PIE

Pathways for Instructionally Embedded Assessment

Educator Perspectives on the PIE Assessment System: Evidence From a Pilot Study

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Contents

Introduction

The PIE project was funded through a Competitive Grant for State Assessments (CGSA) award offered by the United States Department of Education. PIE aims to construct and evaluate a prototype assessment system built on cognitive models of student learning (learning pathways) aligned with grade-level academic expectations. The PIE project is led by the Missouri Department of Elementary and Secondary Education (DESE) in partnership with Accessible Teaching, Learning, and Assessment Systems (ATLAS) at the University of Kansas.

The PIE prototype system includes assessments embedded throughout instruction as well as end-of-course or end-of-year assessments. Instructionally embedded assessments offer students the opportunity to demonstrate what they know and can do as they learn. By using learning pathways as the basis for assessments that are administered at instructionally relevant points in time, embedded assessments can provide more fine-grained and timely information about student academic progress for teachers to inform their instructional decisions during the school year. The end-of-year assessment, in combination with the instructionally embedded assessments, supports a multiple measures approach to assessment that can potentially meet the goals of traditional spring summative assessment models. The PIE project aims to evaluate the feasibility and technical adequacy of this integrated, prototype assessment system. A project goal for the PIE project is to evaluate the usability of the PIE assessment system in classrooms.

The studies described in this report were intended to support PIE project goals and provide evidence of PIE system usability, including teachers' perspectives on training and resources, implementing assessment and instruction cycles, and the reporting dashboard, and to provide evidence to evaluate specific claims in the PIE theory of action. This report presents evidence from multiple studies carried out as a part of the broader pilot phase of the project. These studies provided PIE project staff with multiple opportunities to learn from teachers about their experiences during the pilot phase of the PIE project. This report describes the findings from a group of studies aimed at gathering information about teacher perspectives of the PIE system. Findings below come from interview sessions with participating teachers, focus group sessions, and open-ended teacher survey data.

While multiple methods were used to conduct the studies, the results are presented holistically, organized according to broad research questions, to provide insight into themes and takeaways that were common across the group of studies.

Background

PIE Assessments

The 2024–2025 PIE pilot study assessments consisted of 427 items to assess learning pathway levels aligned to 25 priority fifth grade Missouri mathematics standards. PIE assessments measure student mastery in fifth grade mathematics. The purpose of the PIE assessments is to support classroom teachers in making instructional decisions that ultimately improve student

progress toward mastery of grade-level content expectations. Results from the PIE assessments are intended to support interpretations about what students know and can do relative to research-based learning pathways. Results provide information that can offer insight into student learning and guide instructional decisions. Research supports the significance of instructionally useful assessments and timely results in providing educators and students with actionable insights into how students acquire knowledge and skills along a content progression (Evans & Marion, 2024). The PIE theory of action and validation plan was used to outline the evidence needed to support valid interpretations of assessment results used for both formative and summative purposes. For more information on the PIE theory of action and validation plan, refer to the *PIE Pilot Study: Design and Administration Evidence Technical Report* (ATLAS, 2025a).

For the pilot study, assessments were administered using the Kite® Suite. In the Kite Educator Portal, teachers were tasked with creating content groups of two to five standards to cover 25 Missouri fifth-grade mathematics standards that were selected for use in the PIE project. Assessment content was developed to align to one of three learning pathway levels for each content standard, each designed to measure increasingly progressive skills and understandings.

Teachers assigned three assessments for each content group throughout the instructionally embedded assessment window: baseline (Level 1), midway (Level 2), and end of unit (Level 3). Educators used content groups to engage in cycles of instruction and assessment, where they would instruct on content and administer one of the three assessments adjacent to instruction. This process was designed to repeat with subsequent content groups. For more information about the design of the pilot study, refer to *PIE Pilot Study: Design and Administration Evidence Technical Report* (ATLAS, 2025a).

Pilot Study

The PIE pilot study took place during the 2024–2025 school year and included 55 teachers across 28 districts, 32 schools, and 69 classroom rosters. Participating districts included rural, suburban, and urban environments. A range of enrollment sizes, from small (n = 2) to large (n = 87, which represented a teacher who was responsible for math instruction for multiple classes), were included.

As pilot study participants, classroom teachers developed content groups and delivered repeating cycles of instruction and assessment to their students. Within these cycles, teachers planned and created content groups based on priority standards, instructed on content, administered assessments, and adjusted their instruction based on assessment results.

PIE project staff sought educator feedback to inform the PIE assessment validation plan and potential future improvements to the PIE system to meet the needs of educators and their students.

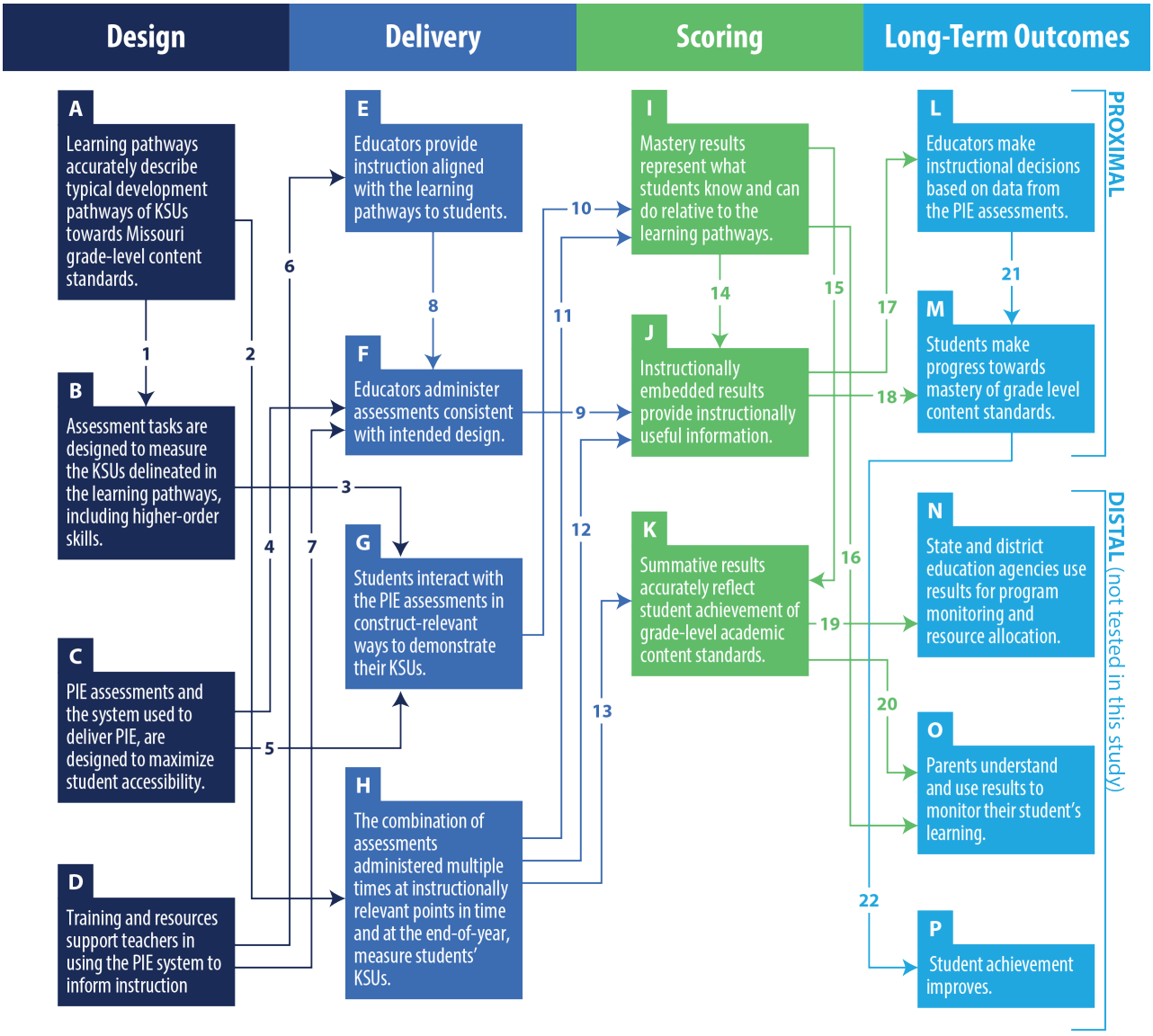
PIE Theory of Action

The PIE theory of action (Figure 1) defines the claims in the validity argument that must be in place to achieve the goals of the system. This report provides evidence to evaluate Claims D

(Design component), E (Delivery component), J (Scoring component), and L (Long-Term Outcomes component).

Figure 1.

PIE Theory of Action Diagram



*KSUs = knowledge, skills and understandings

For a comprehensive overview of all claims and corresponding propositions in the theory of action, including sources of evidence for each claim and proposition, refer to the *PIE Pilot Study: Design and Administration Evidence Technical Report* (ATLAS, 2025a).

Research Questions (RQs) and Study Goals

The studies described in this report were intended to collect information about: (1) feasibility and usability of the PIE system in classrooms, and (2) how teachers used the PIE system relative

to the claims in the PIE theory of action. Researchers sought to understand teacher experiences with the PIE system interface, creation of content groups, experiences with carrying out cycles of instruction and assessment, their use of results to inform subsequent instruction, and recommendations for the future use of the PIE system. The findings from these studies provide evidence to inform the overall validity argument for the PIE assessment system and will be used for future versions of the PIE system.

This report includes information gathered during interview sessions with educators who participated in the PIE pilot study, information collected during focus group sessions with participating teachers, and data gleaned from open-ended survey items administered to teachers at the conclusion of the PIE pilot.

In the first round of interviews, PIE project staff sought teacher feedback on their experience with the PIE system, particularly their experiences in creating PIE content groups and with implementing PIE assessment and instruction cycles. In the second round, these discussions were continued with an emphasis on how their use of the PIE system may have evolved over time from continued use over the course of the pilot period. In the focus groups, researchers were interested in how teachers perceived the timing of PIE instruction and assessment cycles and the cycles' usefulness to their instruction. In addition, PIE staff sought to gather information on the types of instructional adjustments teachers made based on results in the PIE reporting dashboard, and if/how teachers reflected on these instructional decisions and adjustments. In the teacher survey, project staff sought to gain teacher reflections on their experiences as participants in the pilot study including their use of PIE training and resources, administering PIE assessments in the Kite system, and their use of assessment results.

The research questions that guided the teacher interviews and focus groups were as follows:

1. What were teachers' experiences in creating PIE content groups?
    a. Which process, materials, and resources did teachers use to inform the creation of their content groups?
    b. Did teachers change their planned content groups over the course of the pilot study, and if so, what prompted those changes?
    c. Did teachers perceive their content groups effective at supporting their instruction?
2. What were teachers' experiences with implementing PIE assessment and instruction cycles?
    a. What were teachers' experiences with using the learning pathways as part of their instructional plans or decisions?
        1. Did teachers' uses of the learning pathways change over the course of the instructionally embedded window, and if so, in what ways?
    b. Did teachers perceive the frequency and timing of the embedded assessments as useful to instruction or a barrier to instruction?
    c. How did teachers interpret and use assessment results in the classroom?
        1. Did their uses change over the course of the instructionally embedded window, and if so, in what ways?
    d. Did teachers change their instruction based on PIE assessment results, and if so, in what ways?

    1. In what ways did teachers' instructional decisions change over the course of the instructionally embedded assessment window (if any)?
  e. What kinds of instructional adjustments based on assessment results did teachers perceive as effective/ineffective with their students?
  f. Did teachers reflect on their instructional decisions, and if so, in what ways?
3. What were teachers' overall experiences, perceptions, and recommendations for potential future use of the PIE system, including PIE's instructional utility in the classroom and training to support intended uses of the system?

To collect information on educator experiences with the PIE system features and interface, in accordance with the research questions, the following open-ended questions were administered to educators via the teacher survey:

- Please describe any factors that affected your ability to implement cycles of instruction and assessment based on content groups.
- What changes would you like to see to improve the content groups management page in Kite Educator Portal?
- What kinds of information would you like to see added or removed on the classroom mastery report or individual student mastery report?
- What changes would you like to see to improve the reporting dashboard in Kite Educator Portal?
- Please provide any additional perceptions or recommendations about the PIE system that you would like to share (e.g., what aspects of PIE worked well in your classroom and what were the challenges or barriers?).

Methods

Interviews

Recruitment and Participation

Participants for both rounds of interviews were recruited from the pool of teachers that participated in the pilot study. However, the second round of participant interviews were conducted as follow-ups to the first round, and therefore recruitment for the second round only included teachers that participated in the initial interviews. To recruit participants, PIE staff sought feedback from teachers who had recorded completion of at least two PIE content groups in the system. These teachers were initially contacted by email in November 2024. Teachers who expressed interest in participation were emailed a consent form via Docusign and were also given the option to submit sample instructional plans they used with their content groups. As a follow-up to this first round of interviews, teachers who participated in the first round were emailed an invitation to take part in round two in February 2025.

Eight teachers took part in the interview sessions, representing rural, urban, and suburban districts. The first round of interviews was held in December 2024, with the second round taking place in March 2025. Educators who participated in the interviews received a $50 stipend per interview.

Data Collection

Participant interviews for the PIE pilot study occurred in two rounds; the first round included seven interviews in December 2024, and the second round included six interviews in March 2025. The interviews were conducted by PIE project staff and each interview lasted no more than 60 minutes. The interviews were conducted, recorded, and transcribed using *Zoom* videoconference software. Staff checked the Zoom-generated transcripts for accuracy and verified accuracy with the audio/video recordings where necessary. The interviews were semi-structured and followed outlined interview protocols (See Appendix A) which were approved by the University of Kansas Center for Research Institutional Review Board (IRB) prior to the sessions.

Analysis

Interview transcripts were cleaned and deidentified by PIE project staff prior to coding and analysis. A coding team of staff members with experience conducting qualitative educational research was assembled to code the transcripts and conduct thematic analysis. For each round of interviews, a codebook was created based upon the interview protocol (See Appendix A and Appendix B). Each interview transcript was independently coded by two or more coding team members. Coding was then independently checked and validated by an additional staff member. Once coding was completed, team members met via videoconference to ensure there was a consensus for all transcript codes. Codes were then processed using Dedoose qualitative analysis software to facilitate formal analysis procedures. A support staff member assisted with generating code reports from Dedoose.

Focus Groups

Recruitment and Participation

To obtain a range of perspectives, PIE project staff specifically sought input from pilot study participants who had not previously taken part in the teacher interviews. These educators were emailed an invitation to participate in January 2025. Teachers who expressed interest in participation were emailed a consent form via Docusign and notified of the expected time commitment (approximately 90 minutes). PIE staff initially sought to recruit a subsample of participants (who were not previously interviewed) based on their usage patterns within the PIE system but ultimately extended the invitation to a larger pool of participants.

Eleven educators took part in the focus groups in February 2025, representing rural, urban, and suburban districts. Educators who participated in the focus groups received a $50 stipend.

Data Collection

Focus groups for the PIE pilot study included four sessions in February 2025. Two of the sessions contained multiple participants, while two of the sessions had one participant. The focus groups were conducted by PIE project staff and each interview lasted no more than 60 minutes. The focus groups were conducted, recorded, and transcribed using Zoom videoconference software. The focus groups were semi-structured and followed outlined interview protocols (See Appendix C), which were approved by the University of Kansas Center for Research IRB prior to the sessions.

Analysis

The focus group data coding and analysis followed the same procedures as those used for the teacher interviews. See Appendix C and Appendix D for the coding protocol and codebook used for analysis in this step.

Teacher Survey

Administration and Data Collection

The teacher survey was administered individually to all teachers participating in the pilot study via Kite Educator Portal during February and March of 2025. Initially, teachers could access the survey from February 1–21, 2025; however, due to numerous inclement weather closures affecting the number of instructional days, the survey was reopened from March 11–18, 2025. Forty-seven of the 55 pilot study participants completed the teacher survey. The teacher survey contained 25 items, a mixture of multiple choice (MC) and open-ended response (OE) item types, asking teachers to reflect on their experiences as participants in the pilot study, including the PIE training and resources, administering PIE assessments in the Kite system, and their use of assessment results (see the Analysis section below for the list of open-ended response items). The results presented in this report are drawn from OE survey questions soliciting teachers' feedback about their experiences with the PIE system. For more information about the teacher survey items not included in this report and a description of teacher survey data-analysis procedures, see *PIE Pilot Study: Design and Administration Evidence Technical Report* (ATLAS, 2025a).

Analysis

PIE staff sorted and organized OE survey responses by question and removed any responses that indicated the question was not applicable, or any "none" responses. Valid responses were tabulated and the number of responses to a given question are indicated below:

- Question 13: "Please describe any factors that affected your ability to implement cycles of instruction and assessment based on content groups."
    - 47 responses
    - 12 responses removed ("n/a" or "I didn't have any factors that affected my ability to complete cycle of instruction and assessment.")
- Question 14: "What changes would you like to see to improve the content groups management page in Kite Educator Portal?"
    - 47 responses
    - 18 responses removed ("n/a," "none," and "It would be nice to have a link to the reports.")
- Question 20: "What kinds of information would you like to see added or removed on the classroom mastery report or individual student mastery report?"
    - 47 responses
    - 16 responses removed ("n/a" or "none")
- Question 21: "What changes would you like to see to improve the reporting dashboard in Kite Educator Portal?"
    - 47 responses

    - 25 responses removed ("n/a" or "none")
- Question 25: "Please provide any additional perceptions or recommendations about the PIE system that you would like to share (e.g., what aspects of PIE worked well in your classroom and what were the challenges or barriers)."
    - 47 responses
    - 13 responses removed ("n/a")

Survey responses were then organized according to the nature of the feedback (i.e., positive or negative) and relevance to the research questions (e.g., timing issues affecting cycle implementation, issues with the system interface, requests for additional resources).

Results

What were teachers' experiences in creating PIE content groups? (RQ1)

Participants discussed PIE content group creation in the initial and follow-up interviews, including their process of creating the groups, the resources they used when creating the groups, their perceived utility of the groups for supporting instruction, and their experiences using the groups throughout the pilot.

1.a. Which process, materials, and resources did teachers use to inform the creation of their content groups?

Most participants created PIE content groups all at once, though a few reported creating them one or two at a time as they worked through their curriculum. Most participants also reported PIE content group creation took two to three hours.

Several participants described working together with other teachers to create groups either by splitting standards to be grouped among themselves or by comparing groupings after they were made. One participant shared their experience:

> Sat down for two to three hours to do it . . . Each of us were doing different parts of it, and then we came together for about an hour and put them in the order we thought they should go on, and about how many days we thought we should stay on each topic to kind of keep us in the timeframe that we had to be in.

Another participant shared,

> When we created our content groups, when we trained, when we communicated about what was going on, it was always in a collaborative setting, and so I think that helps because . . . it's not on that one person . . . It's more of a collective.

Participants described creating four to nine PIE content groups, but several participants noted that they were unable to complete all of the groups that they planned. Participants also noted the numbers of standards they used in each group. While the program only allows a max of seven standards and recommends between two and five, most participants noted using two to three standards per group. Participants reflected that as they gained experience with using PIE content groups, they found that limiting the number of standards worked well as it kept assessments from getting too long. One participant noted that the PIE content groups were

useful, as they helped them to plan their instruction differently than they had in past years (e.g., ordering instruction of KSUs within content standards differently).

Some participants noted that they built their PIE content groups beginning with what they were already teaching when the pilot began. This approach was noted by educators as a way to ensure instructional continuity for their students.

Participants reported using several different resources when creating PIE content groups including standards from curricula used in their districts, curriculum pacing guides, the PIE learning pathway maps, and the Missouri standards.

Several participants described creating PIE content groups by matching their curriculum standards to the Missouri standards. One participant shared, "Honestly, they matched really well . . . Since they're coded with [Missouri standards], I was able to look and see which ones matched up . . . It's been really easy to pick and kind of lump them together." Multiple participants reported that while the combination of concepts within the Missouri standards may have differed slightly from the way in which KSUs were ordered within their curriculum, the curriculum used in their districts largely aligned with Missouri standards, making it easy to match them up.

Other participants reported using pacing guides or the PIE learning pathway maps to order their groupings in addition to matching curriculum standards to the Missouri standards. One participant shared,

> We printed out each standard with the description, and we printed out the ones [Missouri standards] from PIE, and then we printed out . . . our district standards, and so then we sat down and we figured out . . . how can we make them work together instead of having to reinvent the wheel . . . We made PIE work for us versus us making our curriculum work for PIE.

Participants also mentioned using the PIE learning pathway maps to understand how standards connect to each other. While some participants found their resources linked well with the PIE content groups, a few described alignment issues. Some participants described how Missouri standards tended to go deeper on concepts compared to their curricula, so they often had to find additional resources to supplement their instruction. Other comments included that the standards did not evenly divide between curricular units, that the order in which they taught content did not match the Missouri standards, and that there were curricula topics not included in the Missouri standards.

1.b. Did teachers change their planned content groups over the course of the pilot study, and if so, what prompted those changes?

Participants appreciated that the PIE system provided them with the freedom to create their own PIE content groups and choose the order in which they were taught. Participants described some changes they made to the content groups in the pilot or would make to the content groups if they were to participate in the pilot again. Multiple participants mentioned that they struggled to find the right number of standards to include in a PIE content group to balance assessments being too long due to too many standards per group or assessing too often when

there were too few standards per group. Participants reported reducing the number of standards per PIE content group due to time demands, test length, or student progress. A few participants noted revising their PIE content groups to ensure student mastery of certain skills were attained in the correct order for scaffolding in later units. One participant mentioned adding standards to some of their groups when they saw connections.

1.c. Did teachers perceive their content groups effective at supporting their instruction?

Some participants shared that they found the PIE content groups useful in their instruction. One stated that they would implement a similar system even outside the pilot:

> I think that the content groups that we made are super. Even . . . if we don't have the PIE program or system next year, I think that we're planning on doing the same kind of system or layout that we had this year, because we realized how well it worked because of the content groups.

Participants also shared that by using the PIE content groups, they were connecting to a bigger picture of integrated ideas rather than teaching only to fill student gaps as in previous years, that the PIE content groups provided more freedom in pacing and the order in which topics were taught, and that the PIE content groups helped them figure out what skills should be prioritized during instruction. One participant was resistant to using the PIE content groups and was concerned about lost time due to testing but found that reducing the number of standards per PIE content group helped with timing.

Another participant said they adjusted their curriculum to align with the content groupings they created in PIE, noting, "I feel like it flowed better for a lot of the students teaching it that way as well." This participant said that while it probably would have been useful, they were not likely to pull out a map "in the middle of everything" to support instruction. One educator said the midway point could be a quiz, as the most important test for them was at the end of the unit.

One participant also noted that a misalignment of standards caused some challenges with trying to fit the necessary standards into PIE content groups to match their curriculum, as they were only allowed seven standards per PIE content group, but that this challenge helped them to hone their instruction and focus on what material really needed to be covered. This participant also reported that the learning targets and the Missouri standards used in PIE helped them to "organize how we were gonna teach rather than starting on page one in our book and moving forward." Another participant shared that they pieced standards together "like a puzzle piece" to match the units used at their school, and that it helped lessons flow into each other better.

What were teachers' experiences with implementing PIE assessment and instruction cycles? (RQ2)

Participants shared their experiences with implementing PIE assessment and instruction cycles including their use of the PIE learning pathways in instructional planning, their use of assessment results, and how their instruction changed over the course of the PIE pilot study.

2.a. What were teachers' experiences with using the learning pathways as part of their instructional plans or decisions?

The majority of participants described approaching instructional planning by working from their created PIE content groups and collaborating with other teachers. One participant created instructional plans by looking at the order in which material was tested in their curriculum and then set up PIE content groups to follow standards in the same order. This participant would then use the PIE learning pathway maps as a guideline to make sure all concepts were covered and that they were using vocabulary similar to PIE. Many participants also described using instructional groups in their classrooms using PIE results reported in the dashboard to group students with similar instructional needs.

Multiple participants reported that they felt the PIE program supported their instruction and benefited their students. One participant shared, "I feel like it's [PIE learning pathways] helped me really think more about what information do I need to tell them. What do I need to be more explicit about to be able to help them understand?"

Another participant shared that they used the PIE learning pathway maps to help them reteach concepts students were struggling with, as it gave them ideas on how to help a student reach the different levels. They also mentioned using the PIE learning pathway maps to help them see a trajectory for their lessons, to help shape activities, and to decide how to teach concepts. Another participant shared that they thought the PIE learning pathway maps were "definitely powerful and helpful." Several participants described instructional strategies they used based on the PIE system, such as working through problem areas as a class level by level, using the Missouri standards and PIE learning pathway maps to guide searches for lessons and worksheets online, and using the PIE learning pathways to scaffold lessons to build toward later concepts. One participant shared that they appreciated the PIE learning pathway maps:

> I was able to help look at what they needed to know for each thing, and what you could pull in from things we might have already learned, or what we're going to learn next, because of the maps. You could see how that all connected.

Another participant used the PIE learning pathway maps to determine where they needed to focus their instruction after their students completed a level. This participant also noted that the PIE learning pathway maps helped them visualize how standards were connected and helped break down concepts. Teacher survey responses indicated that the content map resources were helpful.

Overall, participants found the PIE learning pathway maps helpful for instructional planning. On the teacher survey, 77% of participants agreed or strongly agreed that they were able to use instructional strategies to reach a continuum of learners at various places in the learning pathways. Participants generally agreed that the PIE system was a valuable resource to gauge student understanding, identify content to reteach, and plan future lessons. Several participants in the teacher surveys expressed concerns about timing issues, with some feeling unable to fit in all the content within the testing window or feeling rushed due to the amount of content in the PIE learning pathways; similarly, there were comments that there was too much content to teach effectively, especially with shortened timelines due to four-day teaching

weeks or inclement winter weather events and other student absences. In addition, several interview participants reported that their curriculum did not directly align to the Missouri content standards (which were used in the PIE system). One participant noted that the Missouri standards did not follow the pacing guide used in their classroom, and this contributed to pacing issues that caused them to rush through some lessons to get through the content in time.

2.a.1 Did teachers' uses of the learning pathways change over the course of the instructionally embedded window, and if so, in what ways?

Participants also described how their use of the PIE learning pathway maps changed throughout the course of the pilot, noting that as their understanding of the system and resources progressed, they increased their use of the maps. One interview participant reported that they used the PIE learning pathway maps more toward the end of the pilot than the beginning, as they had more time to dig in and see how the maps connected to the tests. Another shared that they started using them halfway through the pilot to see how to teach to the different levels, adding,

> I was always pulling them up to make sure that I was following exactly what the level . . . content was. And then obviously here at the end, I would pull it up almost daily and go, okay, this is what I need to teach today [and] to who . . . in small groups versus whole class.

Another participant shared that their use of the PIE learning pathway maps changed over the course of the pilot as they came to understand how skills built upon each other even if students were not being assessed on some skills immediately. One participant mentioned that PIE helped coordinate instruction by organizing the way they teach standards. They noted that the PIE learning pathways helped them stay on pace and attend to what students needed, not investing time if students had mastered specific content.

2.b. Did teachers perceive the frequency and timing of the embedded assessments useful to instruction or a barrier to instruction?

Participants noted that the PIE assessment schedule helped them stay focused and guided their instruction. One participant said the timing of PIE assessments kept them on pace generally, but that they felt "crunched" during the winter when weather cancellations impacted the number of days they had students in their classroom. Conversely, one educator said the timing was excellent and appreciated the limit on the number of standards per content group. Another teacher similarly noted that PIE embedded assessments helped guide instruction throughout the cycle. Further, a participant mentioned that the assessment windows between September and February allowed for time to revisit concepts as needed.

Multiple participants discussed how they fit PIE assessments into their normal time for instruction. One participant shared that, while their students might have been taking assessments at different times, it was easy to fit the assessments into their instruction as each student finished a lesson. Another participant noted that they were still able to teach lessons after baseline, as the assessments did not take their students very long to complete. They also shared that they would assign end-of-unit assessments and baseline assessments for the next

level at the same time, so they were available if students had free time or finished something early (since assignments take 24 hours to upload).

Overall, however, participants expressed mixed opinions on the timing of assessment administrations within the cycles, with some describing feelings of being rushed to fit in all the instruction after the midpoint assessment. Multiple participants noted that they would prefer shorter cycles with fewer standards and instructional units. Participants also noted that starting the cycles earlier in the school year (i.e., in August) would be beneficial for their instruction. One participant stated that they would have liked the assessment window to extend through the end of April to allow more instructional time and to help them feel less hurried.

One participant stated that the cycles were overwhelming as a first-year teacher because "I think some weeks it felt like all I did for an entire week was test." Another participant stated that the timing felt rushed between assessments as they had a 50-minute block, and other demands competed with that time. One participant noted the impact of curriculum alignment challenges on their instructional practice, requiring them to move at a quicker pace with more standards than they would prefer: "We felt like we were testing all the time, especially on that four-day week . . . you've got to get five days' worth of material within four, and it was tough."

Further discussions revolved around the difficulties participants encountered in covering standards. One participant said they spaced out the baseline, midpoint, and end-of-unit assessments because they had more standards to cover. Another participant noted that they tried the same approach but felt their students were burning out from receiving five days' worth of material on a four-day schedule. Yet another participant said they were able to get through about 75% of the standards and that they created their own curriculum from several resources.

One participant shared that the hardest part of using the PIE system was the time constraint. Two participants from rural districts felt it was difficult to get through all the content groups, referencing limited support, and noted that they are the only math teachers. One of these participants said that they missed 18 days of school for snow days and other cancellations.

2.c. How did teachers interpret and use assessment results in the classroom?

Participants described various approaches to interpreting assessment results. Several teachers shared experiences that indicated potential misconceptions about the meaning of mastery information shown on the reports. Some teachers requested data beyond mastery indications, including the ability to view missed questions and the ability to see a raw score (percentage). One participant stated that they wished the PIE reporting dashboard provided more details on what students did and did not master and mentioned that they would have appreciated if the system would suggest pathways to aid with targeted instruction for struggling students.

One teacher requested a way to save reports of the baseline, midway, and end-of-unit assessments to track growth and asked for more specific feedback from the reports. Several participants wanted raw scores included, with one specifying,

> We are asked to grade based on proficiency scales and we were told PIE assessments could be graded and put into the grade book. Since we couldn't see the questions and

what students were actually asked to do, it was hard to see if they were actually mastering the content according to our district's proficiency scales.

Participants also requested the ability to view missed questions, including the number and types of incorrect responses, as well as student answers, which some noted would help them inform instruction. Multiple participants mentioned that they wished they had a better understanding of how mastery correlated to a percentage score. Multiple participants also shared that they wished they could use PIE assessments for letter grades, while one teacher noted that they were able to do so within their district grading scheme.

Teachers appreciated assessment data about specific student learning areas within the reports. One participant "really liked the different symbols that indicated different levels of mastery" while another appreciated "the x, check, and circle system." Another participant mentioned that the file review (i.e., collected information documenting student performance on the content groups and mastery statistics) helped show where students were struggling and helped them look at specifics.

On the teacher survey, participants reported that they generally liked the reporting dashboard and appreciated the different symbols that indicated mastery levels. They also felt that reports showed areas where students encountered difficulty. However, several participants pointed out that it would be helpful if reports included information on what questions students missed.

These teacher responses suggest that some of the educators in the pilot study may have been confused by the nature of the mastery information included in the PIE reporting dashboard. These observations indicate that future research using the PIE system or other similar reporting methods may benefit from including additional information on using mastery reports in any educator trainings.

2.c.1 Did their uses of assessment results change over the course of the instructionally embedded window, and if so, in what ways?

Multiple participants initially expressed some hesitation regarding how they should use the reporting dashboard and assessment results, but as they grew more comfortable with the dashboard and the PIE system in general, they grew more comfortable with using assessment results to make changes in their instruction. One teacher agreed that their use of the results changed over time as they grew more familiar with the learning pathways and were able to see the connections between pathway levels and the overall standard, using information on the results as a tool to target gaps in understanding. Another educator noted that their ability to interpret the results more quickly and accurately (i.e., to process and analyze what the results were indicating to help them take action) improved as time went on, aiding in their ability to use the results to inform instructional changes.

Generally, participants described being able to utilize the results reported in the dashboard more effectively as the pilot progressed. One participant noted that they were able to use results more when they understood how the levels connected to reach the overall standard. They also described how, at first, they did not know an individual student profile was available in addition to the class report. Another participant described how they used the individual results in greater depth as they progressed into the pilot. Another participant shared that at

first, they were not sure how to use the results of PIE assessments, but as they gained familiarity with the program and with their students, their ability to use the assessment results improved.

One participant stated that they used assessment data to inform instruction more at the beginning of the year and, as a new teacher, they "focused way too much on the data." However, this participant noted that their students were more open about needing help and willing to join small groups when they encountered problems.

Another educator shared:

> I would say at the beginning I kind of used [the results] more loosely. It was like, oh, they're there, if I need them, you know . . . By the middle I was always pulling them up to make sure that I was following exactly what the level was, exactly what the content was. And then, obviously here at the end, I would pull it up almost daily and go, "Okay, this is what I need to teach today . . . in small groups versus whole class." So I'd say, as the pilot went on, I definitely leaned more towards using those reports.

Teacher survey responses offered some positive impressions of the PIE reporting system, including an appreciation for the ability to create small groups of students for targeted instruction based on information in the reports.

2.d. Did teachers change their instruction based on PIE assessment results, and if so, in what ways?

Some participants reported being able to use the PIE reporting dashboard to create small groups in their classroom. One educator discussed feeling more comfortable with using results to inform instruction as time went on, noting that their instruction deepened "more toward the middle" and stated that "I felt like I really had it down fairly good with my last test. I felt like, 'Okay, I know what I'm doing now.'"

One educator described using results to look for growth and "movement" to identify ways to continue driving students forward: "I was looking for how to bump those that had moved up. How do I move them up [from Level 2] to Level 3?" This teacher reported using resources like videos and related activities to reinforce learning: "I had more movement than any other test getting up to Level 3 after I showed that video."

Another teacher noted that they used results to pinpoint gaps and assign individual supplemental materials to the students who needed additional support mastering a concept. This allowed the teacher to differentiate their instruction based on specific student needs: "I might not have to go back over dividing fractions for one student, but I can assign line plots to another student, so I can tailor it to each individual student."

Participants described using PIE assessment results to identify gaps in student skills and then adjust their teaching or provide additional instruction. Many noted using the reporting dashboard to illuminate where students were struggling and subsequently where to target additional instruction or make instructional changes. One participant described how the PIE reporting dashboard was easy to use and helped them to quickly identify where students needed help with immediate feedback:

> I absolutely love the fact that I get immediate feedback when I give the baseline and midway and then end-of-unit assessments . . . you get instantaneous results with this assessment, and I can go back and then adjust my instruction per individual student and make up any gaps that they have before they take that into the year cumulative assessment. I have found it to be extremely useful, and I've really used it as an instructional tool to improve my individual students.

Participants reported adjusting their instruction based on identifying the PIE results in the dashboard that showed where students struggled and what might need to be retaught or taught in a different way. Several participants described using the assessment results to create small instructional or intervention groups. There were mixed responses as to how PIE helped support small group instruction. One participant stated:

> We did use [the assessment results] to kind of help create our small group instruction for those specific kids [I would pull]. And again, like, when we would do that . . . and this is where I would notice . . . [so] I would pull small groups and practice on the types of questions that I thought would address that standard and my students would be successful. So then it would leave me like, "Okay, they're doing fine."

Another participant described using short, 10–15-minute, teacher-led small group and whole group lessons, pair-sharing, and stations in their instruction based on student assessment results.

One participant said they adjusted instruction based on what students missed if a student did not pass the beginning or midpoint assessments and stated that they had to get that data by observing students during the assessment. Another participant shared that in the past, their instruction was guided by a daily outline included in their curriculum, but that the addition of the PIE assessment results allowed them more flexibility to know what their students needed and what to spend more or less time on.

2.d.1 In what ways did teachers' instructional decisions change over the course of the instructionally embedded assessment window (if any)?

Participants offered some insight into how they modified their instructional decision-making. Several educators noted that they were able to observe the needs of their students throughout the instructionally embedded window and sought ways to address these needs.

Some educators described recognizing the need to slow down and be more intentional with their instruction as the window progressed. One teacher described establishing a timeline for content areas they wanted to instruct, but then realized that their students would require slower-paced instruction:

> We can't rush it . . . if we really want our students to grasp this information, and we don't want to treat this just like another thing to do, we need to make sure that, you know, they're learning . . . We need to slow down.

One teacher noticed that their students were not advancing the way they expected they would, so they implemented more hands-on activities to enhance understanding, but due to time constraints, they had to move on to other content. They continued to apply more small

activities to content as they moved forward but were not always able to devote the time they felt was needed. A few teachers indicated that they did not make any changes to their instructional decisions during the pilot.

2.e. What kinds of instructional adjustments based on assessment results did teachers perceive as effective/ineffective with their students?

Participants noted some specific changes they made in response to assessment results, with many teachers able to describe how these adjustments supported their students.

One educator mentioned using the results to pinpoint areas of student challenges related to fraction concepts. This teacher then obtained colored tiles to use as manipulatives and guided their students through using these hands-on materials to "see patterns." Other teachers echoed the use of manipulatives and other hands-on activities as helpful for their students to make sense of a given concept. Another teacher reported using information from results to target mixed number concepts by creating visual resources for students, stating, "We really worked a lot with visual models … working to turn whole numbers into fractions."

Multiple educators reported utilizing small group instruction, physical manipulatives, and visual resources like flash cards to target knowledge gaps noted on results, and many of these teachers perceived these adjustments as beneficial for their students. Several educators also mentioned utilizing individualized instructional strategies for some of their students and found that personalizing instruction based on information from the results was a useful approach.

Some educators noted that they looked at the results to inform adjustments but felt they would need more information from the results on specific areas where students demonstrated challenges, rather than a "couple categories mastered or not mastered." Others described implementing a strategy to address certain areas of challenge from results but were unable to devote sufficient time to the strategy because they needed to move on to other content.

2.f. Did teachers reflect on their instructional decisions, and if so, in what ways?

While some teachers were able to describe their instructional adjustments and note areas where they found these adjustments to be effective, the majority of participants did not discuss if and how they reflected on their instructional decisions. For many participants, issues with timing and curriculum alignment did not offer adequate opportunities for reflection. Future research into how teachers might be supported in integrating regular reflection into their instructional practice could prove fruitful for the field.

What were teachers' overall experiences, perceptions, and recommendations for potential future use of the PIE system, including PIE's instructional utility in the classroom and training to support intended uses of the system? (RQ3)

PIE System

Participants shared their overall impressions of the PIE system. Several participants noted the flexibility of the PIE system. One participant shared that it was helpful that they had the freedom to set their own assessment dates for content groups. This participant also noted that the PIE system is "really usable and flexible," that they "love the concept" of PIE, and that they

love being able to teach one PIE content group at a time before moving on to the next. However, this educator shared that they did not always have time to properly review standards that students were struggling with before they had to move on to new concepts. One participant reported that they liked how they could teach as they normally would using the PIE system and supplement that teaching to align to the PIE learning pathways. Another participant shared that they appreciated that the PIE system was flexible enough to fit into their weighted grading system.

Some participants requested that the reporting system recommend the next pathway for students, an option to group students by missing skills, and a simpler way to track which students had completed assessments. One participant asked for more detailed resources and information about suggested next steps.

Multiple participants described complications they faced related to the Kite platform. Some responses indicated difficulties adding standards to established content groups, issues with test wait time, and issues accessing the modules. One participant requested a system option to assign multiple content groups at once, while others noted persistent login issues and recommended changes to the login procedure. Several participants noted challenges related to entering responses, particularly fractions and issues with deleted words. One noted,

> Some challenges that came up were the tools that they had to use when answering a question. Sometimes it would freeze and not go away and they had to toggle/read the questions with a large bar up on the bottom.

Assessment Content

One educator noted that even when PIE assessments did not match how they typically teach, it presented content to students in a different way, providing a learning opportunity. Another noted that there was sometimes content they did not realize would be included in the assessments. Several participants felt there was too much content to cover in the given timeframe, and that content did not align with their pacing guide. One participant noted,

> There are too many targets to assess in the time we have with our students. My students that work at a slower pace or missed questions on the baseline/midway [leading to a very long posttest], started having tests piling up in the app because we never had time to finish them.

One participant noted that PIE added to the amount of testing they were required to administer.

Several teachers requested to be given example questions, with one participant elaborating, “It would have been beneficial to have example questions to help the students understand the vocabulary and the set-up for test questions.” One participant added that they wished students were reassessed on PIE learning pathway Level 3 material, as students were not given the opportunity to show growth as they were at previous levels by revisiting questions.

Training

Several participants pointed out ways that the PIE training, including e-learning modules designed to familiarize them with the PIE system components, supported their ability to

develop content groups and administer assessments as part of ongoing cycles of instruction and assessment. Teachers noted that the training was engaging, and they appreciated that it was interactive. When asked for feedback on how the training prepared them to work with the PIE learning pathways and create content groups, a few interview participants mentioned that the ability to see examples of these components would have been useful.

On the teacher survey, multiple participants mentioned issues with training and a lack of access to information. One participant shared,

> We had a very difficult time understanding the Kite platform in the beginning. The entire first month was messed up for us because we didn't realize how we had to group standards or that we couldn't have multiple content groups open at one time. It became easier after our second month, but it was a huge learning curve.

Conversely, one interview participant commented that they found the training resources "really useful in helping set up the content groups," showing what the Kite program has to offer, reading the learning pathway map, and downloading the reports. They also stated the training resources were especially helpful for implementing PIE for the first time.

Overall, most PIE pilot participants agreed that the PIE training and resources prepared them to create content groups for instruction and assessment, and that PIE training modules and associated resources provided the requisite knowledge and skills to support implementing cycles of instruction and assessment. Despite some feedback that educators required some time and experience to grow comfortable with using the PIE reporting dashboard and PIE results, over 75% of educators surveyed agreed or strongly agreed that PIE training and resources prepared them to interpret and use PIE reports and data to inform their instruction. For more information about the PIE training and e-learning modules, refer to the *PIE Pilot Study: Design and Administration Evidence Technical Report* (ATLAS, 2025a).

Student Experience

One participant noted that, while there are many supporting standards in their fifth-grade math curriculum, by focusing on priority standards through the PIE system, they found that the supporting skills students needed came naturally. However, when asked to discuss student experiences with content groups and the tested standards, some teachers described their students as feeling "burned out" and sometimes confused by "all these different standards at the same time."

One participant shared that their students were not prepared for the length of the questions on the PIE assessments, and that the adaptive number of questions per test caused some frustration for students. Participants also reported technical challenges with either hardware (iPads, Chromebooks, etc.) or the PIE system platform that caused some frustration for their students. However, several teachers noted that their students appreciated the proximity of assessments to recent instruction, the computer-based format, and that the assessments were not timed. Participants mentioned a few areas where they felt additional information in the reporting dashboard could improve student experience.

Several participants desired a way to view student responses, either so students could see their results or so teachers could use the data to inform instruction. Others requested help aligning PIE to the school curriculum, with one participant indicating that they felt the content was not covered deeply enough. Some teachers discussed ways that the assessment results could be designed with student experience in mind. One participant commented,

> The students were able to understand results only with one-on-one conferring with me. It would be helpful if the results were delivered in a student-friendly way directly to each student. It would also be beneficial for students to see their "overall" progress throughout the year with all content groups they've covered. It would make conferring with each student easier as well as help create student agency in their learning.

Multiple participants mentioned that their students performed similarly on PIE assessments as they did on other assessments included in their curriculum or administered by the state. One teacher discussed how their students performed to their expectations on PIE: "The students that were typically successful were successful throughout the program. The ones that struggle continued to struggle . . . but I feel like they . . . would have had the hardest time in any assessment setting."

Another participant echoed this observation: "Those kids that struggle the most … I don't think benefited much from it." Yet another educator spoke to the specific challenges of students struggling in their rural district:

> I mean, we're a very rural district, and I will admit that . . . a lot of the kids I get are sadly two grade levels behind. And I do feel like those results reflected that. And you know, it's a reality. I mean, we can only do with the reality of kids we have. And it's our job to get them to try to fill those gaps the best we can.

However, one participant mentioned that their students improved their performance after being retested, noting that the mastery reports were able to help students see where they had made strides, and described positive student reactions upon learning they had mastered Level 2 content. Another participant described how their students appreciated seeing their growth and progress visualized on PIE results: "It was, I think, encouraging for some students to see . . . the check mark with the circle, like 'You guys were retested on that, and . . . you did great the next time around.'"

Future Recommendations

Participants shared in the teacher survey that they would benefit from some added resources to support their use of the PIE system. Educators noted that example questions would help teachers and students alike to prepare for PIE assessments. Some participants also mentioned that they would appreciate additional resources to help with instructional planning, including example content groupings, additional options for data visualization, and the ability to review questions missed by students.

Participants also discussed how they would use or advise others to use content groups in the future. While some participants noted that they would reorganize their content groupings in the future or use fewer standards, other participants shared that they would use similar

groupings in the future. One participant described how they would tackle prerequisite skills if they were to repeat the pilot study:

> The only thing I would say is that some of the standards that we have to teach are not explicitly in the PIE study . . . because those are like sort of prerequisites for the standards that we are testing over, so they're naturally embedded in those assessed standards. So if I were to do it again, ideally, I think I would like to separate out those standards that were just embedded into the assessed standards, and I would say, expand it, and just assess over all the standards that are required for fifth grade.

When asked what advice they would share with other participants creating PIE content groups, multiple participants mentioned making their curricula work with the PIE program. One participant shared that their curriculum provides online resources with the state standards listed out per topic, which made creating content groups easy. Another participant shared that they advise combining curricula with the Missouri standards and to split big curricula units into smaller groups to test more standards rather than trying to test entire units at one time. Another participant advised, "Make sure that you're pairing up ones that go well together . . . and make sure you're pairing them up based on the content you're going to be teaching." A second participant suggested that working in teams with other teachers was helpful for developing content groups. Some participants wished PIE provided suggestions for how to group the standards. Many of these observations were shared in the teacher survey responses, including the request for example content groupings.

Discussion

Teachers shared a range of valuable perspectives on their experiences with the PIE system during the pilot study. Several common themes emerged across each of the studies described in this report.

PIE pilot participants generally described the PIE system training and planning resources as useful. On the teacher survey, over 95% of teachers agreed or strongly agreed that, overall, the PIE training and resources prepared them to create content groups for instruction and assessment. Approximately 85% of educators agreed or strongly agreed that PIE training modules and associated resources provided the requisite knowledge and skills to support implementing cycles of instruction and assessment. Over 75% of educators agreed or strongly agreed that PIE training and resources prepared them to interpret and use PIE reports and data to inform their instruction. Interview and focus group participants provided valuable feedback about the training, noting that they would benefit from seeing examples of content groups, and that they required hands-on experience with the reporting dashboard and results to use them effectively.

Educators consistently noted that assessment window timing and the volume of content relative to their teaching loads and schedules presented an obstacle for the effective use of PIE assessments. Some teachers reported teaching on a four-day week schedule, which limited the amount of time they could dedicate to instruction. Other teachers pointed out the complications introduced by a substantial number of inclement weather days during the winter;

while these disruptions were unforeseen and beyond the control of educators, they were nonetheless impactful. Several educators noted that the PIE assessment window could be expanded (i.e., to open in August or extend through the end of April or both) to allow for more time for instruction and assessment.

PIE pilot participants offered some mixed perspectives on the instruction and assessment cycles. Several teachers made positive comments about the ability to develop content groups based on the pace of their curriculum, highlighting the flexibility of the PIE system in allowing them to connect recent instruction to PIE content groups. Some teachers in rural districts described feeling stressed by time constraints and limited resources, including a diminished ability to support students with special needs in their inclusive classrooms. In addition, some educators indicated that the content groups contained too much content for them to instruct adequately to prepare their students for the assessments. These factors impacted the ability of some teachers to progress through all of their content groupings without feeling "rushed," and some teachers reported that their students felt "burned out" as a result. However, teachers reported that their students generally enjoyed the assessment format, alignment with recent instruction, and that the assessments were untimed and offered the ability to take breaks. Several educators described how their students were able to successfully demonstrate mastery of content following retesting, and these teachers noted that they provided positive reinforcement for their students in this scenario.

Educators consistently expressed a need for more guidance and information about creating content groups. For some teachers, examples of content groups would have been welcomed and beneficial to their instructional planning. Some educators indicated that they learned the best approach to creating content groups by trial and error, discovering midway through the pilot that keeping the content groups small made the instruction and assessment cycles more manageable. A few teachers expressed that they would have appreciated this insight as a part of their training to use the PIE system. One teacher described learning about this approach from other teachers who were taking part in the PIE pilot.

While many educators found the PIE reports and reporting dashboard useful, a few expressed confusion over the meaning of some of the symbols and the language used to describe student mastery. These teachers noted that this confusion extended to their students, who sometimes required an explanation of the meaning of symbols or mastery language. Some teachers suggested clarification or definitions of this language and the need for a way to decode the symbols used to better communicate outcomes to their students. A few participants indicated that they (and in some cases, their students) would like to see raw scores and percentages rather than mastery symbols, suggesting that there were some challenges in interpreting the mastery information. However, teachers generally found that the reporting dashboard was helpful and easy to navigate. Teachers offered positive feedback on the overall PIE administration process, finding the learning pathways useful for pacing and instruction.

Participants described a range of impacts on their instruction. Several participants noted that they were able to adopt new instructional strategies, such as small-group instruction, targeted individualized instruction for struggling students, or the use of manipulatives or visual aids based on the information they gained from the PIE system. Educators consistently desired to

see more data from assessments, indicating that the ability to see which specific items their students missed would help them inform their instruction and know which content standards to target as they moved through the cycles. Some teachers described the experience of their students taking PIE, noting that the students were curious about which questions they had answered incorrectly. According to these teachers, this unknown factor caused frustration for some of their students. Nonetheless, several educators noted that their students responded positively to the PIE assessments and these students felt that the format and timing of the instruction and assessment cycles made sense.

Teachers generally appreciated the design of PIE assessments, the mixture of item types, and the adaptive nature of the assessments. Some teachers indicated that a practice test or more examples of test questions would be beneficial for them and for their students to help them acclimate to the PIE system and the instruction and assessment cycles used. Some teachers expressed concerns that the wording of concepts or math problems within standard groups did not match with how assessment questions were worded, and they noted that this discrepancy could confuse their students when taking the assessments.

Educator perspectives from the PIE pilot study underscore trends in the field highlighting the usefulness of assessments that are aligned with instruction and can provide actionable results for educators to make instructional adjustments. Research also supports several facets of the PIE assessment model, including flexible administration, diverse item types, and appropriately timed results reporting (Evans & Marion, 2024). Feedback from educators proves vital in developing and implementing an assessment system that can respond to the needs of teachers, students, and the field at large. With the conclusion of the PIE pilot study, PIE project staff can utilize this feedback and additional evidence to address these broader trends.

These findings from this collection of studies will be used to inform continuous refinements to the PIE prototype system and offer several pieces of evidence for PIE as a proof-of-concept, instructionally embedded learning pathway-based assessment system. Future PIE dissemination efforts will include technical reports and other documentation describing system components, including descriptive statistics, item analyses, and additional data collected during the PIE pilot.

Conclusions

The perspectives collected during these studies offer insight into how educators may use an innovative, instructionally embedded assessment system built on learning pathways. These insights contribute to the body of knowledge for educational assessment and may be of benefit to the field in exploring future innovative assessment designs that are oriented to improved alignment between assessment and instruction. Parallel dissemination efforts (see *PIE Pilot Study: Design and Administration Evidence* (ATLAS, 2025a) and *PIE as a Proof-of-Concept for Future Summative Use: Evidence from a Pilot Study* (ATLAS, 2025b) explore the technical evidence supporting the PIE approach to validity and alignment with the claims in the theory of action. Combined with educator perspectives and feedback, this collection of evidence can provide the field with a proof-of-concept for similar innovative assessment systems in the future.

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Appendix A: Teacher Interview Protocol

PIE Teacher Interview—Time 1: October 2024

60 minutes

Semi structured protocol

I. Introductions, purpose of the interview, review of consent, basic procedures. [10 mins]

- Introductions (ATLAS staff on the call)
- Purpose: We want to hear from you about your use of the PIE system. In particular, about your experiences in creating PIE content groups and experiences with implementing PIE assessment and instruction cycles.
- Reminder that they already consented and that
    - Participation in interviews is voluntary, you can withdraw at any time.
    - All responses are confidential. Results from the interviews and instructional plan reviews will be reported in aggregate form. Your name will not be associated in any presentation or publication with the information collected about you, any direct quotes from you, or with the results from this study.
    - We'll record the interviews including video of you. You may decline to be video recorded and participate via audio only.
- Today I'll ask you to talk through how you used the different components of the PIE system and how you used PIE with your teaching and instruction. The interview will take no more than 60 minutes.

II. Assessment and Instruction Cycle–Retrospective Think Aloud—Content Groups [10 mins]

- Ask teacher to display a content grouping from one of their cycles
- Interview questions:
    - Starting *after* you completed Module 2 of the training, talk me through the steps you took to make your content grouping(s)
        - Did you create content groups all at once? Or one-by-one?
        - How many content groups did you create?
        - What was easy?
        - What was hard?
        - Listen for use of Learning Progressions and Levels:
            - How did you use the Learning Progressions to make the groups?
    - What other resources, if any, did you use to help you create the content groups?
        - Listen for the following and probe as needed:
            - Did any other teachers, building, or district staff help you? If so, who?
            - How did you use local/district resources, curriculum plans, or pacing guides, if at all?
    - About how much time do you think you spent creating the content groups?
- Ask teacher to display the content grouping from *one* of their cycles
- Interview questions:

    - Describe this content group—how many standards does it include? What is the group about (i.e., how/why do these standards hang together)?
    - How well do you feel this content group supported your instruction?
        - If so, explain how. Listen for: consistency with local curriculum, logical from a pedagogical and/or content perspective, ability to dive deeper into the KSUs leading up to grade level standards

II. Assessment and Instruction Cycle–Retrospective Think Aloud—Assessment and Instruction Cycles [20 mins]

- Ask teacher to display the score report from the content group they previously shared
- Interview questions:
    - How did you interpret this report?
    - Did anything surprise you?
    - Did you use this report? If so, how?
    - Let's talk through the assessment and instruction cycle for this content group, considering the baseline, midway, and end-of-unit assessments and subsequent instruction.
        - What did your instruction that followed this Baseline assessment look like? What did you do and what did the students do?
            - Listen for: usual instruction versus instruction plan based on the Baseline report, student groups, differentiated instruction based on results, use of learning pathways
        - What did your instruction that followed this Midway assessment look like? What did you do and what did the students do?
            - Listen for: usual instruction versus instruction plan based on the Midway report, student groups, differentiated instruction based on results, use of learning pathways
        - What did instruction that followed this end-of-unit assessment look like?
            - Listen for: any actions teachers took instructionally, based on these EOU results. E.g., did the T[eacher] do anything to support S[tudent]s that still had not mastered L1, L2, and/or L3? Did they do anything different before proceeding with the next unit/content group?
- If the teacher submitted instructional plans, display one of the instructional plans that the teacher shared prior to the first interview (optional activity)
    - I'd like to switch gears and talk about instruction plans. Thank you for sharing some sample instructional plans with us!
    - Different teachers and districts use different formats and approaches when creating their instructional plan. Please talk me through your instructional plan.
    - Please describe for us the tools or thought processes you used to put together your instructional plan. What did that look like?
        - Listen for the teacher's use of the learning pathways (positive or negative) to construct aspects of the instructional plan.
            - Follow-up questions:

        - You mentioned the learning pathways. Can you talk me through how the instructional plan reflects the learning pathways?
        - Did you use the learning pathways when you were making this instructional plan?
        - Overall, how well do you feel your planned instruction supported students in learning this content?
    - Did you depart from your plan? Why or why not?
    - Listen for: how well students engaged, what went well, what may not have gone well
    - Listen for: referencing KSUs, KSUs at L1, L2, and/or L3, understanding students' mastery/nonmastery of precursor skills, focusing on teaching/helping students master early levels (as opposed to just focusing on instruction at the level of the grade-level KSU)
- How are these PIE instruction and assessment cycles similar or different from how you normally plan and implement instruction?
    - Listen for influence or noninfluence of participation in PIE on instruction

III. Training [10 mins]

- Let's step back some. You have completed a few cycles now. How did the training support or not support you with planning and implementing the cycles?
    - Listen for knowing: what to do, interpreting reports, planning instruction based on data
        - Follow-up as needed

IV. Wrapping-up [10 mins]

- You've given us such good information already, did anything else stand in the way of implementing the cycles or using the reports in the dashboard?
    - Listen and probe for time, materials, student factors, leadership support, curriculum, competing district initiatives
- Did any other supports or strategies help with those barriers?

PIE Teacher Interview—Time 2: February 2025

60 minutes

Semi structured protocol

I. Reintroductions, purpose of the interview, review of consent, basic procedures. [5 mins]

- Purpose: We want to continue the conversation we started a few months ago about your use of the PIE system. In particular, about your experiences in using the content groups, resources, and with implementing the PIE assessment and instruction cycles.
- Reminder that they already consented, and that
    - Participation in interviews is voluntary; you can withdraw at any time.
    - All responses are confidential. Results from the interviews and instructional plan reviews will be reported in aggregate form. Your name will not be associated in any presentation or publication with the information collected about you, any direct quotes from you, or with the results from this study.
    - We'll record the interviews, including video of you. You may decline to be video recorded and participate via audio only.
- Today's interview will take no more than 60 minutes.

Overall Facilitation Direction (since this is the second interview session):

- Capture any "aha" moments teachers may have had as they got more into a rhythm of using the PIE system (ideally) OR other changes that resulted from continued use over the course of the pilot.
- If teachers talk about changes over time or revelations with continued use, probe further.

II. Assessment and Instruction Cycle–Retrospective Think Aloud—Assessment and Instruction Cycles [10 mins]

- What did the second half of the PIE pilot look like for you (i.e., after we talked in December)? How many cycles did you complete? How did it go?
- Let's talk about the most recent instruction-assessment cycle you completed—what was the focus of the content group?
- In this content group, I'd like you to think back to when you reviewed the results after students completed the midway assessment.
    - How did you interpret the results and students' performance?
    - Did anything surprise you?
    - What did you do next, instructionally?
        - Did anything you saw in the result inform what you did / what students did?
    - What did instruction look like for this unit? What did you do and what did the students do?
        - Listen for: usual instruction versus instruction plan based on the Baseline and/or Midway reports, student groupings, differentiated instruction based on results

- How did instruction in this unit turn out?
  - Listen for: how well students engaged, what went well, what may not have gone well

III. Content Groups and Results Pilot Reflections [15 mins]

- Ask teacher to pull up all the content groups [They were asked to screenshot content groups; if they don't have a screenshot, they can figure out content groups from Dashboard Reports page]
  - How many content groups did you have in total and how many standards per group (average)?
  - Do you think your content groups supported effective instruction? Why (or why not)?
  - Did you change planned content groups during the pilot and if so, why and how?
  - About how much time did you spend creating the content groups (in total)?
    - Were there strategies that made it more or less efficient?
  - If you were to use PIE again, would you change the content groups? Why (why not)?
  - How would you advise other teachers in the future about how to create content groups?
- Ask teacher to pull up the score report dashboard
  - Over the course of the pilot study, did your use of the results change? If so, how? (If not, why not?)
  - What aspect of the reporting dashboard—or information in the reports—did you find most useful?
  - What aspect of the reporting dashboard—or information in the reports—did you find least useful?

IV. Instructional Plan Reflections [10 mins]

- Discuss instructional planning (process & focus).
  - How did you go about putting together your instructional plans? What did that look like? How much did you use curricular resources, PIE resources, and/or PIE assessment results?
    - Listen for the teacher's use of the learning pathways to construct aspects of the instructional plan.
    - Listen for both + and – presence of use of the learning pathways/maps.
  - How did your understanding or use of the learning pathways in your instructional planning evolve or not evolve over the course of the pilot?

V. Normal vs. PIE Instructional Practices [5 mins]

- Looking back over the pilot, how has the instruction and assessment cycle been similar or different from how you normally plan instruction and then teach?
  - Listen for influence or noninfluence of participation in PIE on instruction

VI. Training [5 mins]

- Now that you are near the end, did the PIE training support you with planning and implementing the cycles during pilot? If so, how (if not, why not)?
    - Listen for knowing and follow-up as needed: what to do, interpreting reports, planning instruction based on data

VII. Wrapping-up [10 mins]

- Considering the entire pilot from beginning to end, did anything else stand in the way of implementing the cycles?
    - Listen and probe for time, materials, student factors, leadership support, curriculum, competing district initiatives
- Did any other supports or strategies help with those barriers?

Appendix B: Teacher Interview Codebook(s)

Teacher Interviews Round 1 (October 2024)—Codebook

Code	Meaning
Con	Any background info/context that the teacher gives that could be relevant
NQ	Any notable quotes you want to keep track of
Hlp (+/-)	Teacher mentions getting help (pos) or no help (neg) from others at the state, district, building, or teacher level for using the PIE system.
Train (+/-)	Teacher gives feedback on PIE training (can be pos or neg).
CG: All codes about content groups have a CG preface code (answers this **RQ: What process, materials, and resources did teachers use to inform the creation of their content groups**?)—this code does not exist by itself	
CG-Proc	Teacher describes the process to create content groups including approach and how many created, and if they were created all at once, time span, and how long it took to create them and any description of the process.
CG-Crea (+/-)	Teacher discussion of a success, something that worked well, or was easy to use in relation to creating content groups (for pos) or Teacher discussion of a challenge, something confusing, or hard to use in relation to creating content groups (for neg).
CG-Sys (+/-)	Teacher provides feedback on the PIE system interface (buttons, etc.); Can be pos or neg perceptions.
CG-Des	Teacher describes what students are learning in the content group and/or the standards that they grouped together.
CG-PR (+/-)	Teacher mentions using PIE resources (mainly the Learning pathways/levels) to inform content groupings (pos = used; neg = did not use).
CG-R	Teacher mentions school/district resources (curriculum, standards, pacing guides, instructional activities, etc.) they use in the context of creating content groups (not PIE resources) Note: curriculum name should be added as a descriptor in Dedoose.

Code	Meaning
CG-Align (+/-)	Teacher discussion of alignment between PIE and school/district resources (could be curriculum, standards, pacing guides, instructional activities, etc.) Pos it aligned, negative it did not align.
CG-Chn	Teacher discussion of a lesson learned/thinking that changed when creating the content groups ("first I did this but then I realized this"; "then I talked with so and so and realized this")
CG-Rev (+/-)	Teacher mentions they revised (pos) content groups or did not revise (neg) content groups.
CG-Ins (+/-)	Teacher discusses how well they were able to use content groups to support instructional planning (can be pos/neg).
CG-PLrn (+/-)	Teacher describes student successes (pos) or challenges (neg) with learning material in the content groups (not related to the reports just teacher impressions).
AIC—All codes about the assessment and instruction cycle have an AIC preface code (answers this **RQ: What were teachers' experiences with implementing PIE assessment and instruction cycles**?)—this code does not exist by itself.	
AIC-T	Teacher describes typical instruction (not based on the PIE system).
AIC-PStrat	Teacher describes instructional strategy based on the PIE system.
AIC-PR (+/-)	Teacher mentions using (pos) or not using (neg) PIE resources (e.g., learning pathways) to inform instruction.
AIC-Grp	Teacher mentions using instructional groupings of students.
AIC-Chn	Teacher mentions changing instructional approach based on results (not just reteaching all students).
AIC-PLrn (+/-)	Teacher mentions student success (pos) or challenge/misconception (neg) in instruction (not assessment) – specific not hypothetical (they did great at X) in relation to the learning pathway levels.
AIC-Lrn (+/-)	Teacher mentions student success (pos) or challenge/misconception (neg) in instruction (not assessment) – specific not hypothetical (they did great at X) but NOT in relation to the learning pathway levels.
AIC-R	Teacher mentions resources (curriculum, standards, pacing guides, instructional activities, etc.) they use in the context of instruction (not PIE resources).

Code	Meaning
	Note: teachers may name the same resource as in the content group section.
AIC-Align (+/-)	Teacher describes alignment between resources (like curriculum) and PIE system (can be pos or neg).
AIC-IP	Teacher describes creating the instructional plans.
AIC-Int	Teacher describes their interpretation of PIE assessment results (Probes include "how did you interpret the report in terms of students doing well or struggling?" and "What does it mean to master the standards?" Response examples = some students struggled, they mastered, surprised a certain group struggled, surprised a certain topic had low mastery. . .).
AIC-U	Teacher describes how they used the PIE reports.
AIC-Score (+/-)	Teacher describes feedback on content and formatting in the score reports (can be pos or neg).
AIC-M (+/-)	Teacher describes high (pos) or low (neg) levels of student mastery based on the reports.
AIC-MP	Teacher notes persistent nonmastery for students after retesting and describes their reflection on those results.
AIC-Adv (+/-)	Teacher mentions students advanced (pos) or did not advance (neg) in their knowledge or mastery results based on the instruction.
AIC-Oth	Teacher mentions other (non-PIE) assessments that the students take.
AIC-Match	Teacher describes how PIE assessments/results match with what the teacher would expect given their knowledge of the student and other data (could be other assessment data) that they may have about the students' math understanding.
AIC-I (+/-)	Teacher describes feedback on the PIE assessment items (can be pos/neg).
AIC-Gen (+/-)	Teacher gives *general* feedback on the PIE system (can be pos or neg)—for example (I like the system).
AIC-GenBar	General barriers/challenges implementing PIE and strategies or supports to help address barriers.
AIC-Stu (+/-)	Teacher describes student reactions to the system (engagement; test length; use; can be pos or neg).

Teacher Interview Round 2 (February 2025)—Codebook

		Descr	Chn	Fut	Advice	Useful
Inst	Instruction time (PIE)	Inst_Des Description of PIE instructional approach	Inst_Chn Description of instructional changes from beginning of PIE pilot to the end	Inst_Fut Descriptions of if teachers were to use PIE again, how they might change their instructional approach	N.a	Inst_Useful (+/-) Description of if teachers found the PIE instructional approach useful
CG	Content groups	CG_Des Description of content groups/content group creation	CG_Chn Descriptions of changes to content groups during the pilot	CG_Fut Descriptions of if teachers were to use PIE again, how they might change the content groups or not	CG_Advice Descriptions of how teachers would advise other teachers about how to create content groups	CG_Useful (+/-) Description of how content groups were or were not useful for instruction
Score	Scores results and reports	Score_Des Description of how students performed/ mastery results	Score_Chn Description of if teachers use of results changed over the course of the study how/or why not	N.a	N.a	Score_Useful (+/-) Description of what aspect of the reporting dashboard or the information in the score results was most useful or least useful OR how it was used or could be used to inform instruction, includes formatting feedback

PIE_influ	Influence of PIE on typical instructional practices (typically/last year I would do this, but now I do this)
Time	Description of how many cycles of assessment and instruction were completed/timing information
Stu (+/-)	Description of student engagement/student response to the assessment
IP	Discussion of creating instructional plans (specifically mention this, not just instruction)
PA	Feedback on the PIE assessment itself
Res	Description of non-PIE resources used (curriculum, worksheets, non-PIE assessment)
PRes	Description of PIE resources used (maps, pathways, pretests or PIE results)
Align (+/-)	Description of alignment between PIE resources and non-PIE resources
E	Description of how teachers' understanding or use of the learning pathways or learning maps evolved over the course of the pilot
E_SR	Description of how teachers understanding of score reports evolved over the course of the pilot (not use, which is Score_Chn)
Comp	Description of comparing PIE results to other data (assessment, classwork)
Train (+/-)	Teachers describe feedback on PIE training (can be pos or neg).
Bar	Teachers describe barriers to implementing the cycles (examples: time, materials, student factors, leadership support, curriculum, competing district initiatives).
Ov_Bar	Teachers describe supports or strategies that helped them overcome barriers.
Gen (+/-)	General "it went well/it didn't go well" or "I liked this" / "didn't like this" statements not captured by other codes
Con	Any background info/context that the teacher gives that could be relevant
NQ	Any notable quotes you want to keep track of

Appendix C: Focus Groups Protocol

Teacher Focus Groups

Study Plan Overview

Purpose

The primary purpose of this study is to gather information about teacher perceptions and use of the PIE system relative to the claims in the PIE theory of action. Findings will inform the overall validity argument for the PIE assessment system.

The teacher focus groups will explore the following research questions.

1. What were teachers' experiences with implementing PIE assessment and instruction cycles?
    a. Did teachers perceive the frequency and timing of the embedded assessments useful to instruction or a barrier to instruction?
    b. What kinds of instructional adjustments based on assessment results did teachers perceive as effective/ineffective with their students?
    c. Did teachers reflect on their instructional decisions and if so, in what ways?
2. What were teachers' overall experiences, perceptions, and recommendations for potential future use of the PIE system, including PIE's instructional utility in the classroom and training to support intended uses of the system?

Sample

Eligible Teachers

Fifth-grade Missouri teachers participating in the PIE pilot study are eligible to participate.

Sample Size

We will invite all teachers involved in the PIE pilot to participate (*N* = ~65 teachers). We will offer a minimum of three, 90-minute focus group times and allow teachers to sign up for one group.

Recruitment

Steps for recruiting teachers:

1. Early in the pilot window, inform pilot participants of the validity research opportunities and that we may ask for volunteers for surveys, interviews and lesson plan reviews, and focus groups.
2. With about 2–3 weeks left in the pilot window, send focus group recruitment materials to all pilot participants; include sign-ups for focus group times.
3. Obtain informed consent via Docusign for those who have signed up for a focus group time.

Participation will be voluntary; teachers will not be required to participate as part of the PIE pilot study.

Procedures

Teachers will have been informed via the pilot participation information that additional research opportunities may be available to them; focus groups will be optional and separately consented from the pilot. Educators who complete focus group interviews will receive $50 in the form of a stipend using PIE grant funds.

We will email details about the purpose of the research as well as the procedures to potential participants. Once teachers have signed up for a focus group time, we will send them consent forms via Docusign. The focus group facilitators will be ATLAS staff who are on the PIE pilot study team. Facilitators will follow a semi structured interview protocol during the session. Each session will be recorded and transcribed using standard ATLAS operating procedures.

Data Analysis

The primary source of data will be the interview transcripts.

At least two members of the research team apply a coding scheme to each interview transcript. We will develop an initial codebook, test the code book with one transcript, revise, and then apply the codebook to the remaining transcripts. Where there is researcher disagreement in coding, we meet and review codes until consensus is reached. We will synthesize results across focus groups, utilizing qualitative research software to assist with summarizing results.

Once the analysis is complete, we will share the results with the research team and compile the results into a technical report.

Timeline

- Recruitment materials distributed – February 1, 2025 (pending input from MO-DESE)
- Focus groups held between February 24 and March 7 (pending input from MO-DESE)
- Interview coding begins after the first transcript is received and continues until complete, pending staff availability.
- Focus group reports are completed by June 2025.

Example Calendar Schedule for PIE Instruction and Assessment Cycles

Cycle	No. of standards	Approx. no. of weeks	Approx. no. of school days*	Approx. start date	Approx. end date
1	3	2	10	9/16/2024	9/27/2024
2	4	3	15	9/30/2024	10/18/2024
3	4	3	15–18	10/21/2024	11/13/2024
4	3	2	9	11/14/2024	11/26/2024
5	3	2	10	12/2/2024	12/13/2024
6	3	2	10–15	12/16/2024	1/17/2025
7	4	3	14	1/21/2025	2/7/2025
8	1	1.5	9	2/10/2025	2/21/2025

* Approximate number of school days accounts for typical no-school days due to breaks and holidays.

Semi structured Protocol—90 minutes

I. Introductions, purpose of the interview, review of consent, basic procedures

II. Briefly review the training modules and resources, learning pathways, content groups, assessment results, and instruction / assessment cycle.

We would like to start with your impressions of the PIE assessment and instruction cycles.

- Over the course of the pilot, did you find the frequency and timing of the embedded assessments (embedded into the instructional cycle) useful to instruction? Or did you find the frequency and timing a barrier to instruction?
    - Follow-up: What helped those assessments happen at the "right" time? [Listen for adequate instructional time between administrations and probe as needed.]
    - Follow-up: What stood in the way?
- What kinds of instructional adjustments did you make, based on the assessment results, that you thought were effective with students?
    - Follow-up: And how did you know the adjustments were effective?
- What kinds of instructional adjustments did you make, based on the assessment results, that you thought were ineffective with students?
    - Follow-up: And how did you know the adjustments were ineffective?
- Over the course of the pilot study, did you *reflect* on your instructional decisions or adjustments that were made based on the assessment results? Tell us about your reflections.
    - Did you notice any patterns?
    - Did the types of decisions or adjustments you were making change over the course of the pilot study and if so, in what ways?

II. Next we would like to ask about your impressions of the PIE system, including the training modules, job aids/resources, user manuals, assessments, reporting dashboard.

- As a whole, how usable and flexible do you think the PIE assessment model is?
    - Listen/probe for: how the approach does/does not fit into any current competency-based or standards-based grading approaches.
- What parts of the system were *most* useful to your teaching?
    - Listen for: flexible and instructionally relevant assessment administration timing, reports based on the learning pathways
- What parts of the system were *least* useful to your teaching?
    - Listen for: time spent taking assessments, time spent on content groups, content groups did not align well to instruction, reports were missing information

- How did the trainings, job aids, resources, manuals, and other supports (e.g., DESE office hours) prepare and support you in implementing PIE? (learning pathways, content groupings, interpreting results, implementing cycles)
    - Which components were *most* helpful?
    - Which were *least* helpful?
    - When did "it" click? (If never, ask what other supports might be helpful.)
    - What stood in the way of learning to implement PIE?
    - How could the training or resources be improved?

III. Finally, we want to step back and think broadly about PIE and the future.

- How do you see yourself, or not see yourself, using a system like PIE in the future?
    - What might stand in the way of you using the system?
    - Did you feel like the PIE content standards and ability to group content standards aligned or "fit" well with your local/district curriculum (and any local instructional resources, if applicable)?
        - If yes, in what ways?
        - If no, talk about how it didn't align or fit well.
    - What might help alleviate those barriers?
- What advice would you give other prospective teachers about using and adopting a system like PIE?
- What conditions would need to be in place for other regions, districts, or schools to implement a system like PIE in the future?

IV. Wrap-up

Appendix D: Focus Groups Codebook

		Cyc	Time +/-	Adj +/-	Ref
Inst	Instructional decisions and modifications	Discussion of PIE instruction and assessment cycles	Comments on frequency and timing of embedded assessments, including useful or other positive comment (+) and/or barrier or other negative comment (-)	Instructional adjustments based on results, including description of effective adjustment (+) and/or description of ineffective adjustment (-)	Teacher reflections on adjustments, including description of patterns noticed and any changes made

		Flx +/-	Use +/-	Trn +/-	CL	Stan +/-	Des +/-
Sys	Impressions of the PIE system	Comments on usability and flexibility of the PIE system, including fitness (+) of approach or nonfitness (-) of approach for competency or standards-based grading	Discussion of the parts of the PIE system that were most useful (+) or least useful (-) to teaching	Discussion of ways that PIE training materials supported (+) or did not support (-) implementation of PIE system, including suggestions for changes /improvements	Any discussion of when something about the PIE system "clicked" in training	PIE content standards and alignment with local/district curriculum (formerly known as Cont)	Description of overall teacher experiences and perceptions of/with the PIE system, both positive (+) and negative (-)

		Bar	Ov_Bar	Adv	Cond	Rec
Fut	Reflections on the future of the PIE system	Discussions of barriers to using the PIE system (including technical/interface challenges)	Discussion of ways to overcome or alleviate barriers to using PIE	Advice for prospective teachers on adopting and using a system like PIE	Discussion of ideal conditions to implement PIE in other regions, districts, or schools	Overall recommendations for successful use of the PIE system

Stu (+/-)	Description of student engagement/student response to the assessment
Gen (+/-)	General “it went well/it didn’t go well” or “I liked this” / “didn’t like this” statements not captured by other codes
CXT (formerly Con)	Any background info/context that the teacher gives that could be relevant
NQ	Any notable quotes you want to keep track of

Note. Block coding in Dedoose; in comment, indicate preview (beginning of sentence) so it is there for context and to more easily locate the specific sentence to which a code applies