each piece of it, but as a whole. How does it function as each piece, then how does that function as a whole.*
>
> *My biggest learning moment is being able to link the different components of 5E. Where before I'd just done a general lesson plan with objectives and steps and an assessment at the end, this, to me, has been a lot different. Each part of the lesson plan is almost like a separate component, yet it snaps into the other via a linking question, or something of that nature. For me, that's been the biggest learning point of this two weeks.*
>
> *My biggest thing that I took away was I already knew how a 5E [lesson] should look in a classroom, so my biggest thing that I took away was the conceptual storyline. You're engaged; it should follow one after another. Then in the seamless assessment, you can have different types of assessments after each different phase of the 5E.*
>
> *I think [conceptual storyline] has been the most exciting thing for me. We were in the classroom the whole first week, learning about these different things, and then being able to get to apply them, and actually get to see it work. Because they tell you about this conceptual storyline, and you're like "Yeah, of course it makes sense," but actually getting to see it. Then when you teach that first lesson, and it's all about "What is matter?" You don't want to give it away, but then our group ended up giving it away in the Engage, and I was really angry. I was mad that the conceptual storyline was interrupted, and I wanted to see them get to that point, which thankfully a lot of the kids weren't even listening. We were able to question them in that Explore to get them thinking differently now. "Oh, maybe that's not it," so at least we've gotten away from what they heard the definition was, or "what was matter." That, I think, was the biggest part, was that application. Getting to see it all so smoothly, and make sense.*
>
> *My general application, the more broad view would be the conceptual storyline to take away. Then also, I was really excited to learn a lot of fifth-grade content. Because I feel like, in college, it was more general "Oh, you're going to learn science-y things," and they'd hit a couple big science things, but I have no idea what fifth graders were supposed to know or what you would be learning. I was excited to hear even the different molecules in water, and what's between the molecules. I was excited to know more of what I'll be teaching.*
>
> *How it all fit together. My brain always thinks like a puzzle, and I like to think about how you put each piece of the puzzle together. I thought about when we were starting with the conceptual storyline and how it fit into the 5E, and each piece that it got connected. Then I felt like, at the very end, you could step back and you could look and it really all fit together. It was really hard to think about from the beginning, when they talked about conceptual storyline, and it needed to flow throughout the whole thing. We struggled with that, but now that I look back on our four days of teaching, it really did fit together.*
>
> *I think the biggest element is to let kids do the thinking without the teachers jumping in and giving the answers before they can actually explore.*

Actually exploring the curriculum that we're going to expect from kids. . . . I've learned matter in school, but it's been so long ago, and we expect them to just pick up on it right away. Kind of refreshing our knowledge and pushing us further helps us be able to teach and follow their thinking a little more.

I think I learned the most from getting the 5E in two different ways, like as a learner and then as a teacher, the practice of it.

I was going to say 5E, but going at the learner's pace.

My two are actually exploring it as the learner, and then being able to turn right around and teach it as a teacher, that is in planning with the team because it made you question some of the things that you might have had missed concepts about from the previous week. It was cleared up and you could then turn around and teach it to the kids. I thought that was just awesome.

I learned the most from being able to practice planning a storyline and then trying to follow that out through lessons and teaching it.

When asked about what elements of the professional development could be improved, the Treatment 1 teachers offered the following comments:

In my opinion, improvement might be in extending the student contact hours a little bit longer each day, so we'd have more time to apply some of these things that we're learning with them. I don't feel like we always have time. Three hours just goes by really quickly. Maybe four, even just an extra hour would make a big difference.

Going back to say that this is the best PD that I've ever been to, and I've learned so much. Now, thinking about going back [to school], it's overwhelming because I'm one of those people that I want it to be like this all the time, and I know that I'm not going to be able to physically do it. For me . . . I wish we could have those resources, to makes us feel at ease . . . as far as lesson planning–wise, and on other units. Because you give us this one, we're going to nail this one out of the park.

I think that if I could feel like I was more comfortable beyond this, because I think about going back to my school and I'd like to be able to do more of this throughout other science units. I don't know if I necessarily feel prepared enough to be able to develop all of those conceptual storylines along all those other subject areas. I wish we would have had turnouts on topic that didn't have anything to do with matter, and let us just say "Here's a topic, where would you start?" Maybe help us and guide us in that direction, and say, "Here's where we started." Because I know they spent a lot of hours creating those, and I'm not sure I feel like I'm comfortable enough to produce a document that's that high quality. That's what I'd like to be able to do, but I'd like to know a little bit, "How did they do it? What was their process? How did they get to create those?" Maybe we could've spent an afternoon doing something like that, teaching us more on how to develop [conceptual storylines] on other units that we had.

I would have wanted some more options as to how to teach certain concepts. I feel like we got great ideas, but I feel like you realized some of these ideas aren't going to work with the students that you have. You get to a point sometimes, as a teacher, where you're like "I've exhausted everything in my bag of tricks. What do I do now?" Maybe having some other options for certain ones might have been nice.

What I'm thinking right now is a little more nitpicky for the actual PD part. One of them that stuck out, I'm sorry if this is picky, is on the very first day when they were doing the introductions. Me, coming from [another state] and not knowing anybody, I hadn't even met these guys yet. The only concept of QuEST I had was the packet that I saw on email and that it was going to be really good. When they did the introduction, everyone was introduced like they had to be convinced to come. Because they kept saying, "We dragged this person in," so I was like, "Is this a program nobody wanted to be in?" You know what I mean? I know what it's like when you're in a community and everyone's like, "We need help, you have to do this," and you're like, "I don't really want to put another thing on my plate, but fine, I'll do it." They kept saying that for everyone, and I was like, "I feel bad. Do they want to be here, or did they just really, really need help so they had to drag people?" I think that's the word that they used, and they kept saying it. Even just that

word. It would be extremely easy for them to pick a different word. It did change my feeling, and how I felt, being in the room.

I would say part of that conceptual storyline. When you go back and look at your curriculum, where do I start? How do I know that this is the beginning? I'm not a science expert, so how do I know exactly where to start in this? We were looking back on our lesson plan on matter in our science curriculum, and we're like, "Why are we starting with this, and are they doing that with every concept they're teaching in science?"

The afternoon sessions in . . . Week 1—making them more relevant. I think we got burnt out pretty quick on the UDL, and maybe more options than that.

Just more hands-on, more action [during the afternoon sessions], more something because we're kind of . . . saturated. Reflecting or something different in the afternoon to keep us moving. I mean, I know we're grown and we can go to the bathroom or whatever, have free will—but if they would have structured breaks. Like, "At this time, we're going to take a break." [Also] . . . some groups wasn't [sic] very welcoming of other people outside of their school. That kind of make you feel real small because it's like, "Maybe you should go work with such and such," because I was by myself, and it was just like putting us together, because we're still from the same district.

With the instructors, like with the planning in the afternoon . . . if we need you, can we come and get you . . . because I felt like they were hovering over us a lot.

I think that sometimes people think when we say we want to move around, it means, "We need to get them up, put them with a new group of people, and make them do something else." That's not what I like. I feel like we almost did that too much. For me, I work best if I can be around the same group of people for a little bit. You have to get to know each other a little bit, even if it's all new people. You need some time. Like our morning groups, we were with people we didn't know. The first day, I was kind of like, "I don't know," but then it was great because I got to know them, and it was great. Then when you have to do that too much, you don't have time to build the relationships, and you can't work together. You can't find your roles. Just more hands-on things, but with people that you're comfortable with, either people from your school or people that you've already worked with in some other group. Constantly having to have a new group was almost part of the exhaustion in itself. It's work to get to know people, and to have to do it every couple hours, it was hard.

I think that we could just spend more time on the curriculum, exploring. Maybe three fourths of the day on that, and then just a little bit of, "Hey, here's how you could plan those lessons." Even if we started with, "Here's how you could plan those lessons," and then explored the rest of the day. I feel like if you start with the more boring stuff, then you can look forward to something throughout the day, maybe just exploration, hands-on engagement.

I dreaded lunch being over because I'm like, "Man, we've got to go to the lecture part." I looked at it as just like a college lecture. . . . They got us up a few times. I know they didn't want us to sit in our seats the whole time. I don't think that was their intentions, but it just wasn't enough. I think it was nice to have a morning group . . . maybe we should have had that PM group the whole week. You're still having other people, but that way, just as you said, you're getting to know people and sticking with it.

I just wish coming into this, I'm going to be a new teacher, and she's going to be on my team. With being a first year teacher, there's nerves, and I don't really know what to expect. Just if we were together on a team, just putting the schools together, but still having some interaction with other places . . . like in the afternoon maybe. But if there's a team that could be just your school, I think that would be helpful, but I don't want it to turn into snobby like, "You're not in our group" kind of thing.

Treatment 2 (No Situated PD)

Objectives. Leading up to the institute, all but one Treatment 2 teacher was familiar with the QuEST project through conversations with other teachers who previously attended a summer institute. However, some Treatment 2 teachers did not have a clear idea of the structure for the two-week professional development. As a teacher conveyed, "I knew that it was two weeks and about properties of matter and I

knew that that was a big weakness of mine so I jumped in. I knew that we were going to be learning and teaching, but that's about it." All Treatment 2 focus group participants indicated the objectives became clear once they began the first week. Several teachers elaborated on a general perceived objective of "building our own background knowledge." As one member conveyed, "They didn't want us to go too fast, they didn't want to say, 'okay you already know it, let's move on.' It was to get to the underlying idea of . . . the *why*."

Materials. Teachers were excited about the classroom materials they received as part of their participation in the summer institute and the ability to bring a set of materials back to their school. All Treatment 2 teachers also appreciated the quality of the training materials, as conveyed by one participant: "Even though they focused on lessons for adults, they keep the ideas where you could take the same concept and materials even and just tweak it to match the fifth-grade plan, which was awesome." One teacher especially noted the flow of the training materials, saying, "The flow of it was really nice, how it was flowing from one to the other and it just went together really well."

Delivery and Organization. Another teacher raised the idea of flow, while describing the Week 1 training, saying, "They knew how it was going to flow so when they finished the learning cycle, they knew that you could go pick up the next packet. They knew that everybody was going to be in different places at different times. It didn't seem chaotic. . . ." Another Treatment 2 teacher noted the use of purposeful ways to keep the group relatively in the same place, while facilitating this flow: "I think they also thought ahead, like maybe the group was falling behind. They asked us to do a couple of things, maybe that night, just to keep it in a certain area, maybe close enough."

Facilitators. Treatment 2 teachers appreciated the QuEST facilitators' approaches and the strength and diversity of their collective expertise. As one teacher conveyed, "They have their specialties, like there is a go-to person for a deeper understanding of the teaching, like elementary teaching versus the physics concepts." Other Treatment 2 focus group participants pointed out the strength of the adjustments the facilitators made in response to participants' needs or questions. One teacher stated, "They came in with a game plan but also tried to meet our needs and always asked for our opinions and how to better the lesson and any idea that afternoon and daily. I think that is really important and I really appreciated that and my team did as well." Another teacher conveyed the effect this attention had, adding, "I really feel like we left with the best feedback the next day." Treatment 2 participants also noted that QuEST facilitators were helpful in seeking out additional resources, such as websites, and sharing them with individual teachers.

Applicability. Treatment 2 teachers agreed all the topics they learned were valuable. Some teachers illustrated their agreement by sharing their initial connections to what they currently do in their classroom. For example, referencing the 5E and the conceptual storyline, one teacher shared, "We use Pearson science, I didn't even notice it until this week, it's set up for five weeks . . . but the problem is, it's not very conceptual. It isn't a flow . . . [but] if we tweak it a bit, it can."

Preparation. All Treatment 2 teachers agreed they felt better prepared to implement what they learned during Week 1. As one teacher framed the two weeks of PD: "Week 1 was making sure that we knew the work and knew what we were teaching and then Week 2 was bringing in the conceptual storyline, UDL, and all of [the rest of the Week 1 material]. That makes sense as to why we did that." Though all teachers conveyed that they were better prepared to implement what they learned, school schedules and testing were raised as several potential constraints: "Sometimes I think with time constraints, that's where I find my goals. I kept it obvious, when I should have went down underneath."

Professional Development Experience. Treatment 2 teachers noted Week 2 as being harder than the first week. One teacher mentioned getting into the flow of lesson writing and needing to jump to other things such as the conceptual storyline: "I think it was harder for us because we would get into the flow of writing our lesson and then we would stop and do the big conceptual story, but it wasn't really necessarily the lesson we were working on." Another teacher noted challenges with balancing the use of the videos they were working to include in their lessons, with finding that the videos did not fit their new understanding of what should happen in the Explore phase of the 5E learning cycle. Despite these challenges, Treatment 2 focus group participants generally agreed that Week 2 helped to build their understanding of concepts introduced in

Week 1. "Whenever I started trying to plan lessons along with the 5Es on the lesson plan sheet, it was very slow and very tedious and I didn't quite understand exactly how long it was. [By] the end . . . it was flowing and I could do it faster with practice, [after] during the week doing it each day." Several teachers conveyed that larger chunks of uninterrupted time would help: "Analyzing their lesson plans was like [reference to other teacher] said, at first, it was absolutely needed. . . . Then it got to the point that we did know what we were doing and it was flowing, but we were being stopped." All Treatment 2 focus group participants reported feeling well prepared to take their learning back to the classroom and integrate what they learned during Week 1.

Treatment 2 teachers made the following comments in response to the focus group prompt, *Elements of this professional development experience from which I learned most*:

> *For me it was the 5Es and how they work together to take the topic . . . to that deeper level. I think I always stopped and explained and never really went down to the bottom of how important that bottom part was. . . . It was important for me to see that and work through it myself as the student to understand how much deeper it took my thinking to carry over to the next topic. Week 1 being the learner, that's what helped me a lot as well.*
>
> *Mine is . . . the content that we learned.*
>
> *I think with me I can maybe be too proactive with things and maybe show [students] too much so the idea of when I go back and letting them explore and problem solve as a team rather than step by step . . . because they can problem solve like this the first week. I think that will pose the biggest challenge for me, because it's a gray area and we need to provide them enough to where they can at least get started. . . . My challenge is going to be where does that stop?*
>
> *I would agree with [other team member], just to go back to that. I just always feel I need to give my students all this information and even though I might rush into that first. . . . I think that would be hard seeing them frustrated, but sticking to it like the class leader did would be really good.*
>
> *Just the idea of the storyline to have the linking with the key ideas.*

When asked about what elements of the professional development could be improved, Treatment 2 teachers offered the following comments:

> *In the afternoons in the first week where we were just basically sitting there worrying but we still wanted to get up and do [the activities] at the same time. Maybe we could still do those same activities, but instead of moving into another room . . . we could just get up and do the activity but come back to the same spot where we were at. I think that would be beneficial. . . . I think that the first day, do the first two units and do the storyline and do the planning, and then the next day you get the whole day to lesson plan and do those two lessons and share it with people. That way you have the entire day to dig into it and some people even got up to be able to practice.*
>
> *I think for me, it's just the lesson feel, not disrupting the flow of the lesson plan, if there was some way to definitely have a plan and we were going to do the conceptual story, do lesson planning, instead of the choppiness. Especially when you are really trying to mull it over with a team, for consensus, and then you get disrupted, it's really hard to get back to the consensus. My biggest issue was just the constant sitting. I heard that from a lot of people, that we're always sitting down. We're pretty active, so finding a way to get a little pep in our step and better utilizing these chairs.*
>
> *I think I'd like normal lectures, maybe that first week in the morning. It's necessary that it has to be done, but I think by the afternoon after you've gone through all of that deep thinking, it felt like, "Ah."*
>
> *Front-load it with the storylines and give more time than an hour to do some planning, because it seems like I was just starting to get to something and we moved onto something else.*

Preservice Teachers

Objectives. Preservice teachers differed in the depth of their understanding of the QuEST project's objectives prior to the start of Week 1. Some preservice teachers had general expectations of learning more about science at the elementary level and anticipated a dual focus on learning material and learning to implement what they learned. Other preservice teachers shared more specific expectations, anticipating properties of matter as the content area, and "the overall goal . . . by the end of the week, you should be able to take all six learning cycles, the 5E, the conceptual storyline, UDL, and then be able to implement that with your group of students." Another preservice teacher conveyed more implicit objectives: "To challenge our misconceptions about matter, being more investigative with our teaching, not just telling them the answer. We were learning about ourselves as teachers." Once Week 1 began, preservice teachers who were less clear about the project objectives conveyed they had a better understanding of the project goals for the first week and what to expect leading up to Week 2.

Materials. Preservice teachers were surprised and pleased with the quality and variety of the materials they received as part of participating in the summer institute to take back to their schools: "I like how we have a purple balance, not as nice as the red balance, also these electric balances, [so] then in the classroom . . . you can talk more about how science is measuring and about accuracy . . . so going in to how we get accurate readings besides just getting the right reading." Another preservice teacher noted the reasonable cost of the materials, which would allow them to conduct the same experiments in their classrooms.

Delivery and Organization. All preservice teachers appreciated how well organized and prepared the facilitators were; as one preservice teacher stated, "They were very well prepared, which helped the organization as a whole. That was easy to tell." Regarding organization, one preservice teacher said, "I think it was put together really well. I was never lost or trying to figure out where to go or what to do next." Some preservice teachers conveyed feeling a little frustrated during the first week, feeling behind compared to their group members or wanting validation or feedback. However, preservice teachers recognized the value of being placed in a learner's role as helping them to get a sense for how their students would feel in a similar situation.

Facilitators. The preservice teachers reported a sense of cohesion and consistency of responses among facilitators and staff members. "I'd say they all worked really well together. . . . With that big of a staff, I feel like a lot of times you might get two different answers from two different people, but it seemed like if you asked four of them the same question, you were going to get the same answer every single time." Other preservice teachers mentioned the quality of interactions with the facilitators that helped build their understanding: "I felt they asked good questions that pushed us towards the goal of the lesson" and "They gave us lots of different ways to look at things."

Applicability/Preparation. Preservice teachers found the 5E model to be valuable, saying, "You don't have to be that specific with it. . . . It's very adaptable to your students." Another preservice teacher shared in reference to her Week 2 students asking many questions, "I like how flexible it is. . . . We spent the entire three hours explaining, just explaining . . . that was really great because we were going at their pace." The preservice teachers shared mixed opinions about UDL. Two preservice teachers noted the many pieces that go into the implementation of UDL and the anticipated challenges to execute UDL effectively to meet the full range of different students' needs. Another preservice teacher reported finding the UDL strategies helpful, particularly in IEP meetings with parents: "UDL is just something any parent, or any teacher with a student with special needs, would like to hear. It's just saying they have a way to get involved specific to them [the student]."

Professional Development Experience. All the preservice teachers valued the opportunity to teach students during the second week, with support from current teachers. "Well, just making the lesson plan and applying it to an actual class, that was something that I personally haven't done before." Another preservice teacher shared, "That helped me not to panic, when they don't get it the first time you deliver it. I was like, 'Oh, they don't understand, what do we do now?' Now I know, okay relax, just try to do it another way."

Several preservice teachers suggested they would benefit from collaborating with people from other groups to get new ideas. The preservice teachers shared several key ideas they took away from the second week, including the importance of behavior management, the need to differentiate instruction to engage advanced learners, the need to "find ways to motivate" students or keep them from becoming distracted, the broader recognition of the different ways that students think, and the need to adapt what they do to meet the needs of each student.

Preservice teachers made the following comments in response to the focus group prompt, *Elements of this professional development experience from which I learned most*:

> *Adapting lessons for all and investigation activities.*
>
> *Using the UDL model.*
>
> *I feel like actual classroom application of the lesson plans. As students, we write a lot of lesson plans and we don't necessarily get to apply them.*
>
> *I'm just always remembering that as a teacher, you're still a learner. I feel like a lot of the time teachers just think they're the authority and that the students are going to learn from them. But putting us in the learner role, I learned that even after fourteen years of school, I learned stuff that I've never even know before. I feel like we're students all the time.*
>
> *I liked how instead of just telling kids what to say, you're going to probe each of them to tell you and use what they say to answer their own questions. I was thinking that I never really thought of that before, so I've really been trying to apply that this week, which is awesome.*
>
> *Just how professional and organized [the QuEST Institute] is. . . . That's something that you can use in your own classroom because they always know what's going on and then also the application. [The application of the lessons is] something that's very useful, because you can never have too much field practice.*

When asked about what elements of the professional development could be improved, the preservice teachers offered the following comments:

> *Even more collaboration between the teachers.*
>
> *I think more lesson time, lesson planning time for the camp.*
>
> *Just for my own perspective, I know that I knew a lot about 5E and UDL, so I feel like having a poll or something of the people who had [previous knowledge] and grouping accordingly. Then you can put one person you know has had to teach then they can help explain and maybe engage more deeply with the content.*
>
> *I'd probably say when we had to the first week with the check-in of your instructor . . . kind of varying, maybe even asking a specific person each time. I had someone in my group who answered every single time and the rest of us may not have been to that point. . . . It wasn't really testing everyone, it was just one spokesman for your group and then they just let you go.*
>
> *One thing that was kind of hard for me was, I liked learning the week before but having to use those same key ideas in that order. I know we can do our own thing but that was hard for me, especially lesson 2B, our group really struggled pulling things from there and applying it to kids and that kind of way. You know, more applicable ways to apply it.*
>
> *I'd say they hit everything. I'm trying to think. I like the more collaboration on Week 2, because I feel like there are a lot of ideas out and my group was kind of going back to the same thing over and over.*

Project Staff Interviews

During project staff debriefs, evaluators asked staff members to reflect on what went well, what challenges they experienced, and recommendations to improve the functioning of future institutes. To help frame their thoughts, staff members were asked to consider pre-summer institute activities, Week 1, and Week 2 separately.

Across all staff groups, the following themes were identified in terms of what went well with the institute:

- Highly engaged and motivated teacher participants, with less interpersonal conflict than the previous year
- Increased confidence and knowledge of team members
- Flexibility in response to participant needs
- Better preparation with technology needs for teacher participants
- Continued high levels of organization and anticipation of teacher needs
- Use of the pre-summer institute research institute for the QuEST staff to establish roles and responsibilities, as well as to pilot new curriculum materials

Themes that were identified as challenges across all participant groups included the following:

- Recruitment and teacher/school attrition
- Smaller than expected meeting space for Week 1 activities
- Loss of project manager in the spring

In addition to the common themes identified above, there were positives aspects and challenges unique to each participant group, as summarized below.

Principal Investigators. The principal investigators were in agreement that the 2016 QuEST summer institute was successful, noting the continuation of excellent organization of all aspects of the PD experience and challenges that were limited and relatively easy to overcome when they did arise. Team members agreed that the overall tone of the summer institute was positive. Similar to last year, the staff research retreat was identified as an instrumental piece of the coordination process, allowing all team members to mentally prepare for the two-week institute. The principal investigators reported that the staff said they were less stressed, having more time to get on the same page in terms of roles and responsibilities and to prep materials for the institute. The teacher participants contributed to the overall preparation with timely submission of materials, allowing the pre-institute data collection activities to proceed smoothly. The staff also noted that having a postdoctoral researcher on board throughout the school year and leading up to the institute was an asset as well, as he was able to contribute in multiple ways, especially being available to conduct observations and provide support to participating schools. The main pre-institute challenge reported was the resignation of the project manager in the spring. Although the QuEST staff needed to work through some snags related to project management, there were no major issues and they were able to successfully hand over institute tasks to a part-time helper. During the interim, several project staff members worked to fill in where needed, attesting to the flexibility of the project staff in general.

Principal investigators reported that during the summer institute the teacher participants worked well with each other, and there was less interpersonal conflict than in the previous year. The PIs were happy with the way the final curriculum turned out. Although the curriculum was not fully developed along the planned initial timeline, the team was able to pilot the activities more extensively this year at the research retreat and during alumni activities, which the staff considered to be helpful. During Week 1, an additional science education graduate student with content area expertise was brought in to provide support during the content learning sessions, which the staff found to be very helpful. Also noted as helpful to the facilitation of Week 1 activities was a change in the method used for lesson checkouts. The changed method decreased the feeling within groups that they were ahead of or behind their fellow participants, so there was less tension in the groups to hurry without paying close attention to the materials. Afternoon sessions also went well. There were fewer problems with technology this year. As for the content of the afternoon sessions, the principal investigators perceived that the teachers got into the material easily and quickly. It also seemed to the presenters that the materials around the conceptual storyline were better received and understood this year, likely because the presenters had more time to develop the presentations across the year and to make better connections to the assessment component guided by the postdoctoral fellow. The team noted that the set-up and download of data from the teacher assessment was smooth, allowing the graduate research assistants on

the research team to function efficiently. A challenge noted in Week 1 was that smaller working groups of teacher participants meant more checkouts for the staff to conduct, but this was balanced out by having more interaction in the groups. The smaller size of the room used this year meant that participants were somewhat crowded together, increasing the noise level and making moving freely a mild challenge. The topic this year also was seen as a mild challenge, as properties of matter was an unfamiliar topic for most teachers.

Week 2 summer institute activities were viewed as successful**.** Kids QuEST was full again this year, and the principal investigators reported that parents began emailing about their child's participation in the summer program as early as last winter. Teachers who worked with students this year seemed more confident with the idea of teaching in Week 2, and teachers reported fewer behavior issues than Treatment 1 teachers had the prior year. Revised reflection forms were helpful to the staff, allowing them to better target support needs. The assigned support team method for providing assistance to Treatment 1 teams also worked well, along with a revised process for supply retrieval and return. One principal investigator commented that teachers this year used their own materials and ideas to a greater degree than groups had in the past. Challenges noted in Week 2 were attendance issues and a last-minute reassignment of students to different rooms on the first day.

> *I think we worked out a lot of kinks. I think there will always be some that come up, but it's made me realize even more, I'm amazed that we do it with as few people as we have, that it could be a much, much larger team doing this. . . . All the things I was worried about prior to the institute didn't come to fruition, or were non-issues. . . .* They [the things worried about prior to the institute] *all got integrated into the procedures we already had, so that was nice to see because we've had a new project manager for every summer, and still it got better and better despite that. I think that says a lot about the core group that works, that despite all the personnel changes and additions, last-minute things, it all went really smooth.*
>
> *I think overall it was actually really successful. I think we met our goals. I think we did an excellent job with delivery . . . content, materials, making all the different pieces fit together and work together. . . . We could always look at what we're doing and improve upon it, but I would say as far as the structures and the systems and the supports and doing what we're doing with what we have, I think it was very successful.*
>
> *I'm really looking forward to this year and digging into the research because we're not writing a new curriculum, we're not recruiting a new cohort of teachers, we are not developing new assessment instruments, we're not recruiting a whole other set of kids, we're not making room reservations, ordering parking passes, catering meals. None of that has to happen now. . . . That really consumes a lot of time, even when someone else is doing it, to just delegate and oversee. I think that's going to be really, really good for us.*

Faculty/Teacher Instructional Staff. The QuEST teaching staff reported that the summer institute ran even better this year than in past years, building on the program's history of strong organization and communication. The staff research retreat was again recognized as a critical tool in preparing team members for the professional development activities of the summer institute, helping to solidify the culmination of the past years' activities. The staff felt better able to fully integrate the different professional development strands, including such activities as sharing presentation materials, piloting and practicing newly developed activities, and reviewing a new evaluation tool in a face-to-face setting. One staff member reported that a QuEST teacher alumnus who participated in the ReQuEST session felt that being involved in the pilot activity was a valuable experience that would in turn allow them to use the activity in their own classroom. Although all staff members noted that they had been slightly worried about having a new project manager going into the busy summer season, they reported that the replacement person fit into the team very well and was able to fill the role without any difficulty.

During the summer institute, the teaching staff noted a positive group dynamic with high levels of excitement and engagement. Check-in activities for the teacher participants were more efficient this year. Examples of methods used to increase efficiency included having several staff members on hand to ensure that teacher dormitory check-in proceeded smoothly, meeting people at the dorms to help with orientation to the campus, and having staff members strategically placed in the mornings to help with parking passes and directions. The Week 1 sessions seemed well received by teachers, and all presenters reported having more

confidence with the materials and being able to anticipate and respond to questions better. One staff member mentioned that the new reflection sheets helped to facilitate better and more targeted participant feedback. Technology issues from last year did not arise because things got set up earlier in the week. Some staff members reported feeling some concern before the summer institute that the curriculum would be too easy, but it turned out that there were a lot of misconceptions to correct and new understandings to build among the teacher participants. The staff also believed that it was helpful to have another science content specialist to assist with questions during Week 1. Challenges noted during Week 1 included room space and some challenges with the materials included in the teacher participants' kits. This challenge, however, was easily sorted through and the staff reported it actually led to a rich scientific discussion around precision and accuracy.

The staff reported having a better understanding of the goals for the outcome of the Treatment 2 group in Week 2 this year. Some teachers still struggled with the conceptual storyline content at first, but a new activity this year that included the narration of a conceptual storyline poster between teacher and students seemed to help facilitate understanding, allowing teachers to understand the narrative flow. The staff believed that teachers dove into the UDL chart early on and deeper than in previous years. Additionally, Treatment 2 participants were reported as happy to have the work time they received immediately after Week 1 PD activities, and there were no comments that teachers would rather be participating in the situated PD experience. Challenges noted by the staff members working with Treatment 2 teachers were focused on curriculum constraints expressed by the teachers, who were concerned about how they would be able to implement what they learned in their district/school. These staff members thought this concern was alleviated for teachers as the week went on and they came to a better understanding of how they could structure their current curriculum using their new knowledge and understanding. One staff member provided an example of a group from a school with a scripted curriculum. At first, they were very concerned about how they would be able to integrate the PD materials into an already prepared curriculum. But as the week went on and they analyzed the lessons for the conceptual storyline, they came to their own understanding of where they could add lessons and drop content to make the storyline stronger. The teaching staff working with the Treatment 1 teams noticed that some teachers struggled at first in terms of planning and moving through the activities and letting students work independently; however, the feedback sessions at the end of each day seemed to allow them to gather and share ideas and work through their challenges. The staff commented that teachers were better able to spot areas where they could add in brief assessments of understanding by the end of the week.

Graduate Research Assistants. The GRAs agreed that the research retreat has been a helpful feature of the pre-summer institute activities during the past two years. Specifically, the retreat is viewed as a means to bring everyone together and use the time to wrap their heads around what is coming in the summer institute, to reestablish roles and responsibilities, and to ensure that everyone is familiar with where the different expertise lies on the team. This year, the GRAs reported that time was used during the retreat to pilot a new curriculum activity. This was helpful because it allowed the team to recognize potential hurdles that participants might have with the activity and related content and thus allowed them to work through solutions ahead of time. Piloting the activity was also seen as helpful to members of the team who are not content experts, giving them a sense of the curriculum content and activities ahead of time. Additionally, the GRAs reported that the teacher data collection activities were completed prior to the beginning of the summer institute, a marked improvement over the prior year. The team attributed this success to a combination of being even more organized and experienced this year, and to this group of teacher participants being especially well prepared. One difference this year that was noted by team members who did not have a science background was that this year's topic was less familiar to them, so finding ways to make connections between the content and UDL was more challenging.

The GRAs perceived that Week 1 activities proceeded very smoothly. The summer institute began with a more successful move-in for teacher participants staying on campus. One GRA reported that having Dr. Thomas on hand to help with the move-in activities was particularly helpful. Additionally, a phone app was introduced to teachers as a tool to help them navigate their way around campus. One GRA noted three

changes this year that helped to better facilitate the flow of the morning content lessons. First, the groups were purposefully set up differently this year, so that teachers from the same schools were split up across the tables. Another change to the process was that instead of writing where groups were in their progression through the lesson with their checkouts up on the board, the table numbers were written on the board. This seemed to allow teachers to focus less on feeling like they had to be at a certain point but to continue at their own pace. Finally, the lesson materials were handed out to teachers when they needed them, instead of having everything in the binders ahead of time, allowing teachers to stay focused on the task at hand. In the afternoon sessions, GRA presenters reported that the opportunities across the year to practice presentations around conceptual storylines and UDL increased their confidence with the material, which they believed resulted in increased teacher understanding of the materials. One challenge identified during Week 1 was the lack of space in the room where the group met each day. Due to space restrictions, the QuEST staff not participating in facilitating a session did not sit at tables with teachers. There was some disagreement among the group as to whether or not it was better this year with no QuEST staff member sitting at the tables with the teachers during the instructional sessions. Some GRAs believed that it was better to not have QuEST staff members at the tables to inadvertently prompt or direct teachers. Others thought that by not sitting with the teachers, they were missing out on the places where teachers were getting hung up in the curriculum and were thus less likely to be able to support them to the extent that they may have been able to. Another challenge reported was minor equipment issues with the material kits, but the GRAs believed this challenge was easily remedied. Another change that was reported to be helpful to the group was the addition of a new student team member with a science content specialty to assist in the instruction during Week 1. The new GRA team member said that although it took some time to determine individuals' roles initially, he felt comfortable with his own role on the team early on. The student said that he noticed immediately how well prepared the entire team was. He noted that even when they did not have time to give him a full introduction to an activity, he was able to fit in and play off their moves and find the pattern that he could fit into.

The GRAs who worked with Treatment 2 teachers reported that the Week 2 activities were very organized yet intentionally flexible, that the plan allowed them to navigate outside the plan when needed. GRA team members reported that the structure and content of the PD worked really well this year, noting that teachers were able to dig in and develop plans around their own classroom/school needs. Additionally, one team member believed that the inclusion of special education teachers in Treatment 2 helped in developing deeper discussions about the use of UDL, reinforcing the importance of including UDL in classroom planning. In general, Treatment 2 GRAs reported that the teachers appreciated the planning time and support they received. GRAs working with Treatment 1 teachers and preservice teachers commented that teachers seemed confident with the materials and did a good job transforming lessons from Week 1 into kid-friendly activities. Additionally, Treatment 1 teachers seemed to have a good handle on instructional and behavior management techniques and made good use of their team advisors by running ideas past them during the reflective sessions. Treatment 1 GRAs believed that the system of having just two of the Treatment 1 staff members assigned to two groups worked well and was more efficient overall. GRAs who also worked on the data collection and analysis activities that occurred during the summer institute reported that these proceeded smoothly and in a very organized manner. Overall, QuEST GRAs reported very few challenges during Week 2. Those that were reported were mainly minor issues with the lesson materials. It was noted that, during Week 2, one Treatment 1 team had a teacher who wanted to explore an extension to the content although not everyone in the group was comfortable with this trajectory. The situation was felt to be effectively resolved through the use of strategic feedback and coaching.

> *Everybody is always . . . five steps ahead. I was just so impressed in general with the way the kits were set up, the way they had everything organized, living situations, and just . . . everything you could possibly think of, they had already been prepared for us. It was impressive.*
>
> *For me I was the most confident, this being the third year, and because we had done so many presentations on my topic area. This is the first year I felt like I could open them up, not that I ever held back an opinion in the past, but really content and design-wise I was able to really speak up and make my own decisions then defend my decisions. I was more of a contributing member than I had been in the past. That was true on my*

UDL team, but that was also true when I'm working in other disciplines. . . . I got the most out of that this year, just working between departments and seeing how other people think and knowing "oh that's your process" . . . but we can meet on this ground.

Mine [takeaway lesson from QuEST] is always related to data collection. I learned a lot as a GRA. I think . . . this being the third year, [I'm continuing to learn] what works, and what needs to be collected, and the data needed to give you the information you might want or to answer particular questions.

For me, I feel like I'm always refining how to teach and learning how others learn. QuEST is such a wonderful place for me to do it, not only because there are so many teachers there, but also talking through certain ways they're coming to me with a certain perspective. And then there's also the full QuEST team that have all the expertise. I always feel like I've learned quite a bit with every QuEST workshop. I'm able to refine my teaching technique, and all the tools that I have in order to be effective in the classroom.

Academic Year Saturday Sessions 2016–17

During academic year 2016–17, quarterly full-day Saturday sessions were held to provide QuEST teachers a chance to regroup and support one another in applying what they had learned in the summer workshops. The structure of the sessions included facilitation by the QuEST project staff on a predetermined topic, integrated with teacher share-outs around the topic of the day and how they are using QuEST-related practices in the classroom, as well as opportunities for problem-solving with colleagues.

An EPIC evaluator attended one of the four Saturday follow-up sessions, on April 8, 2017. A professional development observation tool was used to determine the presence of best practices for professional development (see Appendix). The same tool was used in the summer institute observations.

Results of the Saturday session follow-up observation are summarized in Table 3. Most of the standards were observed during the Saturday session and those that were not were standards that either did not apply or would have been challenging to observe during this type of one-day session.

Table 3. ***Summary of Professional Development Standards Observed in Spring Follow-Up Session***

Standard/*Indicator*	April 2017 Session
Selection and Organization of Content	
Clearly stated the purpose of the instruction	●
Defined the target audience and necessary prerequisite skills	●
Solicited and answered questions about their instructional goals/activities from teacher participants where necessary	●
Clearly defined expected outcomes	●
Formulated a limited number of goals and/or objectives	●
Developed a conceptual framework to highlight major ideas to be presented and to organize the content	●
Research	
Described the research, evidence, theory, or reports from practitioners that supported the content	●
Avoided conjecture and lots of personal opinion, but included valid alternate opinions to help the participants make their own judgments	●
Fully cited all references and research	○
Identified professional standards or content standards where applicable (e.g., CCSS,	●

Standard/*Indicator*	April 2017 Session
NGSS, GLES)	
When possible, cited evidence of effectiveness of practices presented in the training or presentation	●
Principles of Adult Learning	
Drew upon and honored learners' prior knowledge and experience	●
Provided opportunities for learners to connect new learning to their own work	●
Designed and used problem-centered activities	●
Provided strategies, tools, and techniques that participants could begin to use immediately	●
Offered opportunities for participants to assume responsibility for their own learning (i.e., to be as self-directed as appropriate given content)	●
Community of Learners	
Encouraged dialogue and sharing among participants	●
Encouraged dialogue and sharing between participants and PD staff/content experts	●
Incorporated opportunities for team building and collaboration during sessions and in designed follow-up	●
Considered structures and practices that connect participants across time	●
Encouraged risk taking	●
Provided for celebration of small successes and learning from failures	●
Practice	
Incorporated opportunities for participants to practice new skills in a safe workshop environment and to receive feedback from facilitator and colleagues	●
Facilitated student teaching component in a clear and organized manner	N/A
Encouraged the use of innovative and/or novel approaches where appropriate	●
Ensured adequate time for lesson planning and team building before each teaching session	N/A
Provided guidelines for analyzing student work and using data to guide future instruction in line with PD goals and activities	●
Included debrief time with content experts and PD facilitators to provide feedback around daily instruction, including content, process, and addressing student misconceptions	N/A
Designed follow-up activities to support teachers in new content and process	●
Included structures to track participants following the professional development	●
Encouraged peer classroom observations when appropriate	○
Developed capacity of individuals at site to provide leadership for follow-through	●
Diversity	

Standard/*Indicator*	April 2017 Session
Established norms of respect, openness, and listening through both the content and process	●
Used language and media elements that were respectful of and appropriate to all	●
Planned for an inclusive approach (i.e., used strategies to engage all individuals and subgroups)	●
Selected resources that brought diverse points of view to the table	○
Provided opportunities for educators to share knowledge, skills, and strategies for involving families or other stakeholders appropriately	○
Process Design	
Incorporated a variety of presentation strategies and activity formats	●
Included media elements that appropriately support the content	●
Ensured that participants have opportunities to develop or review related knowledge base	●
Varied learning activities, interspersing didactic with active, hands-on learning	●
Structured daily activities and kept on task so that adequate time was available for instruction, activities, and reflection	●
Self-Assessment	
Ensured that participants were clear about expectations for their own learning and change	●
Allowed for practice and assessment of all stated outcomes	●
Encouraged participants to identify and build on their individual strengths	●
Provided opportunities for participants to identify barriers to change	●
Evaluation	
Built in debriefs at critical points in the training (e.g., at the end of a day)	●
Sought participant feedback throughout the formal learning experience – both formally (e.g., quick feedbacks at day's end) and informally (e.g., by asking participants to signal how it's going for them at intervals throughout the learning experience)	●
Scheduled ample time for end-of-session evaluation	●

Teacher Survey Spring 2017

In the spring of 2017, EPIC administered a survey to teachers to gather information about their experience with the QuEST project, specifically the impact of the professional development received during the 2016 summer institute and the follow-up sessions that occurred during the academic year. The survey consisted of 30 items. Additionally, five demographic questions were included on the survey. Each survey item was mapped to the overall evaluation framework, ensuring adequate data collection for each project objective, including science curriculum descriptions for participating schools, implementation of QuEST project curriculum, development of understanding of science content knowledge, Universal Design for Learning, the 5E model of instruction, and attitudes about the quality of the professional development received. The survey was administered using an online format and designed to be completed in approximately

20 minutes. Most questions were closed-ended, using a 4-point Likert scale (*Strongly Disagree* to *Strongly Agree).* Eleven open-ended items were also included. Survey questions are included in the Appendix.

Teachers were invited to complete the survey during the spring Saturday follow-up session. All teachers who attended the 2016 QuEST summer institute were invited to participate. Participation was voluntary and respondents were assured that their responses would remain confidential, to be used only for research purposes. Teachers who did not attend the April 8 follow-up session were emailed the survey link and given four weeks to complete the survey; teachers who had not completed the survey were prompted at the beginning of the third and fourth weeks of the administration window. There was an overall response rate of 73% (32 respondents out of a total of 44 possible). Open-ended data were analyzed and summarized thematically using NVivo qualitative research software. Closed-ended items were analyzed using descriptive statistics.

Prior to completing questions related to the summer institute, teachers were asked to provide information on their curriculum and instructional practices. Three respondents (16.7%) reported being a preservice teacher during the 2016 summer institute. Among the practicing teachers, there was some variability in the type of curriculum used, with the largest percentage of teachers selecting the *Other* category, followed closely by the percentage of teachers reporting use of a district-created curriculum. In addition, most teachers reported engaging in science instruction several times per week (35.5%) or daily (64.5%), with no teachers reporting engaging in science instruction once weekly or less often. More than half of respondents (54.8%) indicated the typical science lesson was 31–45 minutes. Further, most responding teachers noted they taught their students about the properties of matter during academic year 2016–2017, with many teachers (32.3%) covering the properties of matter for several learning cycles; more than half of respondents taught the full unit. Less than half of responding teachers (41.9%) reported that the properties of matter instruction was very close to the summer institute. Respondents also reported spending an average of 1,144.8 minutes (about 19 hours) teaching students about the properties of matter. Table 4 summarizes this information.

Teachers were asked to indicate how qualified they felt to teach science, physical science, and the properties of matter in the spring of 2016 when they completed the enrollment survey for the program and then again on the spring 2017 survey, after their participation in the summer institute. As shown in Figure 1, most respondents noted feeling *adequately qualified* to teach science in general (84.2%) before their participation in QuEST, with a small percentage of teachers (2.6%) reporting feeling *not well qualified.* After participating in QuEST, all teachers reported feeling *adequately qualified* (59.4%) or *well qualified* (40.6%). In regard to teaching physical science, on the previous survey most teachers (76.3%) reported feeling *adequately qualified* to teach physical science and 7.9% felt *well qualified* to teach physical science, with 15.8% of teachers reporting feeling *not well qualified* to teach physical science. In the spring of 2016, most teachers reported feeling *well qualified* to teach the properties of matter, with 62.5% of teachers selecting this response. On the enrollment survey, most teachers (65.8%) reported feeling *adequately qualified* to teach the properties of matter, with 23.7% of respondents selecting *not well qualified* and 10.5% selecting *well qualified.* This item showed the greatest growth in self-perceived qualification from summer institute enrollment to nine months post-institute. Wilcoxon Signed-Ranks tests were run for each of the pre- and post-survey comparisons shown in Figure 1. The output indicated that post-test scores were statistically significantly higher than pre-test scores for each comparison (Teaching general science $z = -2.65$, $p = 0.008$; Teaching physical science $z = -2.33$, $p = .02$; Teaching properties of matter $z = -4.07$, $p = .001$).

Next, teachers were asked to report how their instruction has been influenced by their experiences as a learner of science in the summer institute. Of the 32 respondents, 31 provided an answer to this question. Many teachers reported the experience of being a learner at the summer institute allowed them to better consider the student learning perspective in their science instruction and to use questioning techniques to encourage students to engage with the content more deeply. Teachers also reported that they gained an increased understanding of the 5E learning cycle method and how to implement it in their classroom. Other respondents noted that they gained content knowledge and that their experience in the summer institute had shifted their thinking about the nature of science instruction in general. See Table 5 for a sample of the comments provided by teachers.

Table 4. *Teacher Information on Science Curriculum and Teaching Practices*

Teacher Information	*n*	%
Were you a preservice teacher during the 2016 Summer Institute?		
Yes	3	9.4%
No	29	90.6%
Do you use a published curriculum or is the science instruction teacher-developed?		
Commercially offered curriculum from a publisher	4	12.5%
District-created curriculum	11	34.4%
Teacher-created materials	5	15.6%
Other (please specify)	12	37.5%
• We have Discovery Techbook plus district and personal are allowed • MySci by WashU, district supplements • We use district and teacher created curriculum • We have a textbook, but we have piece mealed [sic] activities from the district • This year we used Mystery Science • I used information from resources I developed and textbooks		
How often does science instruction happen in your classroom?		
Daily	20	64.5%
Several times per week	11	35.5%
Once weekly	0	0%
Less than once weekly	0	0%
What is the typical lesson duration of the science instruction in your classroom?		
30 minutes or less	4	12.9%
31–45 minutes	17	54.8%
More than 45 minutes	10	32.3%
In the 2016–17 school year, did you teach your students about the properties of matter?		
Yes; a full unit	17	54.8%
Yes; several learning cycles	10	32.3%
Yes; only one learning cycle	2	6.5%
No	2	6.5%
How close was the properties of matter instruction to the unit that you experienced in the summer institute?		
Very close	13	41.9%
Close	15	48.4%
Not very close	3	9.7%
Instructional Time Spent on Properties of Matter	***M***	***SD***
How much total instructional time (in minutes) was spent teaching students about the properties of matter?	1,144.8	1,212.0

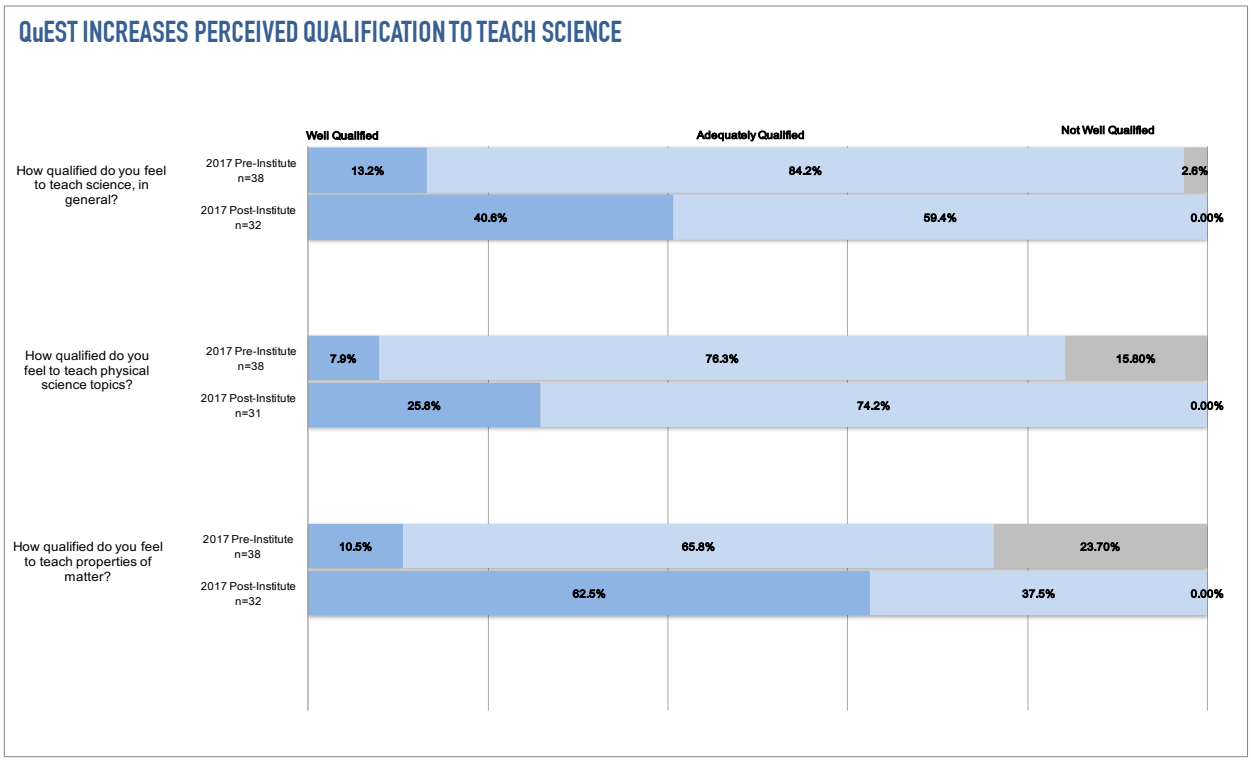

Figure 1. **Teacher Perceptions of Their Qualification to Teach Science-Related Topics.**

Table 5. ***Teacher Perceptions of How Instruction Has Changed as a Result of QuEST Participation***

Theme	*n*	Representative Comments
Student self-discovery	13	• From the summer institute, I feel like I am better at questioning my students in the classroom to get them to think on a critical level. Students are continuing to question how they think about science. • It has helped me to remember what it's like to be a student and confused on what to do. It also helped to realize what problems my kids may face. • By being a learner during the summer, I was able to put myself in the shoes of my student. Asking the questions they would ask, then finding the answer by discovery. This helped me to better understand the content which in turn helps me instruct better.
Increased confidence in and use of 5E	11	• A lot of commercially written lessons just touch the surface of the 5Es. The Summer Institute gave me the opportunity to more fully understand the possibilities of the 5E structure. • I have been able to implement the 5E Learning Cycle into my teaching throughout subject areas. It has been a more accurate representation and measure of student learning. • I learned that the use of the 5E model is more effective than the traditional teaching I was used to before participating in QuEST.
Changes in content knowledge	9	• I gained a lot of knowledge and feel more comfortable with my curriculum. • I feel much more knowledgeable about the materials and subject matter. • I have a better knowledge base for the properties of matter, which makes me confident in teaching that subject matter.

Theme	*n*	Representative Comments
Reflection on the nature of instruction in science	7	• It has made me think deeply about simple science concepts such as what is happening to particles. It has also made me use more vocabulary to help students understand and solidify the concepts taught. I was able to look at science through a different lens of how I even approach science instruction as it pertains to students at different levels of learning. • I've got a lot of ideas that replaced old ideas on how I teach and manage science.
Increased confidence in science instruction	5	• Extremely! I was not confident in physical science as an educator. I was comfortable with my science units in 4th grade. As I transitioned to 5th grade I found myself feeling like a first-year teacher again. The QUEST program allowed me to question my students in the right direction, rather than questioning them as if I had no idea where I wanted them to go or end up. • I enjoyed having the lesson plans available to use during my instruction of the matter unit. I could use, tweak and extend many of the lessons. But having the experience and lessons, better equipped and increased my confidence when teaching.
Increased awareness and use of UDL	3	• It has been very much influenced, it has allowed me to look at science a lot differently and teach it very differently using the UDL model. • It has enlightened me on multiple levels. I am better able to understand balancing UDL and the 5 E's in my science lesson and walking away with multiple teaching strategies and tools. To differentiate instructions in the special education environment.
Understanding use of conceptual storyline	3	• Considering the 5E lesson model and using a conceptual storyline is greatly in the forefront of my mind as a result of the Summer Institute. • From the Summer Institute, I feel that my instruction is now heavily influenced from my experience as a science learner. I now see how important it was for me to tap into my own background knowledge before diving into the more in-depth information. This is something I have been doing and intend to do in all future lessons. I am also checking my instruction to ensure that I have conceptual storylines and use the 5E model a majority of the time when planning science instruction, as this helped me learn.

Another portion of the survey focused on teachers' confidence in their ability to meet the needs of diverse learners before and after attending QuEST. As shown in Figure 2, the majority of teachers (70.8%) reported feeling *somewhat confident* in their ability to meet the needs of diverse learners prior to attending QuEST, although it is interesting to note that no teachers reported feeling *not at all confident* prior to QuEST. After attending QuEST, all teachers reported feeling *somewhat confident* (29.2%) or *very confident* (70.8%) about their ability to meet the needs of diverse learners. Respondents were also asked to describe how UDL has influenced their science instruction for diverse learners. Many of the respondents indicated their exposure to the principles of UDL has made them more cognizant of finding solutions that fit the needs of all students, not just struggling students. Teachers also reported they now have more resources available to them and have actively sought out others as well. Many teachers noted their assessment practices have changed based on the principles of UDL, introducing a variety of ways to let students demonstrate their understanding of concepts. See Table 6 for representative comments.

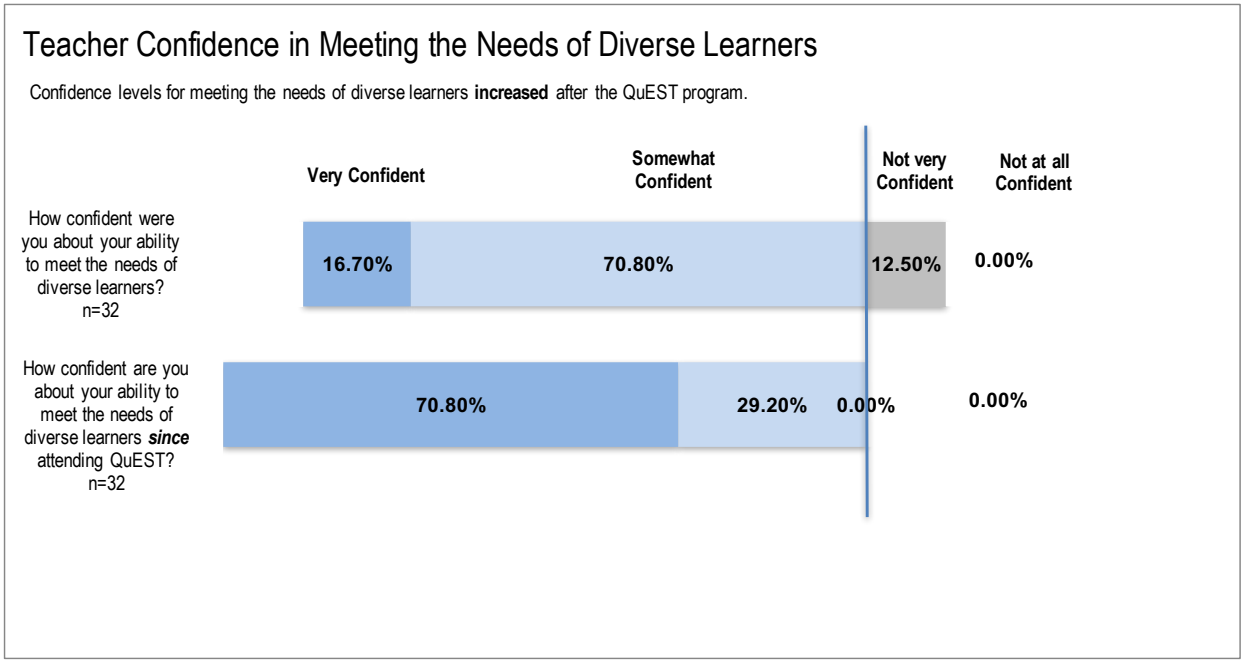

Figure 2. **Teacher Perceptions of Confidence Related to Meeting the Needs of Diverse Learners.**

Table 6. ***Teacher Perceptions of How UDL Has Changed Their Instruction***

Theme	*n*	Representative Comments
Providing solutions for *all* students	15	• I have been able to meet all students where they are in science. I have been able to group students based on reading level for science activities where reading is a prevalent piece of the experiment or activity. This has allowed students to all get the full experience of the content. • I truly think I am proficient enough [to]allow my students to accomplish the same goals while completing different activities. The quest program has allowed me [to] help the diverse learners in a way that did not effect [sic] the learning of others and they all were able to achieve the same results. Due to this they were able to have group discussions and share their learning of science.
Resources	7	• I gained an abundance of tools and strategies. I also was introduced to more resources that I can apply almost immediately within my classroom. In my beginning years of teaching science it was very easy to give a struggling student something other than science to complete while we were doing an experiment. However, after going through UDL workshops two years in a row I have developed strategies to include these students.
Alternative means of representation for assessment	6	• UDL has influenced my science instruction, as I am better able to assess my students and allow them to choose a way in which they can represent their thinking that best suites [sic] their needs. For example, I now provide several different means of representation when assessing students. Not all students are going to be able to demonstrate or explain their thinking using the same forum, so I use the UDL guidelines to ensure that I am accommodating to the needs of all students. This may mean that instead of demonstrating a concept on a piece of paper every time, students may have the option to make a video or PowerPoint or explain their thinking and understanding orally.
Lesson planning	6	• I love having the resource of the UDL to use when planning lessons. It helps me to think about and plan for possible roadblocks that might interfere with lessons.

Theme	*n*	Representative Comments
		Although I was already using many of these strategies they were not formally identified as being part of the UDL. Many new ideas were also introduced to help me become more effective when addressing students with various challenges. • I consider any accommodations or modifications that may be needed while in the planning stages of my science instruction and implement them during the actual lesson.
Awareness of and responsiveness to barriers	6	• It makes me think of my particular group and make adjustments to my lesson plan. It helps me stay accountable for making sure all needs are met. • I have been more open to what hurdles students may face. Then introduced to the various paths possible for these hurdles.
Other	2	• I am constantly differentiating for and scaffolding students, but I am still not certain that I fully grasp UDL.

Teachers were asked about their confidence in their ability to implement the 5E Learning Cycle before and after attending QuEST. As shown in Figure 3, many respondents reported being *not at all confident* (15.6%) or *not very confident* (34.4%) in their understanding of and ability to implement the 5E Learning Cycle prior to attending QuEST. However, after attending QuEST, all respondents indicated that they were *somewhat confident* (34.4%) or *very confident* (65.6%) about their understanding of and ability to implement the 5E Learning Cycle. Respondents were also asked to provide an example of a change in their understanding or ability to implement the 5E Learning Cycle. Many of the respondents reported that the use of 5E helped to engage students in the content. Teachers also provided examples of how 5E helped to increase their effectiveness and confidence in science instruction, provided better organization and presentation of the science concepts, or changed their approach to pedagogy. Representative comments are presented in Table 7.

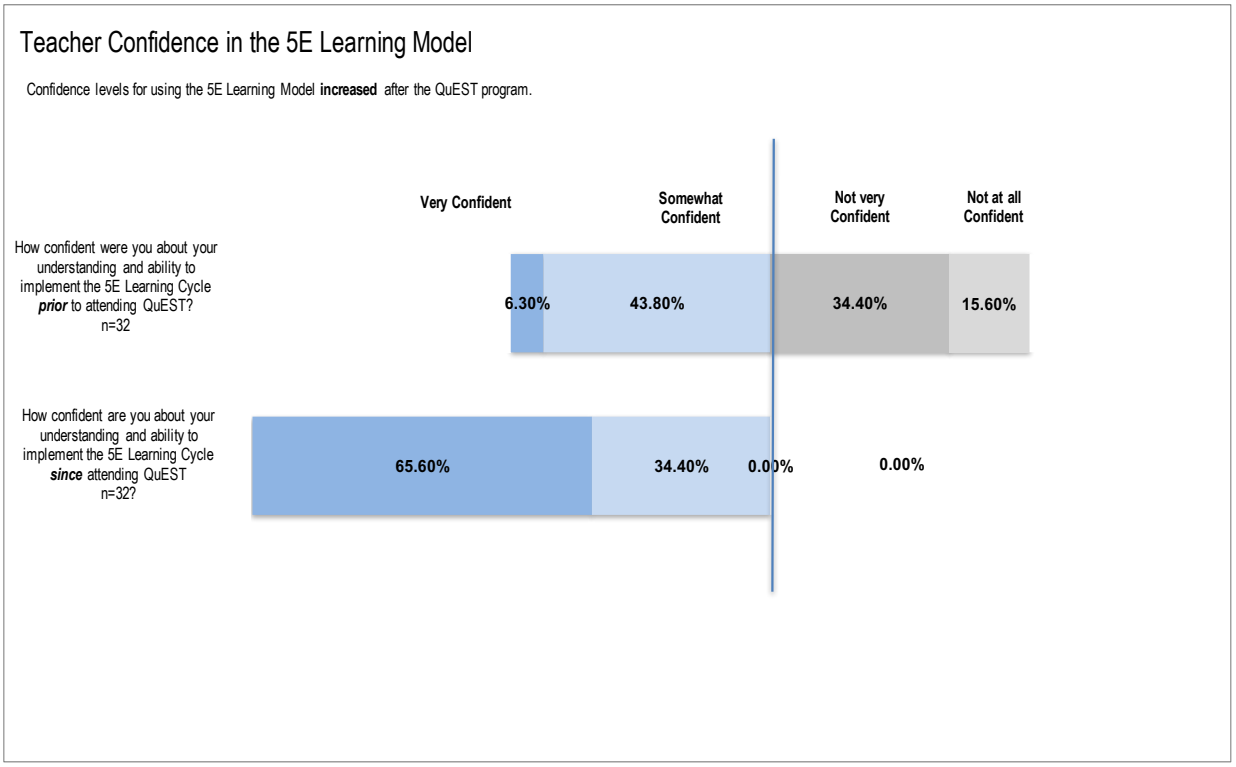

Figure 3. **Teacher Perceptions of Confidence Related to the 5E Learning Cycle.**

Table 7. ***Teacher Perceptions of How the 5E Model Has Changed Their Instruction***

Theme	*n*	Representative Comments
Increased effectiveness/ confidence	13	• I learned about the 5E learning cycle in Dr. Hanuscin's class. I came to the summer institute with prior knowledge, but I have solidified my thinking further through the summer institute. For example, I now know ways I can implement assessment throughout the entire process of the design. We have talked about the ways we can help further student thinking in each stage. • I had learned about the 5E model as a pre-service teacher. However, during that time, I found myself trying to get through all 5E's in one class period, which is not too realistic. This Summer Institute taught me how to more effectively implement it into my classroom (over the course of a few days, etc) and how to make changes as I go, that will best meet the current needs of all of my students. • I had no clue what the 5E Learning Cycle was prior to attending Quest. I feel I have a pretty good understanding of it now. • I realized that I used the 5E instinctively without really knowing what the 5E was prior to the Summer Institute. Now I am more aware of the process and feel like lessons have improved because of my learned knowledge in this area. • With this experience I have gained more and more confidence and feel like I know more of what my goals are in how I want to teach, but that will take time and experiences. Quest has done a fabulous job of letting me experience personally and then giving me the tools to teach using 5 E in lessons done extremely well. Now, I know much more what it should look like!
Better organization/ structure of instruction	8	• I was able to understand how to allow the students to go through this process in a natural order. It was expected and understood by the students and it even allowed them to ask questions and think about different processes of the cycle. Some students would even know what the end result should be of what they were trying to accomplish and from there they knew what do achieve or stride for with the concepts. • I have now modified the district provided curriculum to the 5E model so that my students are more engaged in creating their own learning experience versus being provided answers and then exploring.
Change in pedagogy	7	• I really like that it has changed who does all the problem solving basing it on a more student-centered approach and getting the students more hands on concrete ideas. • I learned that front loading vocabulary words are not necessary of this prior knowledge does not aid in understanding of materials presented.
Use across content areas	2	• I think using the 5E Learning Cycle is a way to incorporate the 5 cycles in all areas of developing my lesson plans. I have found that I think about the 5E's as I am developing plans in all areas.
Other	2	• I learned about the 5E in college and participated in other professional development on it.

Respondents were asked to describe something they have done ***within*** their classroom as a result of QuEST that they would not have done previously. The majority of teachers noted they increased their use of hands-on learning techniques. Teachers also indicated that they have increased their use of 5E and UDL as a result of QuEST, and they have introduced more small group instruction.

Teachers were also asked to describe something they have done ***outside*** their classroom as a result of QuEST that they would not have done previously. Most teachers noted that QuEST allowed them to increase collaboration with other educators, within their school as well as across the state. Several teachers reported that QuEST facilitated changes in their personal knowledge and awareness of the subject matter or of their instructional practice. Three teachers indicated that they became involved in external science-related

activities because of their participation in QuEST. These activities occurring outside the classroom as a result of QuEST participation can be thought of as one type of project dissemination. Table 8 displays representative comments from the respondents.

Table 8. ***Teacher Perceptions of Changes Within and Outside Their Classrooms as a Result of QuEST Participation***

Theme	*n*	Representative Comments
Changes WITHIN classroom		
Increased use of hands-on learning	11	• QuEST allowed me to teach physical science in a hands-on manner. I never imagined that I would use materials and experiments to instruct students how particles move and look. This is such an abstract idea and I always envisioned just telling my students the answer, however, QuEST introduced me to examples and experts that helped me in my planning process. • QuEST provided me with materials to teach and time to think about science lessons. Both are such simple, but often overlooked, entities to teaching.
Use of 5E	8	• Using the 5E method. I traditionally would do lessons straight from the textbook. While using the lessons from QuEST, my students were MUCH more engaged in the lessons than they would be with textbook and regular classroom activities.
Increased use of small group instruction	5	• Letting the students work as a group to discover what I want them to learn. Instead of me feeding them the answers. Which is beneficial to the students in so many ways. • Most of my past science teaching was done more in a whole group format. Through QuEST I saw the importance of students working in small groups and directing their own learning.
Use of a framework for instruction	4	• It has helped me identify more of the backwards design & helping teacher implement it.
Increased emphasis on nature of science	3	• Explain ideas of matter with greater clarity. I have also been more prepared to provide counter examples or additional experiences which would help students arrive at the objective without me "telling" them.
Increased use of UDL	2	• I would not have given as much thought to UDL principles for all students. My experience with accommodations was aimed at students with identified needs only. I am more aware of doing this for all my students now.
Changes OUTSIDE classroom		
Increased collaboration	16	• Engage and collaborate with teachers from other districts and learn from their experiences. • Share the 5E model with other teachers and collaborate with them to help get out lessons into this format. • The opportunity to interact and collaborate with my peers throughout the state has proved highly beneficial. I have been able to exchange ideas and learn about how other teachers are being successful in reaching their students.
Personal knowledge and awareness	7	• I have a new lens for thinking about different scientific concepts. I question way more than I used to. QuEST challenged me to think about science in new ways. • I believe my questioning has increased. I have always been a curious person, but having questions asked of me that made me think at a deeper level, has been extended to so many areas that I have to stop myself sometimes from thinking and just doing. • I think more scientific.

Theme	*n*	Representative Comments
External involvement in related activities	3	• I was able to participate in an ongoing science program that helped guide me to deliver instruction differently this year in my teaching. • Collaborate with my grade level on the same topic at the same time with matter. Last year, half of us taught it at the same time while others did not really teach it at all. This year, 4/5 of us taught it all throughout second trimester and with the same lessons, same materials, same progression, etc. . . . so we could have shared conversations and refine our lessons and practices.
None	1	• I'm not sure.

Next, teachers were asked whether they had support from their school/district to implement what they had learned in QuEST. The majority of respondents indicated that they felt supported by their school and district. Additionally, respondents were asked whether they had support from their QuEST colleagues throughout the school year. Again, the majority of respondents indicated they also felt supported by their QuEST colleagues. Specific comments related to the ways in which teachers felt supported are included in Table 9.

Table 9. ***Teacher Perceptions of School, District, and QuEST Colleague Support***

Theme	*n*	Representative Comments
Support from school and district		
Yes	17	• YES! My principal recommended it, as it was my first year of teaching. I was fully supported by him to implement what I learned at the institute in my classroom. • My school was very supportive of the program. We were given the opportunity to share what we learned in one of our building meetings. The other teachers were receptive to the concepts because several of them have been through the process in other years with the QuEST program. They all wanted to know what we had learned so they could use some of the ideas in their classrooms. • My principal and instructional specialist as well as my district science coordinator supported my participation in QUEST. They allowed me to use the 5-E learning cycle for plans as needed. • Yes. Our science coordinator provided our grade level team with all of the additional supplies that we needed to teach the lessons the team wrote during QuEST.
No	6	• Not really. We are supposed to teach from the curriculum we are given and follow a specific pacing guide. My principal knew I was in the QuEST program so she allowed me to teach using the 5E method. I plan on using it in the future though because it is a great model. • I wish that we had the support to actually teach the lesson, our principal has been supportive in implementing new ideas. We were not able to teach the lesson we needed because we due to inflexibility and resistance from that end. QuEST however has been amazing at answering questions and problem solving.
Not Sure	2	• Not really.
Support from QuEST colleagues		
Yes	23	• Yes. Several of the other teachers in my building have been through the QUEST program in years past, so they were supportive of the program. Also, have two other team members in the building provided me the experiences I needed to grow as a teacher of science. • Yes, the other teachers from my school who also attended QuEST helped me with modifying our district curriculum to fit the 5E model.

Theme	*n*	Representative Comments
		• Yes, I have been able to do a lot of collaboration with my grade-level team. I was also supported by the QUEST team. They were available to help when needed. • YES! It was wonderful to be teaching this unit with my entire grade level. We were constantly bouncing ideas off one another and sharing the results on our students. Reflection and discussion was constant.
No	3	• Those from my district didn't seem as motivated as I was to apply information in all areas throughout the year.
Both	1	• To be honest, time to collaborate was not capitalized upon. Part of this was due to logistics. Every day, I was breastfeeding/pumping during my planning period and lunch. This limited my time with colleagues. However, I think conversations and support will continue and grow in the coming years.

Preservice teachers were asked if they were able to apply what they learned through QuEST to their teaching of science. See Table 10 for the comments provided by three of the preservice teacher participants; two of the three responding preservice teachers reported being able to teach a unit on the properties of matter.

Respondents were asked to describe the ways in which they were most affected by their participation in the QuEST program. A majority of the responses from respondents featured aspects of their pedagogical knowledge and/or understanding that had changed. Several teachers noted that they experienced increased confidence in their abilities as science teachers. Teachers also appreciated the opportunities for collaboration with other teachers, and several cited their increased content knowledge as a benefit of their participation in QuEST. Teachers were also asked what aspects of QuEST they would have liked to spend more or less time on during the follow-up PD sessions. Teachers' perceptions were varied, although many respondents noted that they would like to spend more time on lesson plans and less time on UDL. Table 11 includes teacher comments related to aspects of QuEST that they would have liked to spend more or less time on. Finally, teachers were asked to describe something they had learned in the follow-up PD sessions that contributed to their understanding or implementation of science instruction. Most teachers reported that the variety of instructional strategies gained from the follow-up sessions were the most useful in their classrooms. Many also noted that they developed a better understanding of the use of assessment practice. Other responses were equally divided among the 5E model, the increased content area understanding, and the principles of UDL.

Table 10. ***Preservice Teachers' Use of Knowledge and Skills Learned Through QuEST in Teaching Science***

Theme	*n*	Comments
Yes	2	• Yes, I am student teaching in the fifth grade, so I had the chance to implement what we learned during the summer institute. The prior knowledge learned from the summer institute helped me question my students' thinking. I was able to take what was learned in the summer and apply it to the classroom experience. I had a better understanding to answer student questions. • Yes! In my actually teaching of science, I was in second grade instead of fifth grade, but I found myself still relating back to my QuEST experience. I found myself thinking of myself as a learner first when planning instruction. I worked on not just giving my students the "correct" answer and allowed them time to explore it on their own first.
No	1	• Since I am a preservice teacher, I did not get to apply what I learned directly to a classroom, but I was able to adapt what I learned and apply it to my field and my job at an after school program.

Table 11. *Teacher Perceptions of Various Aspects of QuEST Participation*

Theme	*n*	Representative Comments
Most Impactful Aspects of QuEST		
Changes in pedagogy	18	• It helped me better understand the conceptual storyline and make sure my lessons within a unit flow together. • Gaining knowledge and confidence for what it looks and feels like to teach science in a more effective manner, student centered and question based. As well as more practice with the 5 E's that can be used cross-curricular. • Differentiation for students—I was able to better understand ways to change the instruction for various types of learners.
Increased confidence	6	• My confidence to know as a teacher I was feeding my students the science they needed to prepare them for additional courses. • I feel stronger in teaching science than I ever have been. I enjoyed the materials we were given and the way the lessons were set up.
Collaboration	5	• One of the ways I was most affected by participating in this program was just the interaction with teachers and professionals from various backgrounds, collaborating, working together to discover better and more effective ways to teach a subject that is often put on the back burning [sic] but so necessary to open up the understanding of students. • I felt as though I had a support team. It truly made a difference in my instruction.
Increased content knowledge	4	• My own conceptual knowledge increased as a result of the program. After the program, it challenged me to rethink how I planned lessons in other units of science. • I have gained a deeper understanding of matter and am much more confident and excited to teach the subject. Also, I understand that students will not come to the answer of a big question right away, instead, build up to a logical conclusion through discovery. • My love for science has grown tremendously. I have been doing research outside of work to challenge myself to learn new things.
Aspects of Follow-Up Sessions Teachers Would Have Liked More Time On		
Lesson development/ planning	13	• Creating more science lessons that fit with the standards and followed 5E. We did this more as the sessions progressed due to the QuEST leaders listening to our feedback after sessions!! • Planning and implementing the strategies into other pieces of our science curriculum. • Planning and more activities that would help us delve even deeper in the content. • Seeing other 5E cycles.
More collaboration	3	• Doing more collaboration. • I would like time to think through more planning with my entire team.
More demonstrations/ hands-on activities	5	• Science experiments. I learned so much from the experiments and the hands-on learning is what I will be able to take back to my class for years to come. • More hands on during the extended yearlong PD sessions.
None	2	• Not sure but the time that was spent was well spent!
Teach lessons	2	• I would have liked to teach the lessons. I was not a part of the group that got to.

Theme	*n*	Representative Comments
Other	1	• Anything that we hadn't already done many times in the summer program. The PD sessions were a waste of our valuable time.
Aspects of Follow-Up Sessions Teachers Would Have Liked Less Time On		
UDL	10	• Talking about the UDL. I feel it was a bit overstated. I know it's important but would rather have designed lessons with materials ready to go in the weeks ahead. • Spending so much time with UDL. I felt like we went through problem solutions so much it became over generalized and wasn't as helpful.
Repetition/ review	3	• Reviewing what we did over the summer.
Other	2	• Talking about how to run our classroom.
Nothing/ not sure	9	• I enjoyed and benefited from everything we did in the follow up sessions. • I cannot think of anything. The learning [was] interesting and fun.
Aspects of the Follow-Up PD Sessions That Contributed to Teachers' Understanding of Implementation of Science Instruction		
General instructional strategies	8	• For me, it was the structures. So the eBook, or hyperdoc, that Dr. H made with structures and new ideas to think through things was helpful. For example, right after the session I attended, I used the Frayer model in class AND it informed my instruction! • I learned a lot, but most of all, receiving resources, links, and listening to others has helped me research and discover even better ways to help my lessons become more meaningful to my students. • More in-depth about previous conversations we have had (ex.: following up on using models as a way to explain thinking) and brainstorming several different scenarios in applying these analyses.
Assessment	6	• I learned how there isn't always one correct answer and if the student has an understanding and can provide how they found their idea then that demonstrates a level of understanding. • How to question students.
5E	4	• I learned some new strategies to implement in the elaborate and evaluate phases that I would not have thought of if left to my own devices. • That students need to explore. The exploration phase is so important and my students were missing out on that until I went to QuEST.
UDL	4	• More ways to help struggling students. • Looking up the UDL online and it's [sic] suggestions was nice. A couple of the follow up had some hands on materials and lessons that I used.
Content knowledge	4	• I have learning a deeper knowledge of matter, and different ways I can implement it in my classroom. Each follow up sessions has allowed me to go back and teach something differently every time. • I learned how to build on the matter unit by incorporating the magnets into the lesson plan. How to use different models into the lesson plans.
Collaboration	1	• That more heads are better than one. Loved the collaboration.
Other	3	• It has been a really long time ago and I cannot remember just one specific thing from that follow up session. More of the same information from the previous answers.

Research Plan Implementation Evaluation

This section provides a summary of the findings from the evaluation activities related to the implementation of the QuEST research plan.

Research Plan

The QuEST project research plan includes the annual recruitment of schools within the partner districts for participation in the project intervention and four phases of data collection and analysis. Research plan evaluation consisted of monthly meetings with principal investigators, regular review of progress on the project management tool Asana, and review of relevant project materials, including curricular materials and summaries of teacher- and student-level data. An end-of-summer evaluation report was provided to the QuEST project staff in the fall of 2016 to summarize data collection activities that occurred during the summer institute and interviews with key staff members after the summer institute. Lessons learned were shared with the QuEST staff through both formal and informal means, allowing a continuous process of feedback and refinement of research processes. As in the previous project year, the main challenge faced by the QuEST project around the research plan was in the recruitment of teachers/schools. QuEST project staff members were able to make adjustments to the research plan by recruiting for project participation at other schools and districts to replace those who dropped out or experienced teacher reassignment that affected the availability of teachers to participate. The QuEST staff continued to refine their recruitment procedure to best facilitate the process.

Baseline School and Student Achievement Data

This section contains a summary of demographic data (see Table 12) and student achievement data (see Table 13) for participating treatment schools. As this is a multiyear and longitudinal study, the final report will include summative analyses of achievement data collected and examined by QuEST and EPIC project staffs.

Table 12. ***Total Enrollment and Student Demographic Information by School, 2016***

District	School	Enrolled	Asian	Black	Hispanic	Am. Indian	Multi -race	Pacific Islander	White	Free/Reduced Lunch
Columbia 93	Mary Paxton Keeley Elem.	707	13%	10%	*	*	7%	*	63%	29%
Columbia 93	Rock Bridge Elem.	597	*	12%	*	*	7%	*	74%	32%
Columbia 93	Shepard Blvd. Elem.	520	*	18%	*	*	10%	*	62%	52%
Columbia 93	Thomas Benton Elem.	300	*	46%	*	*	12%	*	38%	*
Fulton 58	Bartley Elem.	275	*	*	*	*	11%	*	84%	55%
Fulton 58	McIntire Elem.	402	*	9%	*	*	*	*	83%	61%
Hazelwood	Cold Water Elem.	431	*	66%	*	*	*	*	27%	60%
Hazelwood	Garrett Elem.	366	*	61%	*	*	*	*	31%	66%
Hazelwood	Lawson Elem.	374	*	51%	*	*	*	*	46%	58%
Independence 30	Fairmount Elem.	367	*	9%	38%	*	8%	*	45%	91%
Independence 30	Procter Elem.	225	*	7%	28%	*	9%	*	54%	79%
Independence 30	Thomas Hart Benton Elem.	450	*	13%	17%	*	12%	*	57%	86%
Normandy	Barack Obama Elem.	481	*	99%	*	*	*	*	*	99%
Normandy	Lucas Crossing Elem. Complex	909	*	96%	2%	*	1%	*	1%	99%

District	School	Enrolled	Asian	Black	Hispanic	Am. Indian	Multi -race	Pacific Islander	White	Free/Reduced Lunch
North Callaway R-1	Hatton-McCredie Elem.	277	*	*	*	*	*	*	90%	50%
North Callaway R-1	Williamsburg Elem.	158	*	*	*	*	*	*	95%	62%
St. Louis City	Buder Elem.	342	*	33%	6%	*	*	*	59%	*
St. Louis City	Hodgen Elem.	223	*	*	*	*	*	*	*	*
St. Louis City	Shaw Visual/Performing Arts Center	377	*	87%	*	*	*	*	10%	*
St. Louis City	Woodward Elem.	289	*	73%	10%	*	*	*	15%	*

*Indicates percent has been suppressed due to a potential small sample size.

Table 13. ***Percentage of Students Performing Below Basic in Key Subject Areas on the MAP by School in ELA, Math, and Science (Grade 5), 2016***

		Below Basic		
District	School	ELA	Math	Science
Columbia 93	Mary Paxton Keeley Elementary	5%	12%	11%
Columbia 93	Rock Bridge Elementary	7%	17%	9%
Columbia 93	Shepard Blvd. Elementary	31%	46%	24%
Columbia 93	Thomas Benton Elementary	30%	44%	35%
Fulton 58	Bartley Elementary	7%	9%	11%
Fulton 58	McIntire Elementary	24%	28%	11%
Hazelwood	Cold Water Elementary	9%	13%	13%
Hazelwood	Garrett Elementary	15%	41%	13%
Hazelwood	Lawson Elementary	16%	21%	10%
Independence 30	Fairmount Elementary	9%	15%	8%
Independence 30	Procter Elementary	29%	38%	19%
Independence 30	Thomas Hart Benton Elementary	29%	46%	8%
Normandy	Barack Obama Elementary	23%	45%	26%
Normandy	Lucas Crossing Elementary Complex	27%	55%	44%
North Callaway R-1	Hatton-McCredie Elementary	24%	35%	10%
North Callaway R-1	Williamsburg Elementary	20%	53%	*
St. Louis City	Buder Elementary	33%	10%	16%
St. Louis City	Hodgen Elementary	24%	33%	24%
St. Louis City	Shaw Visual/Performing Arts Center	24%	33%	27%
St. Louis City	Woodward Elementary	29%	51%	32%

*Indicates no data available or cell value is too small.

Conclusions and Recommendations

In keeping with the responsive, utilization-focused evaluation practice, conclusions and recommendations around the implementation of the three focal areas of the QuEST project have been shared with the QuEST team in an ongoing process during the project year.

The following conclusions and recommendations about the data collected during the Year 4 evaluation of the QuEST project are categorized by the three foci of the overall evaluation plan.

Professional Development Implementation Evaluation

Professional Development Observations

Summer institute. Based on the observation protocol of professional development standards, the QuEST professional development program seemed to adequately address all nine standards for professional learning. Hands-on activities and the opportunities for participants to share experience and knowledge were evident in all observed sessions.

Standards where support evidence was missing were in *Practice* during Week 1 of the institute and *Selection and Organization of Content, Research, Community of Learners, Diversity,* and *Practice* in Week 2. This may have to do with the fact that the evaluators were not able to observe every PD session or that the design of a series of sessions is structured in such a way that evidence is not readily available. However, the project leadership may want to reflect on whether any of the indicators that were not addressed could be important additions to the quality of the PD, or whether they are simply outside the PD model used for QuEST.

Saturday Follow-up Sessions. Based on the observation protocol of professional development standards, the QuEST professional development program seemed to adequately address all nine standards for professional learning during the observed Saturday session. As was observed during the summer institute, hands-on activities and the opportunities for participants to share experience and knowledge were evident in all observed sessions, and well received by the teacher participants. Activities included whole group, small group, and individual work arrangements.

Standards where support evidence was missing were in *Selection and Organization of Content* and *Practice.* The project leadership again may want to reflect on whether this is a gap to be addressed, a reflection of only observing one out of a series of four session, or a philosophical difference in approach.

Teacher Focus Groups

Teacher participants were generally very satisfied with the program's attention to the following aspects of professional development: materials, delivery and organization, facilitator quality, applicability, and overall experience. Participants reported that the professional development experience was more useful than other types of professional development they had attended. They also expressed high levels of satisfaction with the science content gained from the instructional modules and the ability of the facilitators to model deeper questioning skills.

A few participants noted issues of dissatisfaction with the program. When asked to provide suggestions for improvement, comments focused on mental exhaustion during the institute, concern about implementing newly learned strategies and lessons in light of district-specific limitations, and requests for increased planning time with individual materials.

Project Staff Interviews

QuEST project staff members reported that the team continued to function efficiently and effectively in meeting the project goals. Success was attributed to the continued high levels of communication

and organization, and to staff members' increased confidence with the materials both within and outside their areas of expertise.

The biggest challenges faced by the project team members were issues with attrition during the recruitment phase, space issues during Week 1 that limited the involvement of the QuEST staff in the content lesson time, and the loss of the project manager in the spring.

Teacher Survey

The results of the 2016 spring survey indicated teachers' perceptions of their level of qualification to teach science, physical science, and properties of matter had increased from the time when they completed the project enrollment survey. Most notable was the percentage of teachers reporting feeling *well qualified* to teach properties of matter (62.5%) after participating in the QuEST project, up from 10.5% reporting feeling *well qualified* to teach this subject matter at the time of enrollment. Teachers reported an increase in their perception of their ability to meet the needs of diverse learners due to their participation in QuEST, with 87.5% of teachers reporting they were *somewhat confident* or *very confident* prior to their participation, compared to 100% of teachers reporting that they were *somewhat confident* or *very confident* after their participation. All teachers (100%) reported feeling *somewhat confident* or *very confident* about their ability to implement the 5E learning cycle after participating in QuEST, compared to only 50.1% of respondents reporting feeling *somewhat confident* or *very confident* about their ability to implement the 5E learning cycle before participation.

Many teachers reported an increase in confidence in teaching science and in teaching and implementing new strategies in their classroom in general after their participation in the project. Additionally, respondents noted that their way of thinking about science had been affected as well. Other aspects of QuEST participation that most affected teachers included increased pedagogical knowledge and/or skills, the opportunity to regularly collaborate with other teachers, and increased science content knowledge. Teachers reported that the follow-up PD sessions contributed to their understanding or implementation of science instruction through increased exposure to and practice with instructional strategies, including the 5E model and UDL, and an increased understanding of the use of a variety of assessment techniques.

Recommendations

Although it is unknown whether there will be future QuEST (or QuEST-like) professional development opportunities, the following recommendations are provided:

- Build on the use of themes that provide through lines in the curriculum to which participants can refer as they progress through the materials.
- Consider starting with UDL instruction in afternoon sessions during Week 1, setting a foundation for the idea that UDL strategies connect to all the other strands.
- Consider whether to test an alternative delivery of Week 1 content. For example, try presenting science content in the mornings of Days 1, 3, and 5, but in the afternoons of Days 2 and 4.
- Provide more opportunities for preservice teachers to demonstrate their knowledge and to connect to current teacher participants.
- Emphasize objectives of each session, when appropriate, and provide recaps of the previous day when possible, including time to answer questions brought up in the previous day's checkouts.
- Continue to hold pre-institute planning sessions/research retreats and use them as a space to pilot activities and involve non–content area staff members.
- Continue to encourage teachers to take risks and learn to be comfortable with not knowing the "correct" answer.

- Provide more opportunities for teachers to explore application of the institute content and skills in other disciplines in which they may feel more comfortable than science.
- Continue and increase the amount of time that teachers have for collaboration and planning during the Saturday follow-up sessions.
- Continue the exploration of best practice in science instruction by providing more resources around topics of teacher interest, such as assessment, technology, and hands-on experiment ideas.
- Decrease the amount of time spent on topics that have already been thoroughly covered in previous sessions.

Research Plan Evaluation

Based on the ongoing communication with the QuEST project staff and use of the project management tool Asana, the QuEST research plan implementation seemed to proceed according to plan. Data collection and analysis activities were carried out in a timely and organized fashion. Smoother operation of the research components during the institute occurred due to increased communication and planning. Changes in/additions to the project staff were accomplished without major disruption to the working of the team as a whole. Recruitment and attrition were again the main challenges encountered by the QuEST team, requiring slight modifications to the research plan.

Recommendations include continuing the process put into place to ensure timely and thorough data collection and analysis activities; continuing to hold ongoing research team meetings; continuing the use of the project management tool; and maintaining a high degree of communication within and between project teams to ensure coordination of research activities. As the research team synthesizes several years' worth of data, the evaluation team will conduct reviews of the analysis plans and outcomes for the summative report.

Dissemination Plan Implementation Evaluation

QuEST researchers accomplished the dissemination of project information and results to the public, researchers, and teacher educators in a variety of ways. Project evaluators continued to collect information and artifacts relating to dissemination during Year 4 of the QuEST project. A discussion of the avenues of dissemination across all project years will be summarized and included in the summative evaluation report. Recommendations at this stage in the project include continuing to reach out to QuEST alumni and other local networking activities to help in the dissemination process.

Year-to-Year Comparison

From their own observations and conversations with participants, evalautors noted the following changes between aspects of the 2015 and 2016 summer institutes:

- Use of new reflection forms designed to elicit more specific thoughts and feedback, resulting in an increased quality and depth of reflections across the summer institute.
- Increased participant interest in developing and integrating formative assessment.
- Increased acceptance of the Treatment 1/Treatment 2 division during Week 2.
- Increased organization and objectives for the Week 2 Treatment 2 activities, and flexibility in responding to individual/group needs.
- Increased participant understanding of the concept and use of the conceptual storyline and UDL.

Appendix

QuEST Professional Development Observation Tool

Observation Data

PD Implementation (Goal 1): The evaluation question for this component asks to what extent has the QuEST project achieved its goal within the expected timetables using the stated principles and processes (summer PD, situated PD experience, quarterly follow-up sessions). The evaluator will examine the factors that facilitate or hinder implementation plans as well as the way in which the project staff manages and overcomes barriers.

General Details

Date: _____ Observer: _____

Group: _____ Lesson Topic: _____

Start Time: _____ End Time: _____

Length of Observation *(in minutes)*: _____

Participant Information

Number of Participants: _____ Number of Facilitators/Trainers: _____

Classroom Organization

Which types of participant organization were observed during the observation? *(check all that apply)*

_____ Whole class _____ Small groups _____ Individual work

What was the overall level of participant involvement? *(check only one)*

_____ Low attention (less than 25% on task throughout observation)

_____ Moderate attention (25% to 75% on task throughout observation)

_____ High attention (more than 75% on task throughout observation)

Standard	Support Evidence for Addressing the Standard	Suggested Practices
Selection and Organization of Content Clearly defined learning objectives provide a focus for the content, which is organized around a framework or structure	Clearly stated the purpose of the week's activities Observed_____ Not Observed_____	Written learner objectives communicated at the beginning of instruction Graphic organizer(s) Outline Assess learners' prior knowledge and experience (formally or informally)
	Defined the target audience and necessary prerequisite skills Observed_____ Not Observed_____	
	Solicited and answered questions about their instructional goals/activities from teacher participants where necessary Observed_____ Not Observed_____	
	Clearly defined expected outcomes Observed_____ Not Observed_____	
	Formulated a limited number of goals and/or objectives Observed_____ Not Observed_____	
	Developed a conceptual framework to highlight major ideas to be presented and to organize the content Observed_____ Not Observed_____	
Standard	**Support Evidence for Addressing the Standard**	**Suggested Practices**
Research Content reflects current research, sound theory, and craft knowledge as appropriate	Described the research, evidence, theory, or reports from practitioners that supported the content Observed_____ Not Observed_____	Report results of research studies Describe previous work with QuEST Consult content standards
	Avoided conjecture and lots of personal opinion, but included valid alternate opinions to help the participants make their own judgments Observed_____ Not Observed_____	
	Fully cited all references and research Observed_____ Not Observed_____	
	Identified professional standards or content standards where applicable (e.g., CCSS, NGSS, GLES) Observed_____ Not Observed_____	
	When possible, cited evidence of effectiveness of practices presented in the training or presentation Observed_____ Not Observed_____	

Standard	Support Evidence for Addressing the Standard	Suggested Practices
Principles of Adult Learning The learning activities are consistent with principles of adult learning	Drew upon and honored learners' prior knowledge and experience Observed_____ Not Observed_____	Assess learners' prior knowledge and experience (formally or informally) Activate prior knowledge Build in time for individual reflection Develop case studies and/or scenarios for problem solving Offer hands-on practice in using related tools, techniques, and strategies Connect new strategies directly to teacher experience Encourage participants to set their own improvement goals
	Provided opportunities for learners to connect new learning to their own work Observed_____ Not Observed_____	
	Designed and used problem-centered activities Observed_____ Not Observed_____	
	Provided strategies, tools, and techniques that participants could begin to use immediately Observed_____ Not Observed_____	
	Offered opportunities for participants to assume responsibility for their own learning (i.e., to be as self-directed as appropriate given content) Observed_____ Not Observed_____	

Standard	Support Evidence for Addressing the Standard	Suggested Practices
Community of Learners The design for the professional learning experience seeks to create a community of learners	Encouraged dialogue and sharing among participants Observed_____ Not Observed_____	Plan carefully for grouping and re-grouping of participants Collaboration in small groups Introduce norms for participation to the group Use cooperative learning strategies Investigate use of online community for past and present participants
	Encouraged dialogue and sharing between participants and PD staff/content experts Observed_____ Not Observed_____	
	Incorporated opportunities for team building and collaboration during sessions and in designed follow-up Observed_____ Not Observed_____	
	Considered structures and practices that connect participants across time Observed_____ Not Observed_____	
	Encouraged risk taking Observed_____ Not Observed_____	

	Provided for celebration of small successes and learning from failures Observed_____ Not Observed_____	Provide participant lists Build in opportunities for individual and group reflection on group processes
Standard	**Support Evidence for Addressing the Standard**	**Suggested Practices**
Practice The design affords participants opportunities to practice new skills and includes appropriate follow-up activities	Incorporated opportunities for participants to practice new skills in a safe workshop environment and to receive feedback from facilitator and colleagues Observed_____ Not Observed_____	Use role plays, rehearsals, etc. Adapt critical friend approach to workshop setting Encourage support groups Online follow-up through discussion areas, listservs, or other social media Self-paced follow-up activities that are not monitored by a facilitator Encourage participants to set their own improvement goals
	Facilitated student teaching component in a clear and organized manner Observed_____ Not Observed_____	
	Encouraged the use of innovative and/or novel approaches where appropriate Observed_____ Not Observed_____	
	Ensured adequate time for lesson planning and team building before each teaching session Observed_____ Not Observed_____	
	Provided guidelines for analyzing student work and using data to guide future instruction in line with PD goals and activities Observed_____ Not Observed_____	
	Included debrief time with content experts and PD facilitators to provide feedback around daily instruction, including content, process, and addressing student misconceptions Observed_____ Not Observed_____	
	Designed follow-up activities to support teachers in new content and process Observed_____ Not Observed_____	
	Included structures to track participants following the professional development Observed_____ Not Observed_____	
	Encouraged peer classroom observations when appropriate Observed_____ Not Observed_____	
	Developed capacity of individuals at site to provide leadership for follow-through Observed_____ Not Observed_____	

Standard	Support Evidence for Addressing the Standard	Suggested Practices
Diversity The content and activities are sensitive to and respectful of cultural diversity	Established norms of respect, openness, and listening through both the content and process Observed_____ Not Observed_____	Use language and media that are free from bias Include media elements of various genders, races, ages, and abilities
	Used language and media elements that were respectful of and appropriate to all Observed_____ Not Observed_____	
	Planned for an inclusive approach (i.e., used strategies that engaged all individuals and subgroups) Observed_____ Not Observed_____	
	Selected resources that brought diverse points of view to the table Observed_____ Not Observed_____	
	Provided opportunities for educators to share knowledge, skills, and strategies for involving families or other stakeholders appropriately Observed_____ Not Observed_____	
Standard	**Support Evidence for Addressing the Standard**	**Suggested Practices**
Process Design The design for the learning experience includes an appropriate balance between the presentation of content and active participant engagement	Incorporated a variety of presentation strategies and activity formats Observed_____ Not Observed_____	Balance lecture of text-based presentation with hands-on or reflective activities Provide opportunities for various intensity and mastery levels of activities Continuously scan and monitor to assess extent of participant engagement Use warm-ups and energizers to energize participants at critical points Provide transitions to maintain the flow of activities Use schedule/timing so that event and participants stay focused
	Included media elements that appropriately supported the content Observed_____ Not Observed_____	
	Ensured that participants have opportunities to develop or review related knowledge base Observed_____ Not Observed_____	
	Varied learning activities, interspersing didactic with active, hands-on learning Observed_____ Not Observed_____	
	Designed for all learning styles: the visual, auditory, kinesthetic Observed_____ Not Observed_____	
	Structured daily activities and kept on task so that adequate time was available for instruction, activities, and reflection Observed_____ Not Observed_____	

Standard	Support Evidence for Addressing the Standard	Suggested Practices
Self-Assessment The learning experience includes formal and informal opportunities for self-assessment that facilitate participant evaluation of their current practice, willingness to change, and monitoring of their progress	Assured that participants were clear about expectations for their own learning and change Observed_____ Not Observed_____ Allowed for practice and assessment of all stated outcomes Observed_____ Not Observed_____ Encouraged participants to identify and build on their individual strengths Observed_____ Not Observed_____ Provided opportunities for participants to identify barriers to change Observed_____ Not Observed_____	Develop and facilitate participant use of rubrics, checklists, etc. Introduce participants to concepts of feedback using some language that focuses on positive vs. areas for improvement Model reflective practice to participants Provides opportunities for participants to surface and examine attitudes and beliefs that relate to proposed behavioral changes
Standard	**Support Evidence for Addressing the Standard**	**Suggested Practices**
Evaluation Participants will have opportunities to evaluate the quality of the professional learning experience	Built in debriefs at critical points in the training (e.g., at the end of a day) Observed_____ Not Observed_____ Sought participant feedback throughout the formal learning experience – both formally (e.g., quick feedbacks at day's end) and informally (e.g., by asking participants to signal how it's going for them at intervals throughout the learning experience) Observed_____ Not Observed_____ Ample time scheduled for end-of-session evaluation Observed_____ Not Observed_____	Be open to participant questions and concerns Plan for brief written feedback at the end of each day of a multiday event Use feedback to identify and meet the needs of participants Consult with staff in design of follow-up evaluations

QuEST Teacher Focus Group Protocol – Summer 2016

The evaluation question for this component of the research project asks to what extent has the QuEST project achieved its goal within the expected timetables using the stated principles and processes (summer PD, situated PD experience, quarterly follow-up sessions). The evaluator will examine the factors that facilitate or hinder implementation plans as well as the way in which the project staff manages and overcomes barriers.

The primary objectives of the QuEST PD program are to:

- Strengthen teachers' knowledge of physical science content appropriate to the K–6 curriculum;
- Enhance teachers' pedagogical knowledge for teaching elementary science;
- Support the development and enactment of teachers' pedagogical content knowledge; and
- Improve the learning of all students in K–6 science.

The goals of the teacher focus groups are to:

- Gauge teacher satisfaction with professional learning;
- Determine whether teachers mastered new knowledge and skills; and
- Gather teacher perceptions around how applicable the new knowledge and skills will be to their classroom.

Welcome

Thank you for your willingness to participate in this focus group and to share your expert insights into the professional development you are receiving in this summer institute. (Introduce Kristine and self.) We are here from the Educational Policy Improvement Center in Eugene, Oregon, as observers of this workshop. We serve as the evaluators of the QuEST project, which means that we are supporting the project leaders in determining improvements to the project and, later on, we will look at the project's outcomes.

Our discussion today will focus specifically on your perceptions of the usability of the materials presented to you in this PD experience and on your level of overall satisfaction with the PD.

The results will be used to improve next year's summer institute.

You were selected because you are participating in QuEST as (change this depending on whether talking to Treatment/Comparison/Preservice teachers).

Introductions

Please tell us your name, where you teach and at what grade level (change this when speaking to preservice teachers – where you are in your preservice program and the certification level you are working toward), and why you signed up for this PD experience.

Guidelines

My role as facilitator will be to guide the discussion. There are no right or wrong answers, only differing points of view. Please feel free to share your point of view even if it differs from what others have said. Keep in mind that we're just as interested in critically constructive comments as positive comments, and at times the constructive comments are the most helpful.

We will be audio recording this discussion today. I will be asking each one of you for your consent to do so. Say to the participant: This is _____ (evaluator) interviewing _____ (participant) on _____ (date). We are audio recording this interview. Is that ok with you? (Wait for positive response.) Thank you.

We ask that you silence your phones. If you cannot and if you must respond to a call, please do so as quietly as possible and rejoin us as quickly as you can.

Discussion Topics

Week 1

We're going to start by asking you some questions about last week, which was Week 1 of the summer institute.

Communication of Objectives

Did you feel like you understood the overall objectives of the QuEST project?

Were the objectives for the first week of the PD institute clearly outlined?

Organization and Delivery of Material

What would you say about the quality of the materials used in the PD?

How well organized was the delivery of the PD material in the first week?

Facilitator Quality

How well prepared were the instructors to facilitate the workshop?

What would you say about the ability of the facilitators to promote understanding of the PD materials?

Applicability to Your Classroom Instruction (PD, curriculum, 5E model, UDL)

How easily do you think the physics curriculum will integrate into your classroom?

How easily do you think the 5E model of science instruction will integrate into your classroom?

Do you have any concerns about integrating the 5E model and/or the science content into your classroom?

How easily do you think the principles of the Universal Design of Learning will integrate into your classroom?

Do you have any concerns about integrating the principles of the Universal Design of Learning into your classroom?

How well prepared do you feel to use what you have learned in your classroom (science content, ConcepTest)?

How effective do you think the 5E model will be in promoting students' understanding of science?

What would you say about the overall delivery of the PD in the first week? (timing, transitions, asking/answering questions, etc.)

Week 2

Now, we'd like to talk to you about the activities that have occurred this week, which is Week 2 of the summer institute.

How Well Were Objectives Communicated

Were the objectives for the second week of the PD institute clearly outlined?

Organization and Delivery of Material

How well organized was the delivery of the PD material in the second week?

Facilitator Quality

How well prepared were the instructors to facilitate the workshop?

What would you say about the ability of the facilitators to promote understanding of the PD materials?

Situated PD Experience (Tx/Preservice Teachers Only)

How would you describe your experience in the embedded teaching experience in Week 2? How has this experience differed from other types of professional development you have attended?

Do you feel like the embedded teaching experience will allow you to better implement what you learned in your classroom this year/when you have your own classroom?

PD Experience (Comparison Only)

How would you describe your experience in the second week of professional development?

Do you feel like the activities in the second week will allow you to better implement what you learned in your classroom this year?

What would you say about the overall delivery of the PD in the second week? (timing, transitions, asking/answering questions, etc.)

Wrap-Up

We have two final "finish the sentence" questions. Let's go around the room and finish each.

Elements of this PD experience from which I learned most were…

Elements of this PD experience that could be improved were…

Again, thank you for your contribution to this focus group. We have enjoyed spending time with you today and hearing about your participation in this professional development experience.

QuEST Spring Teacher Survey 2016

Consent

The Educational Policy Improvement Center (EPIC) is evaluating the QuEST grant to investigate the effects of the professional development model used to provide teachers with support around elementary science instruction. EPIC staff, along with staff from QuEST who lead the grant, have put together a survey to ensure we have teacher input on the impact of the professional development received as part of the QuEST project during the summer institute of 2015 and the following academic school year. This survey should take about 20 minutes to complete.

Use of Teacher Survey Data

The use of teacher survey data by QuEST may include, but is not limited to, overall reporting of results at the school level to the grant funding agency; use of school-level and grant-level results to improve professional development for teachers around elementary science instruction; and sharing overall results with others in education who want to learn more about the QuEST model of professional development delivery.

Confidentiality

EPIC and QuEST will take all steps necessary to make sure that the results of this survey are kept confidential. Surveys are collected and delivered to EPIC for statistical analysis. There is always the possibility of tampering from an outside source when using the Internet for collecting information. While the confidentiality of your responses will be protected once the data are downloaded from the Internet, there is always the possibility of hacking or other security breaches that could threaten the confidentiality of your responses. Please know that you are free to decide not to answer any question.

Terms of Assent

Completing this survey is voluntary. If you decide to complete the survey, you are free to stop at any time. EPIC and QuEST do not believe there are any risks related to your participation and hope that your survey responses will help the grant team to improve teacher professional development around science instruction. If you have any questions regarding the survey or the evaluation of this grant, you may contact the evaluator, Tracy Bousselot, at 541.246.2600 or 877.766.7729 or tracy_bousselot@epiconline.org.

First Name

Last Name

Please describe how science instruction was accomplished in your school in the 2015–16 school year.

Do you use a published curriculum (e.g., kit or textbook) or is the science curriculum teacher-developed?

- ○ Commercially offered curriculum from a publisher
- ○ District-created curriculum
- ○ Teacher-created materials
- ○ Other, please explain: _____

How often does science instruction happen in your classroom?

- ○ Daily
- ○ Several times per week
- ○ Once weekly
- ○ Less than once weekly

What is the typical lesson duration of the science instruction in your classroom?

- ○ 30 minutes or less
- ○ 31–45 minutes
- ○ More than 45 minutes

In the 2015–16 school year, did you teach your students about electrical circuits and energy?

- ○ Yes; a full unit
- ○ Yes; several learning cycles
- ○ Yes; only one learning cycle
- ○ No

How much total instructional time (in minutes) was spent teaching students about electrical circuits and energy?

How close were your lessons to the electrical circuits and energy unit that you experienced in the Summer Institute?

- ○ Very close
- ○ Close
- ○ Not very close

Since your participation in the 2015 QuEST Summer Institute:

How qualified do you feel to teach science, in general?

- ○ Well-qualified
- ○ Adequately qualified
- ○ Not well-qualified

How qualified do you feel to teach physical science topics, in particular?

- ○ Well-qualified
- ○ Adequately qualified
- ○ Not well-qualified

How qualified do you feel to teach electrical circuits and energy?

- ○ Well-qualified
- ○ Adequately qualified
- ○ Not well-qualified

How has your instruction been influenced by your experience as a learner of science in the summer institute?

How confident were you about your ability to meet the needs of diverse learners prior to attending QuEST?

- ○ Very confident

- ○ Somewhat confident
- ○ Not very confident
- ○ Not at all confident

How confident are you about your ability to meet the needs of diverse learners since attending QuEST?

- ○ Very confident
- ○ Somewhat confident
- ○ Not very confident
- ○ Not at all confident

How has UDL influenced your science instruction for diverse learners? Please provide a concrete example.

How confident were you about your understanding of and ability to implement the 5E Learning Cycle prior to attending QuEST?

- ○ Very confident
- ○ Somewhat confident
- ○ Not very confident
- ○ Not at all confident

How confident are you about your understanding of and ability to implement the 5E Learning Cycle since attending QuEST?

- ○ Very confident
- ○ Somewhat confident
- ○ Not very confident
- ○ Not at all confident

Please elaborate on your response to the item above with an example about a change in your understanding or ability to implement the 5E Learning Cycle.

Were you a preservice teacher during the 2015 Summer Institute?

- ○ Yes
- ○ No

Discuss something your participation in QuEST has enabled you to do WITHIN your classroom that you would not have done previously.

Discuss something your participation in QuEST has enabled you to do OUTSIDE your classroom that you would not have done previously.

Did you have support from your school/district to implement what you learned in QuEST? Please explain.

In what way were you affected the most by your participation in the QuEST program? Please explain.

Were you able to apply what you learned in QuEST to teaching other content areas? Please explain.

Did you have support from your QuEST colleagues throughout the school year? Please explain.

What would you have liked to spend more time on during the follow-up PD sessions?

What would you have liked to spend less time on during the follow-up PD sessions?

Please describe something you learned in the follow-up PD sessions that contributed to your understanding or implementation of science instruction.

Preservice Teachers Only:

Were you able to apply what you learned in QuEST to actually teaching science? If so, in what context and how effectively?

Describe something your participation in QuEST has enabled you to do that you would not have done previously.

What about your participation in the QuEST program affected you the most? Please explain.


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