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Research Report

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Coherence in English Language Arts and Mathematics Instructional Systems Across the United States

Standards-based reform is a key feature of U.S. education policy. Several decades ago, scholars—including Smith and O'Day (1991) and Porter and colleagues (1988)—posited that if states set ambitious standards and then aligned curricula, assessments, and professional development (PD) to those standards, teaching and learning would improve. At the same time, such organizations as the National Council of Teachers of Mathematics (1989) and the International Reading Association and National Council of Teachers of English (1996) led efforts to develop rigorous learning standards that could drive instructional change. More recently, ambitious standards—including the Common Core State Standards (National Governors Association Center for Best Practices and Council of Chief State School Officers, 2010) and Next Generation Science Standards (Next Generation Science Standards Lead States, 2013)—have been developed to guide K–12 education and promote college and career readiness.

KEY FINDINGS

- Majorities of teachers reported receiving guidance from various instructional system components—particularly from curricula and teacher collaboration opportunities—about content to emphasize in instruction.
- Teachers perceived little guidance around addressing equity and diversity and desired a lot more guidance.
- Teachers reported receiving insufficient support to teach traditionally underserved groups of students.
- Teachers perceived a moderate level of instructional system coherence, with state standards and curricula conveying the most-similar messages about what and how to teach. In the face of conflicting messages across system components, teachers prioritized state standards.
- In systems in which coherence was stronger, contextual conditions hypothesized to be associated with coherence were present to a greater extent. However, we found minimal associations between coherence and our limited measures of instructional practice.

However, the focus on establishing standards has often overshadowed the important idea that standards are effective only if the other inputs in an instructional system (e.g., curriculum, assessments, PD) are in alignment with those standards and coherent with each other (Coburn, Hill, and Spillane, 2016; Cohen and Slover, 2022; Desimone, 2002; Honig and Hatch, 2004; Newmann et al., 2001). Without that alignment and coherence, teachers may perceive different messages about what to teach and how to teach it from all of those inputs (see, e.g., Kaufman, Thompson, and Opfer, 2016). At worst, those messages can conflict, leading to both fragmented instruction and reduced learning opportunities (e.g., Fuhrman, 1993). Indeed, much research published over the past several decades demonstrates that standards alone have had a weak impact on teachers' instruction (Coburn, 2004; Hiebert et al., 2005; Spillane and Zeuli, 1999). Meanwhile, little research has explored the extent to which inputs that guide instruction—such as curriculum, assessments, and PD—cohere. Among available research, Coburn, Hill, and Spillane (2016) suggested that the degree of congruence, along with the strength of accountability policies, likely determines the extent of instructional improvement. Similarly, Desimone (2002) noted the *consistency* of instructional policies and programs—i.e., the extent to which they reinforce one another—as one of several key policy attributes that determines successful implementation of educational reform.

Focusing on the coherence of messaging among various parts of an instructional system is also important because of its potential to address race- and poverty-based opportunity gaps and ensure success for all students. That is, teachers often perceive requirements to address the learning needs of traditionally underserved students (e.g., students of color, English learners, students with disabilities, students in poverty, struggling learners) but are left to figure out how to do so in a standards-based system in which messages prevail about teaching a curriculum with fidelity and ensuring that students pass standardized tests. Past research has documented that underserved students are particularly vulnerable to instructional practices that exacerbate the opportunity gap (Flores, 2007; Lubienski, 2002; The New Teacher Project, 2018). For example, teachers engage these students in test preparation or overscaffold to help students get through what they (teachers) perceive to be an overly rigorous curriculum. A coherent instructional system would help ensure that teachers have clear guidance on how to effectively meet student needs.

In this report, we aim to contribute to research on the extent to which an instructional system is coherent and provides consistent and clear messages to teachers about instruction, including messages about how to address the learning needs of traditionally underserved students. To date, little research exists that characterizes instructional system coherence in U.S. schools. Even less research has empirically explored associations between a measure of coherence and factors thought to support the development of coherence or between coherence and teachers' instructional practice. In a recent RAND Corporation report, we began to approach these questions, documenting instructional system coherence in the unusual context of the first year of the coronavirus disease 2019 (COVID-19) pandemic (Wang et al., 2022). The present study provided an opportunity to examine instructional system coherence in a more typical school year, when concessions and adjustments to requirements made in response to the health crisis—such as waiving standardized testing and teacher evaluations (Education Commission of the States, 2020)—were no longer in effect (although the aftereffects of COVID-19 are still present). In this report, we present a portrait of instructional system coherence in schools across the country during the 2021–2022 school year, using reports from a nationally representative sample of public school K–12 English language arts (ELA) and mathematics

Abbreviations

COVID-19	coronavirus disease 2019
EL	English learner
ELA	English language arts
K–12	kindergarten through grade 12
PD	professional development
SD	standard deviation
SoC	student of color
SWD	student with disabilities

teachers. This study advances our understanding of instructional system coherence and has the potential to inform standards-based reform policies.

As part of this project, we have also developed a toolkit (Kaufman et al., 2023) that is intended to help school systems and schools informally assess, reflect on, and improve coherence in their instructional system. The toolkit includes a workbook and slides to aid team members in thinking about our definition of *coherence* and how to operationalize coherence in their own school systems.

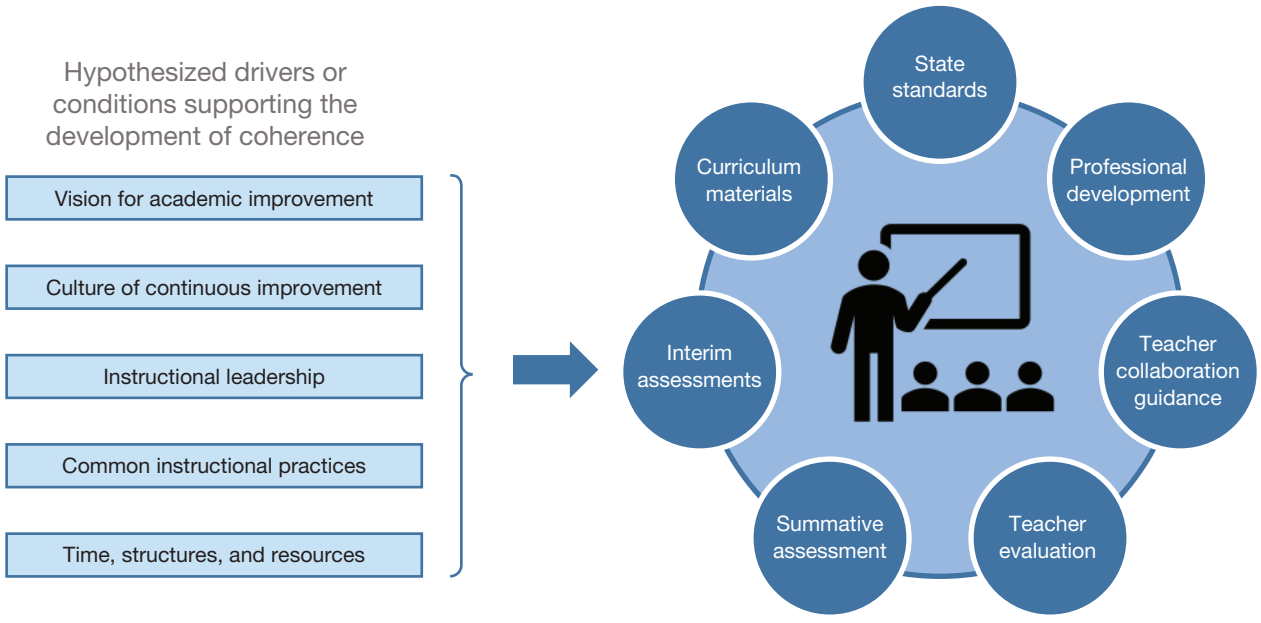
What Does a Standards-Aligned Coherent Instructional System Look Like?

In this report, we offer a conceptualization of a coherent instructional system and an approach for measuring coherence. Figure 1 illustrates our conceptualization of a standards-aligned coherent instructional system at the school level, which we described in previous reports (Polikoff et al., 2020; Wang et al., 2022).[1] Our conceptualization is informed by Smith and O'Day (1991) and elaborates on prior research about system coherence and how that coherence is linked to instructional quality and student achievement (e.g., Desimone, 2002; Hodge and Stosich, 2022; Kaufman, Thompson, and Opfer, 2016; Kaufman et al., 2020; Leo and Coggshall, 2013; Porter, 2002). Furthermore, we drew on work identifying conditions that enable coherence (e.g., Fullan and Quinn, 2016; Honig and Hatch, 2004; Newmann et al., 2001).

In our conceptualization, an instructional system is made up of seven key components. Table 1 defines the components in our conceptualized instructional system; they correspond to the circles depicted in Figure 1. In theory, when these key components are mutually reinforcing (i.e., when there is system coherence), teachers gain clarity about what to focus on in their instruction instead of having to navigate contradictory messages. This clarity results in teachers' more-consistent use of high-quality ELA or mathematics instructional materials and practices. As a result of such high-quality instruction, students are more likely to experience achievement gains.

FIGURE 1

Conceptualization of a Standards-Aligned Coherent Instructional System and Associations with Conditions Hypothesized to Support the Development of Coherence



NOTE: Only the school-level instructional system is depicted. We recognize that components of instructional systems and conditions supporting coherence are present at various levels (e.g., state, district, school).

In our conceptualization, K–12 ELA or mathematics academic content *standards* are the anchor of the instructional system. In the era of standards-based reform, standards arguably present the clearest message about what to teach and what skills and concepts students need to master. Next, high-quality, standards-aligned *curriculum materials* are essential for providing consistent messages to teachers about how to implement the standards.[2] Many states have prioritized the adoption and use of high-quality, standards-aligned curriculum materials. Moreover, states have promoted preservice and in-service efforts grounded in the use of those instructional materials (Council of Chief State School Officers, 2020). In keeping with these efforts, our conceptualization also considers the professional learning experiences available to teachers through the system to be a key component of a standards-aligned coherent instructional system. Such experiences include *formal PD* and *opportunities for teacher collaboration*, such as a professional learning community or common planning time. These mechanisms can help teachers understand and undertake desired practices that support the implementation of standards-aligned materials. Indeed, states and districts widely leverage professional learning, coaching, and peer-to-peer collaboration opportunities to increase teacher knowledge of the standards and to improve standards and curriculum implementation (Rentner and Kober, 2014a; Woulfin and Rigby, 2017). *Teacher evaluation criteria* also have the potential to convey messages about what teachers should emphasize and how to teach ELA or mathematics. To this end, some states and districts have developed or revised their teacher evaluation systems to help ensure that the systems support standards implementation (Kraft and Gilmour, 2017; McGuinn, 2012). Finally, *assessments*—both *summative* and *district-wide benchmarks* (i.e., interim assessments)—should align with the standards and the curriculum materials and with each other. Such assessments are common across states and districts seeking to measure student mastery of the Common Core State Standards (Davidson and Frohbieter, 2011; Rentner and Kober, 2014b; Shepard, Penuel, and Davidson, 2016). In sum, our conceptualization of a coherent instructional system is informed by research and observed practices in how states, districts, and schools are activating various components to support standards-based reform.

TABLE 1

Components in Our Conceptualization of a Coherent Instructional System for ELA and Mathematics and Their Definitions

Instructional System Component	Definition
State standards	The state **standards for K–12** ELA or mathematics instruction
Curriculum materials	The **instructional materials**—in print or digital format—intended to constitute a full, comprehensive course of study for ELA or mathematics at a particular grade level
PD	**Formal school- or district-offered PD sessions:** These could be general in nature or focused on ELA or mathematics in particular. These sessions tend to be delivered or facilitated by an expert (from the school, district, or external organization).
Guidance for teacher collaboration	Guidance that the school or district provides around **what to focus on or how to use any peer collaboration time**, such as professional learning community or common planning time
Teacher evaluation criteria	The **criteria by which** ELA or mathematics **instructional performance is evaluated** by the school or district
Benchmark or interim assessments	The **school- or district-required or -recommended** interim assessments (e.g., quarterly, end-of-unit) that students take (e.g., MAP, STAR tests, school- or district-wide end-of-unit assessments) in ELA or mathematics
State-mandated summative assessment	The **state-mandated standardized test** of ELA or mathematics that students take

NOTE: MAP = Measure of Academic Success; STAR = Standardized Testing and Reporting.

Our conceptualization does not privilege any particular component. Although much has been written about the unfortunate incentive to teach to high-stakes summative assessments when they are misaligned with state standards (e.g., Hamilton et al., 2013; Martone and Sireci, 2009; Polikoff, Porter, and Smithson, 2011), and although curriculum materials have been widely used to support standards implementation, there is no empirical evidence that any given component is more pivotal to a coherent instructional system or is more critical for informing teachers' practice. Therefore, our conceptualization and survey instrument for measuring coherence weigh the seven components equally.

In addition to specifying the seven components of an instructional system, we have identified critical contextual conditions that are necessary to support or drive the development of coherence among the instructional system components by drawing on literature (e.g., Fullan and Quinn, 2016; Honig and Hatch, 2004; Newmann et al., 2001; Srinivasan and Archer, 2018). Although many other conditions may be important for the development of coherence, the five critical conditions we focus on in our work are a vision for academic improvement; a culture of continuous improvement; the presence of instructional leadership; the use of common instructional practices; and time, structures, and resources, including how they are allocated to support curricula and instructional frameworks (for more details, see Polikoff et al., 2020, and Wang et al., 2022).

Conceptualizing the Instructional System as a Network

Our conceptualization of an instructional system evokes the concept of a network. Indeed, we position coherence as a measure of the strength and qualities of relationships among instructional system components rather than as a property of any one component or school. This aligns with literature suggesting that coherence requires the simultaneous coordination of multiple system components and that understanding and characterizing instructional system coherence require charting how components are interrelated and in what context (Coburn, 2004; Desimone, 2002; Elmore et al., 2014; Hodge and Stosich, 2002; Newmann et al., 2001; Park et al., 2022). Our instrument and data analysis methods reflect both this conceptualization of the instructional system as a network and our focus on characterizing the relationships within the network.

Finally and notably, we draw on Hatch's (2015) notion of coherence as a state of mind and focus on teachers' *perceptions* of how much the messages from various components are mutually reinforcing. That is, because of our definition of *coherence* and our use of a survey as the instrument for understanding coherence, it might be more accurate to characterize the conceptualization of coherence we present in this report as teachers' *perceptions* of how mutually reinforcing the components are. In other words, *coherence* is teachers' experience of the strength and qualities of the relationships among the components in the network rather than an objective state of affairs.

Research Questions, Context, and Methods

The primary goal of the research study was to characterize coherence in ELA and mathematics instructional systems across schools in the United States and explore associations between coherence and conditions thought to support the development of coherence, as well as between coherence and teachers' instructional practices. We detail our research questions, context, and methods—including our application of network concepts—in the following sections. The first two research questions help us characterize the aspects of teachers' instructional systems that provide them with guidance and the extent of that guidance. Our third research question focuses explicitly on the coherence of that guidance. The fourth and fifth research questions examine relationships between coherence and other factors, including the conditions that we hypothesized affect coherence and teachers' instructional practice.

Research Questions

This report addresses the following research questions:

1. What **guidance** about instruction did teachers report receiving from various instructional system components?
   a. How much more guidance did teachers report wanting on various topics?
2. To what extent did teachers perceive that guidance from instructional system components supported them to address the needs of students—in particular, **traditionally underserved student populations**?
3. What were teachers' perceptions of the **coherence** of their schools' instructional systems?
   a. Which component did teachers prioritize when they perceived incoherence?
4. How were teachers' perceptions of instructional system coherence **associated with conditions** identified through literature as related to the development of coherence?
5. How were teachers' perceptions of instructional system coherence **associated with instructional practice**?

For each question, we considered responses from ELA and mathematics teachers separately.

National Context

Our primary data collection occurred in spring 2022. Specifically, we administered a survey to a nationally representative sample of K–12 public school ELA and mathematics teachers. During spring 2022, schools were still monitoring and mitigating against the risks of COVID-19. Although much less so than in the two previous school years (2019–2020 and 2020–2021), the 2021–2022 school year still included some teaching and learning in a hybrid or remote model. In our nationally representative sample (which we describe further next), about 20 percent of teachers reported that a few days of instruction had been canceled or moved to remote delivery because of COVID-19. About another 15 percent of teachers reported that one or more weeks of school had been canceled or required remote instruction. Meanwhile, some states had received waivers allowing them to cancel the state summative assessments (Education Commission of the States, 2021; Gewertz, 2020) in the 2019–2020 and 2020–2021 school years, but in the year of our study (2021–2022), the U.S. Department of Education required administration of state assessments (Office of Elementary and Secondary Education, 2021). In our sample, however, about 20 percent of teachers indicated that the stakes attached to the state summative assessments were lower than in prepandemic years. The trend was similar for teacher evaluations; in our sample, about one-quarter of teachers indicated that the stakes attached to teacher evaluations were lower. Altogether, then, our study was set in a context in which schools were recovering from the impact of the COVID-19 pandemic, when key instructional system components that might have been interrupted in the two previous years (see Kaufman et al., 2021; Wang et al., 2022) were reinstated or in the process of being reinstated.

Methods

Sample

In March and April 2022, we administered a survey to a nationally representative sample of K–12 public school ELA and mathematics teachers across the country. The survey sample was drawn from RAND's American Teacher Panel (ATP), which includes 24,000 K–12 public school teachers who were randomly chosen from a list of teachers to participate in periodic surveys on education issues of national import. Responses from ATP samples are weighted to provide nationally representative data and to potentially provide state-representative samples in 25 states.

The sample for this survey included 3,246 teachers across the country, 1,810 of whom completed the survey or answered a requisite number of items to be included in the survey sample, for a response rate of 55.8 percent. This completion rate is comparable to or higher than rates obtained for other ATP and other large-scale surveys. Table 2 shows descriptive statistics for our sample. Except for Table 2, all data presented in this report are weighted to provide nationally representative estimates of ELA teachers' and mathematics teachers' responses.[3]

TABLE 2

Descriptive Statistics of the Samples

	ELA		Mathematics	
Variable	Count	Percentage	Count	Percentage
Teacher demographic characteristics				
Female	802	85%	637	81%
Male	118	12%	130	16%
Nonbinary	—	< 1%	—	< 1%
American Indian or Alaska Native	10	1%	6	1%
Asian	13	1%	21	3%
Black or African American	53	6%	42	5%
Hispanic, Latino, or Spanish origin	68	7%	51	6%
Native Hawaiian or Pacific Islander	—	< 1%	0	0%
White	785	83%	656	83%
Teacher professional characteristics				
Highest degree earned: associate or bachelor's	278	29%	256	32%
Highest degree earned: master's	530	56%	451	57%
Highest degree earned: doctorate or equivalent	25	3%	14	2%
Teaching certification: regular or standard state certificate or advanced professional certificate	933	99%	783	99%
Average years of experience	945	17.8	789	17.1
Grade band taught				
Elementary	480	48%	408	50%
Middle	221	22%	177	22%
High	255	26%	189	23%
Student populations that teachers serve				
High EL population (i.e., in classrooms with more than 10 percent ELs)	270	28%	242	30%
High population of SWDs (i.e., in classrooms with more than 10 percent SWD)	475	48%	392	48%
Majority SoCs (i.e., in classrooms with more than 50 percent SoCs)	278	28%	226	28%
Majority below-grade-level students (i.e., in classroom with more than 50 percent students below grade level)	358	38%	278	36%
Weeks of canceled or remote instruction in SY 2021–2022 by time of survey administration because of COVID-19				
0 weeks	644	65%	555	68%
Less than a week	187	19%	160	20%
1–2 weeks	119	12%	77	9%
3–4 weeks	27	3%	15	2%

Table 2—Continued

Variable	ELA		Mathematics	
	Count	Percentage	Count	Percentage
More than 4 weeks	15	2%	11	1%
Policy context in SY 2021–2022				
School or district waived teacher evaluations	52	5%	40	5%
School or district conducted or will conduct teacher evaluations, but the stakes are lower than in a typical (pre-pandemic year)	231	23%	216	26%
School participated in or plans to participate in the state summative assessment	905	91%	736	90%
School participated in or plans to participate in the state summative assessment, but the stakes are lower than in a typical (pre-pandemic year)	197	20%	161	20%

NOTE: Percentages might not sum to 100 percent because of rounding, because of nonresponse to the question, or because not all response options are presented in this table. All variables were obtained from survey responses of teachers. EL = English learner. SoC = student of color. SWD = student with disabilities. SY = school year. *N* = 992 ELA respondents and 818 mathematics respondents.

Survey Content

In terms of background information, the 20–25-minute survey elicited demographic information about teachers themselves and their students. Survey items also addressed how many weeks in the 2021–2022 school year (by the time of survey administration) classes had been canceled or were delivered remotely because of the COVID-19 pandemic; whether teachers' school or district waived or lowered the stakes for teacher evaluations; and whether their school or district required or recommended particular curriculum materials for the 2021–2022 school year or adopted new curriculum materials for that year.

In a prior report on the spring 2021 administration (Wang et al., 2022), we detailed the content of the survey. We repeat that information here: Substantively, the survey asked about the different topics for which teachers received information or guidance related to ELA instruction (i.e., content to emphasize, instructional strategies, pacing or sequencing, rigor, addressing diversity and equity) via the seven components we identified as constituting an instructional system (i.e., standards, curriculum, PD, teacher collaboration, teacher evaluation, benchmark or interim assessments, and state-mandated summative assessment), as well as the perceived coherence among these components. We also asked about the presence of hypothesized conditions that support the development of coherence and the extent to which certain standards-aligned instructional practices are present in teachers' classes.

Survey Descriptive Analysis

For the most part, we calculated simple means representing the average proportion of teachers who provided a certain response (e.g., receiving guidance on a particular topic from a particular instructional system component). In some instances, we also report the average proportion of teachers who reported receiving guidance about a topic across *all seven components*. In these cases, we calculate and present a simple mean (see the "average" row in Table 3). We explored whether there were differences by contextual characteristics, but any differences based on these factors (including student race or ethnicity, student prior achievement, EL status, proportion of SWD, and grade level) were neither statistically nor practically significant. Consistent with the structure of the survey sample, which was designed to facilitate inferences about ELA and mathematics teaching nationally, we present our results throughout this report by subject area. We caution that statistically significant differences do not necessarily translate into differences that have practical significance.

Survey Network Analysis

In relating the instructional system to a *network*, wherein the relationships among the components (e.g., standards, curriculum, PD) are key, we leveraged network analysis methods (Shaffer, Collier, and Ruis, 2016; Wasserman and Faust, 1994) to examine and characterize the relationships among the components. According to our conceptualization of an instructional system, there are seven *nodes* (e.g., standards, curriculum, PD). Each node can be connected to six other nodes, so the maximum *degree* possible per node is six. Such connections can be *positive* (in our case, when two components convey similar or reinforcing messages to teachers) or *negative* (when components convey dissimilar or conflicting messages). Zero degrees is also possible, if the node is not connected to any other node. In terms of the whole network, *ties* refers to the connections between nodes; they can be positive, negative, or absent. Most significantly, we adopt the notion of *density*, which describes the ratio of observed ties to total potential ties in a network. In this study, we calculated both *positive density*, which is the ratio of observed similar or reinforcing ties to total potential ties, and *negative density*, which is the ratio of observed dissimilar or conflicting ties to total potential ties. Because there are seven nodes, the total number of potential ties is 21. We use positive density to represent overall instructional system coherence, with numbers closer to 1.00 suggesting greater system coherence. Density has been used to conceptualize network cohesion in prior literature (e.g., Aboelela et al., 2007; Wise, 2014). We also apply the network analysis concept of diagrams that depict the nodes and ties in the network (Froehlich, Van Waes, and Schäfer, 2020; Moolenaar, 2012). These diagrams support visual analysis of the network.

To explore how structural measures of coherence (i.e., network density) were associated with contextual conditions and with instructional practice, we built univariate regression models that used density as a dependent variable predicted by the independent variables that quantified contextual conditions and teachers' instructional practice. We used the svyglm procedure in R (Lumley, 2019), which fits a generalized linear model incorporating survey weights and using design-based standard errors.

Limitations

There are several limitations to this study, many of which are common among survey studies. First, the measures are based on teacher self-reports. Therefore, the data may be subject to social desirability bias or other response biases, although we kept responses confidential and no accountability pressures were associated with them. Second, although our sample is weighted to be nationally representative on several characteristics, teachers who chose to respond to our survey may be different in other ways from teachers who chose not to respond. In this way, it is possible that results would have differed with another sample. Third, teachers' responses reflect their perceptions, which may not always or necessarily reflect district or school intentions. In particular, our analyses and findings are based on the responses of a single teacher per school. Fourth, our application of network analysis concepts to the examination of instructional systems is novel. Our conceptualization of density as a measure of overall instructional system coherence is logical and defensible but may be subject to refinement. A final and related limitation connects to our conceptualization of instructional system coherence. In our survey questions and subsequent analysis, we regarded all seven components of an instructional system as essential. In that sense, a fully coherent system cannot be achieved when one or more components is not present or is omitted, although in theory this might be possible. Again, our conceptualization is open to refinement.

Findings

In this section, we present key findings for each research question. The boxes present the survey question that teachers responded to and that we analyzed for each research question. The survey items may have appeared differently to teachers; in the interest of space, we did not preserve the formatting of the items for this report. Most of these questions have been featured in our previous report focused on ELA

instructional system coherence in the first full year of the COVID-19 pandemic (Wang et al., 2022).

What Guidance About Instruction Did Teachers Report Receiving from Various Instructional System Components?

In this section, we present the main findings about guidance that teachers reported receiving from various instructional system components. The pattern of findings appears to be nearly identical for ELA and mathematics. For parsimony, we discuss the findings across subject areas.

Across subjects, majorities of teachers reported receiving guidance on content to emphasize in their instruction. Curricula and teacher collaboration time provided the most guidance. Teachers perceived little guidance around addressing equity and diversity. First, we looked at the topics about which teachers reported receiving instructional guidance. As the last rows in Tables 3 and 4 show, across both subjects and averaged across the seven instructional components, a majority of teachers reported receiving guidance on content to emphasize. About 40 percent of teachers reported receiving guidance on pacing, rigor, or the difficulty of what students are expected to do, followed by instructional strategies. Notably, when averaged across components, only about one-quarter of teachers reported guidance on addressing equity and diversity in their teaching.

When we look at the results by instructional system component, as Tables 3 and 4 show, curricula and teacher collaboration time provided the most information to both ELA and mathematics teachers. Majorities of teachers indicated that these two components provided guidance on four of the five topics we asked about—all topics except addressing equity and diversity. Guidance around addressing equity and diversity tended to come from PD and from information about what to focus on in teacher collaboration opportunities. About 30–45 percent of teachers indicated this, suggesting that the topic is not neglected altogether throughout the instructional system.

When we further examine the topics that various components provide guidance on, we see that majorities of teachers indicated that standards and benchmark or interim assessments provided guidance on content and pacing and that summative assessments were a source of information about content to emphasize in teachers' instruction. Notably, most teachers indicated that formal PD and teacher evaluation *did not* provide them with guidance for any topic we asked about. In fact, PD lags behind

Survey Question: Guidance from Instructional System Components

Thinking about this school year (2021–2022), what *guidance* does each instructional component provide about teaching ELA/mathematics, regardless of whether or not you agree with and use that guidance? [Select all that apply.]

Components	Guidance Topics
• State standards	• The ELA/mathematics content to emphasize (knowledge and skills students should learn)
• Curriculum materials	• The rigor or level of difficulty of what students are expected to do for ELA/mathematics
• PD trainings	• The ELA/mathematics instructional strategies to use
• Guidance around teacher collaboration	• The pacing or sequencing
• Teacher evaluation criteria/focus	• How to address diversity and equity in ELA/mathematics class
• Benchmark/interim assessments	• The component is present in my school, but it does not provide any of these types of information/guidance
• State-mandated summative (end-of-year) assessment	• N/A: The component is not present or used in my school at all this school year (2021–2022)

TABLE 3

Percentage of ELA Teachers Indicating the Topics on Which Each Instructional System Component Provided Information or Guidance

System Component	Content to Emphasize (%)	Rigor or Difficulty (%)	Instructional Strategies (%)	Pacing or Sequencing (%)	Addressing Equity and Diversity (%)	No Guidance (%)	N/A—Component Not Present (%)
Standards	78	31	36	56	15	5	2
Curriculum	65	61	68	53	34	4	2
PD	37	47	29	34	40	13	12
Teacher collaboration	59	64	59	54	44	8	9
Evaluation	40	44	21	40	25	22	10
Benchmark assessments	62	31	36	50	13	9	6
Summative assessment	58	21	23	43	10	18	6
Average	57	43	39	47	26	11	7

NOTES: The number in each cell represents the percentage of teachers nationally that reported that the instructional system component (row) provided guidance about the topic (column). For example, 78 percent of ELA teachers reported that their state standards provided guidance about the ELA content they should emphasize in their instruction. All percentages are weighted. *N* = 992.

TABLE 4

Percentage of Mathematics Teachers Indicating the Topics on Which Each Instructional System Component Provided Information or Guidance

System Component	Content to Emphasize (%)	Rigor or Difficulty (%)	Instructional Strategies (%)	Pacing or Sequencing (%)	Addressing Equity and Diversity (%)	No Guidance (%)	N/A—Component Not Present (%)
Standards	80	36	39	57	9	3	1
Curriculum	63	64	65	53	19	5	2
PD	32	42	30	32	31	11	19
Teacher collaboration	58	65	67	55	40	7	8
Evaluation	40	40	25	38	24	21	14
Benchmark assessments	65	34	39	53	12	10	7
Summative assessment	56	26	27	46	9	15	13
Average	56	44	41	48	21	10	9

NOTES: The number in each cell represents the percentage of teachers nationally that reported that the instructional system component (row) provided guidance about the topic (column). For example, 80 percent of mathematics teachers reported that their state standards provided guidance about the mathematics content they should emphasize in their instruction. All percentages are weighted. *N* = 818.

teacher collaboration–related guidance for all topics and particularly for instructional strategies (a gap of more than 30 percentage points). Finally, almost one-quarter of both ELA and mathematics teachers indicated that teacher evaluation criteria or processes present in their systems provided no guidance for their instruction.

By specific component, 6 to 15 percent more ELA teachers than mathematics teachers indicated that their PD, curriculum, and standards guided them to address equity and diversity in their instruction. This seems to align with general assumptions that, as an academic discipline, ELA is more sensitive than mathematics to issues of equity and diversity or is somehow more accountable to addressing these topics.

How Much More Guidance Did Teachers Report Wanting on Various Topics?

We considered that, regardless of whether teachers reported receiving guidance on certain topics from their instructional systems, the question remains of whether they need or want more guidance on certain topics to support their teaching. Responses to this question may help schools and districts target scarce resources.

Both ELA and mathematics teachers desired a lot more guidance around addressing equity and diversity. Figures 2 and 3 suggest similar patterns for ELA and mathematics teachers, respectively. In brief, more than three-quarters (and up to 90 percent) of teachers indicated wanting no more or only a little more guidance on four of the five topics we asked about. Specifically, teachers seemed to receive enough information on content to emphasize and pacing. Meanwhile, more than one-third of ELA and mathematics teachers desired a lot more guidance around addressing equity and diversity in their instruction, and another 40 percent wanted a little more guidance on this topic. That the pattern is similar for the two subjects suggests that this is a critical topic overall for school systems and that mathematics teachers are just as aware as their ELA colleagues of the need to address diversity and equity in their instruction. Any assumptions about the relative importance or suitability of addressing these topics in mathematics versus ELA should likely be reassessed.

Survey Question: Additional Guidance Teachers Want from Instructional System Components

Regardless of how much guidance you receive on each topic for your ELA/mathematics instruction, how much *more guidance* would you like on these topics from your district or school (whether through curriculum, professional development, or other instructional system components)?

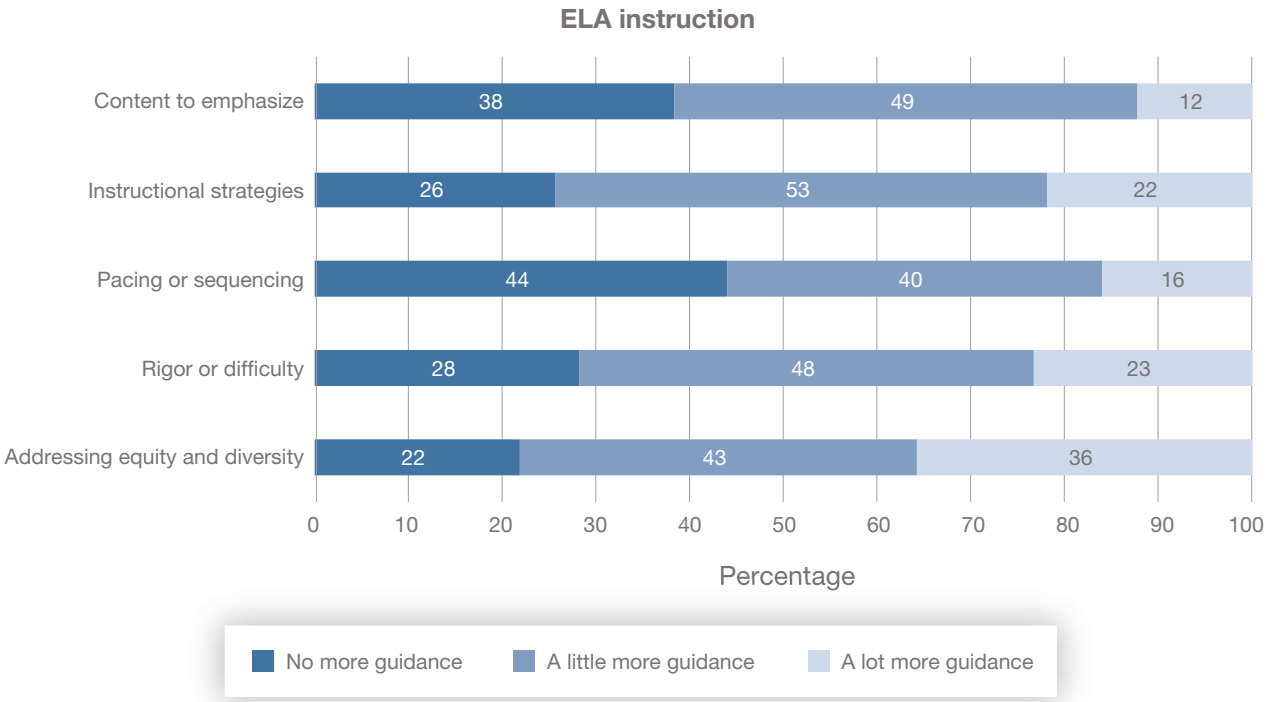
- 0 = *no* more guidance
- 1 = *a little* more guidance
- 2 = *a lot* more guidance

Teachers serving a majority of students performing below grade level generally desired a lot more guidance. Mathematics teachers serving mostly SoCs wanted more guidance, but not on addressing equity and diversity.[4] We considered that teachers serving different student populations may desire guidance on different topics. To investigate this, we estimated a series of regression models that predicted whether a teacher would like a lot more guidance on various topics by four classroom-level student demographic characteristics (high ELs, high SWD, majority SoCs, and majority below-grade-level students). Technically, these were univariate linear probability models with a dichotomous outcome and predictors entered into the model one at a time. The regression estimates can be interpreted as the percentage-point difference in the probability of wanting more guidance between (1) a teacher whose classroom contains high EL, high SWD, majority SoCs, or majority below-grade-level students and (2) a teacher whose classroom does not contain high EL, high SWD, majority SoCs, or majority below-grade-level students.

As Table 5 shows, in general, across both subjects, teachers who teach a majority of below-grade-level students were more likely to indicate that they would like a lot more guidance compared with teachers serving a majority of grade-level or above-grade-level students. Beyond this, mathematics teachers teaching majority SoCs have a higher probability of wanting more guidance on all topics than mathematics teachers teaching majority White students. The size of this difference ranges from around a 2-percentage-point increase in the probability of wanting more guidance on how to address equity and diversity issues (a difference that is not statistically significant) to around a 10-percentage-point increase in the probability of wanting more guidance

FIGURE 2

ELA Teachers Want More Guidance on Certain Topics to Support Their Teaching



NOTE: This figure shows ELA teachers' responses to the following survey question: "Regardless of how much guidance you receive on each topic for your ELA/mathematics instruction, how much more guidance would you like on these topics from your district or school?"

on how to address pacing or sequencing. Mathematics teachers teaching a high proportion of ELs were also more likely to desire additional guidance than mathematics teachers teaching lower proportions of ELs. The size of this difference ranges from around a 1-percentage-point increase in the probability of wanting more guidance on how to address equity and diversity issues (a difference that is not statistically significant) to around an 8-percentage-point increase in the probability of wanting more guidance on how to address pacing or sequencing. There is no difference in the probability of wanting a lot more guidance around instructional strategies between these two groups of teachers. We caveat these findings by noting that, given the exploratory nature of the analyses, *p*-values have not been adjusted for multiple comparisons. Moreover, the regressions cannot account for conflation among groups, for example, if there are overlaps among teachers that teach in classrooms with a high proportion of SWD and a majority of students performing below grade level.

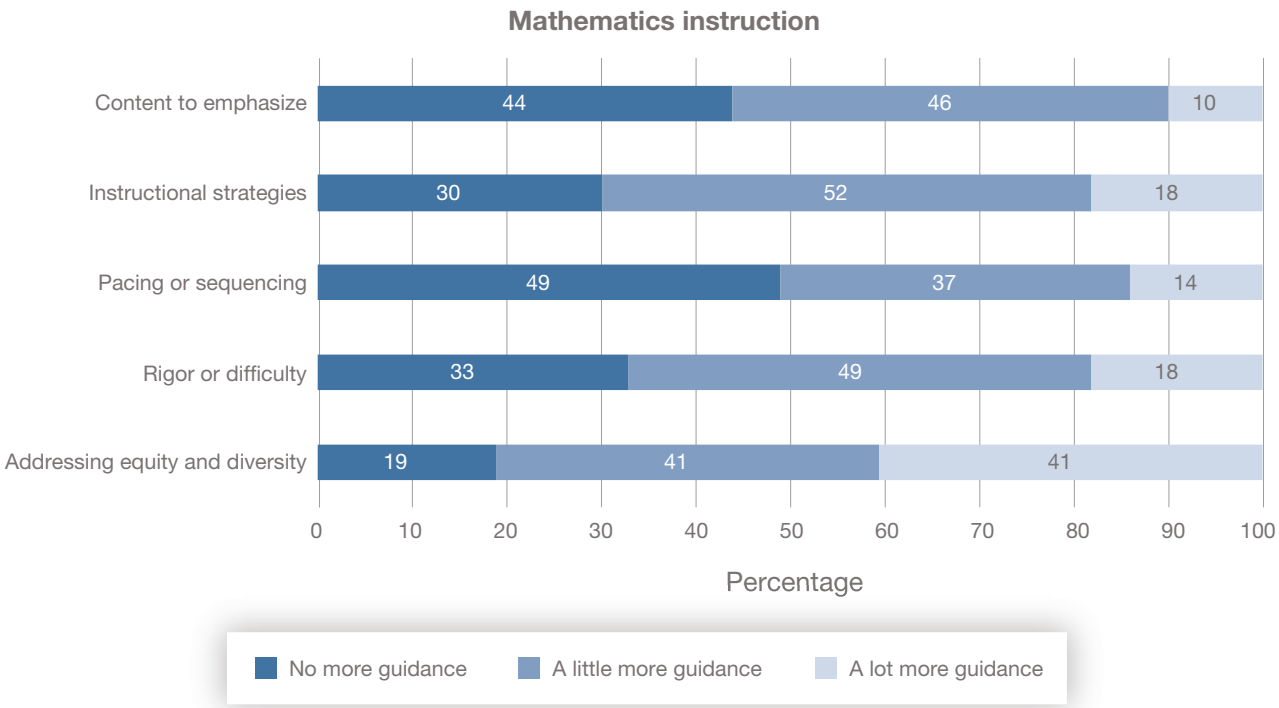
To What Extent Did Teachers Perceive That Guidance from Instructional System Components Supported Them to Address the Needs of Students, Particularly Traditionally Underserved Student Populations?

We asked teachers to indicate the extent to which the guidance provided by each instructional system component supported them to teach various groups of students.

Across subjects, teachers reported receiving insufficient support to teach to traditionally underserved groups of students. As Figure 4 shows, findings are again similar for ELA and mathematics teachers. Almost 80 percent of teachers indicated that the guidance they received from at least one of the seven components provided a lot of support to teach to all students. However, the proportion of teachers indicating that response decreased by about 20 percentage points, to 55 to 60 percent, when they

FIGURE 3

Mathematics Teachers Want More Guidance on Certain Topics to Support Their Teaching



NOTE: This figure shows mathematics teachers' responses to the following survey question: "Regardless of how much guidance you receive on each topic for your ELA/mathematics instruction, how much more guidance would you like on these topics from your district or school?"

Survey Question: Addressing the Needs of Traditionally Underserved Students

Select a rating from 0–2 (or N/A) to indicate how much the information/guidance provided by each instructional component supports you to teach ELA to each group of students this school year (2021–2022)?

- 0 = provides *little to no support*
- 1 = provides *some but not enough support*
- 2 = provides *a lot of support*
- N/A = the component or group of students is not applicable to me

Components	Student Groups
• State standards	• All students, in general
• Curriculum materials	• Students performing below grade level
• PD trainings	• ELs
• Guidance around teacher collaboration	• SWDs
• Teacher evaluation criteria or focus	• Black or Hispanic students
• Benchmark or interim assessments	
• State-mandated summative (end-of-year) assessment	

TABLE 5

Regression Estimates from Linear Probability Models Predicting Whether a Teacher Would Like A Lot More Guidance on Various Topics, by Classroom-Level Student Demographic Characteristics

	High EL	High SWD	Majority SoCs	Majority Below Grade Level
ELA				
Content to emphasize	0.00 (0.02)	0.03 (0.02)	0.00 (0.02)	0.05 (0.02)
Instructional strategies	0.02 (0.03)	0.03 (0.03)	0.04 (0.03)	0.08** (0.03)
Pacing or sequencing	0.02 (0.03)	–0.03 (0.02)	0.04 (0.03)	0.02 (0.03)
Rigor or difficulty	0.04 (0.03)	0.04 (0.03)	0.11*** (0.03)	0.08* (0.03)
Addressing equity and diversity	0.06 (0.03)	–0.04 (0.03)	0.01 (0.03)	0.10** (0.03)
Mathematics				
Content to emphasize	0.05* (0.02)	0.01 (0.02)	0.07** (0.03)	0.09*** (0.02)
Instructional strategies	0.00 (0.03)	0.06* (0.03)	0.06* (0.03)	0.11*** (0.03)
Pacing or sequencing	0.08** (0.02)	0.05* (0.02)	0.10*** (0.03)	0.07** (0.03)
Rigor or difficulty	0.06* (0.03)	0.02 (0.03)	0.07* (0.03)	0.03 (0.03)
Addressing equity and diversity	0.01 (0.04)	0.08* (0.03)	0.02 (0.04)	0.07 (0.04)

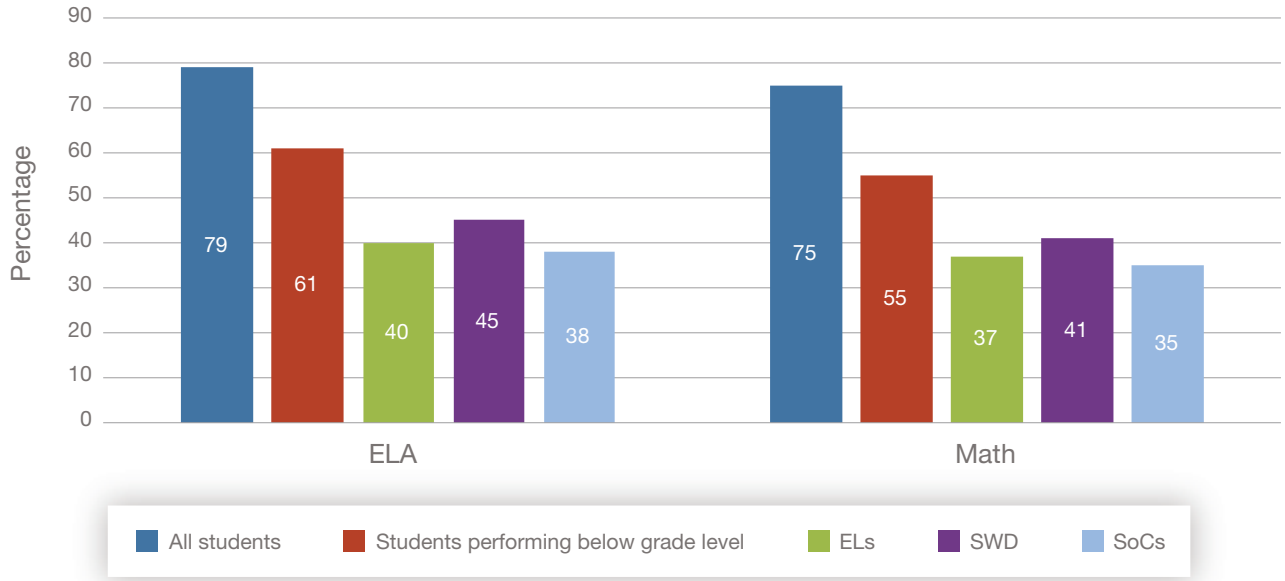
NOTE: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Standard errors are shown in parentheses. *High EL* and *high SWD* are defined as classrooms with more than 10 percent ELs and more than 10 percent SWDs, respectively. *Majority SoCs* and *majority below grade level* are defined as classrooms with more than 50 percent SoCs and more than 50 percent students performing below grade level, respectively. All characteristics are based on teacher-self reports from survey responses.

were asked about the support they received to teach to students performing below grade level. For ELs, SWD, and SoCs, that figure drops further to about or below 40 percent. This suggests that, although teachers might receive information that influences their general instruction, instructional system components can provide more-specific information that targets the needs of traditionally underserved groups of students. Moreover, because Figure 4 depicts the percentage of teachers indicating that just one of the seven instructional system components provided helpful guidance, we can infer that the percentage of teachers in systems in which multiple components convey coordinated and supportive messages to teachers about how to serve particular groups of students (e.g., PD reinforces the messages provided in the curriculum for how to support ELs) is much smaller.

Teachers who served larger proportions of key subgroups were more likely to say that they had support to teach those subgroups, with the exception of teachers serving a majority of students performing below grade level. We examined whether the amount of support teachers reported receiving to teach to particular groups of students differed depending on the student populations they served. We found that ELA and mathematics teachers serving high proportions of SoCs were more likely than their peers serving majority White students to say that the guidance provided by at least one instructional system component provided them a lot of support to teach to SoCs (8 percentage points more ELA teachers and 16 percentage points more mathematics teachers; the differences are statistically significant). The trend is similar for teachers teaching larger shares of SWD and ELs; the difference is larger for teachers serving high proportions of ELs. The trend does not hold, however, for teachers serving a majority of students performing below grade level. ELA teachers were less likely than their peers serving a majority of students performing at or above grade level to say that the guidance they received provided a lot of support to teach to these students (7 percentage points, $p < 0.05$). Mathematics teachers serving

FIGURE 4

Percentage of ELA and Mathematics Teachers Indicating That the Guidance Provided by *At Least One* of the Seven Instructional System Components Provides a Lot of Support to Teach Particular Groups of Students



NOTE: The difference in perceived support to teach to all students and to each traditionally underserved student group is significant overall, $p < 0.001$. All percentages are weighted. $N = 992$ ELA teachers. $N = 818$ mathematics teachers.

a majority of students performing below grade level were equally likely to say that the guidance provided a lot of support.

What Were Teachers' Perceptions of the Coherence of Their Schools' Instructional Systems?

Thus far, we have addressed the extent to which instructional system components provide information or guidance on what to teach and how to teach ELA or mathematics, but central to the concept of coherence is whether the messages are reinforcing. If system components convey dissimilar or conflicting messages, teachers must make sense of the mixed messages and decide what content and skills to emphasize, to what depth, and what instructional strategies to use. For our third research question, we sought to characterize teachers' perceptions of their instructional systems' coherence. Our analysis drew on teachers' ratings of the extent to which each possible pair of the seven instructional system components provided similar messages about ELA or mathematics instruction. (We discuss the 21 component pairs later in this section.)

Across subjects, teachers perceived standards, curriculum, teacher collaboration, and interim assessments to be most connected to other system components. First, we applied the network analysis concept of degree. We calculated the number of positive degrees for each network node. This represents the number of other components with which a given component (e.g., curriculum) is connected, in the sense of providing similar or reinforcing messages to teachers about what and how to teach. As Table 6 shows, for both subjects, standards, curriculum, teacher collaboration, and interim assessments each were positively connected to about four other system components. Meanwhile, PD, evaluation, and summative assessment each were connected to about three system components. On average, ELA teachers indicated that each instructional system component is negatively connected to (i.e., conveys dissimilar or conflicting messages to) about one or two other components. Mathematics teachers were inclined to identify only one negatively connected component.

Survey Question: Instructional System Coherence

NOTE: Teachers who had indicated on a prior question that a particular component "is not present or used in my school at all this school year (2021–2022)" were not asked to rate that component.

[For each instructional system component pair,] provide a rating from 1–4 of how coherent the two components are, in other words how well they support each other and provide similar messages about ELA teaching. Think about this school year (2021–2022).

- 1 = provide *conflicting messages* about ELA/mathematics teaching
- 2 = provide somewhat *dissimilar messages* about ELA/mathematics teaching
- 3 = provide somewhat *similar messages* about ELA/mathematics teaching
- 4 = provide *reinforcing messages* about ELA/mathematics teaching

TABLE 6

Average Number of Similar or Reinforcing Connections (Positive Degrees) and Dissimilar or Conflicting Connections (Negative Degrees) for Each Instructional System Component for ELA and Mathematics

	Mean (SD)	
	ELA	**Mathematics**
Positive degree		
Standards	3.99 (1.98)	4.07 (1.81)
Curriculum	3.88 (1.99)	3.90 (1.92)
PD	3.48 (2.33)	3.42 (2.37)
Teacher collaboration	3.67 (2.22)	3.91 (2.10)
Evaluation	3.30 (2.38)	3.42 (2.37)
Benchmark assessments	3.62 (2.32)	3.70 (2.23)
Summative assessment	3.34 (2.43)	3.27 (2.42)
Negative degree		
Standards	1.48 (1.73)	1.25 (1.53)
Curriculum	1.60 (1.80)	1.36 (1.68)
PD	1.57 (1.93)	1.26 (1.77)
Teacher collaboration	1.54 (1.89)	1.21 (1.64)
Evaluation	1.89 (2.16)	1.40 (1.88)
Benchmark assessments	1.69 (2.02)	1.46 (1.90)
Summative assessment	1.96 (2.22)	1.59 (2.06)

NOTE: The maximum degree possible per node (i.e., component) is six. Degrees are positive in cases in which teachers rated two components as conveying similar or reinforcing messages. Degrees are negative when teachers rated two components as conveying dissimilar or conflicting messages. When a teacher indicates that a component was not present in their instructional system (see Tables 3 and 4), this is considered "zero" degrees; it is counted as neither positive nor negative. SD = standard deviation.

Across subjects, state standards and curricula convey the most similar messages. The concept of degrees indicates *how many* other instructional system components each component is connected with—either positively or negatively—but it does not reveal which components teachers rated as most similar or reinforcing of each other. To determine that information, we calculated the average rating teachers provided between each pair of instructional system components (see Tables 7 and 8).

The patterns are similar for ELA and for mathematics. According to the average similarity rating, state standards and curricula convey the most-similar messages among all 21 possible pairs. Furthermore, state standards are perceived as conveying messages that are similar to the guidance teachers receive on how to use teacher collaboration time as well as guidance from benchmark assessments and from summative assessments. Indeed, about three-quarters of teachers rated these pairs as conveying similar or reinforcing messages. Curriculum materials are also perceived as closely linked with PD and teacher collaboration guidance, and the rating for the teacher collaboration and benchmark assessments pair is also among the higher ratings. These observations suggest that schools are likely to have at least a standards, curriculum, and teacher collaboration triad that provides a basis for coherent messaging, if not a four-component cluster with the addition of benchmark assessments. On the other hand, for both ELA and mathematics, the PD and summative assessment, and evaluation criteria and summative assessment pairs received the lowest rating (with at most two-thirds of teachers perceiving similar messaging), indicating an apparent disconnect between these components.

Across subjects, teachers perceived a moderate level of instructional system coherence. Finally, we examined teachers' perceptions of the overall coherence of their instructional systems, considering all components at the same time. Recall that our density metric for characterizing overall system coherence is based on the proportion of positive ties (i.e., principals rated the two instructional system components as "similar to" or "reinforcing of" each other). Because there are seven instructional system components, there is a total of 21 possible ties. A higher positive density (a maximum of 1.00) suggests a more coherent instructional system.

Again, results were similar for ELA and mathematics instructional systems. On average, according to teachers' ratings, about 13 of 21 possible ties are present and positive, and around five of 21 possible ties are present and negative. This translates to schools having an average instructional system coherence index (i.e., density) of 0.61 (SD = 0.33) for mathematics and 0.60 (SD = 0.32) for ELA. We interpret this as moderately coherent. Teachers likely experience similar messages from multiple components of their instructional systems about what to

TABLE 7

Average Rating of Similarity Between Pairs of Instructional System Components by ELA Teachers and Percentage of Teachers Reporting Similar or Reinforcing Messages

	State Standards	Curriculum Materials	PD	Teacher Collaboration	Evaluation Criteria	Benchmark or Interim Assessments
Curriculum	3.0 (76)					
PD	2.9 (75)	2.9 (74)				
Teacher collaboration	2.9 (73)	2.9 (76)	2.9 (75)			
Evaluation	2.7 (71)	2.6 (67)	2.6 (69)	2.7 (71)		
Benchmark assessments	2.9 (73)	2.8 (69)	2.7 (66)	2.8 (72)	2.6 (64)	
Summative assessment	2.9 (72)	2.6 (65)	2.5 (61)	2.6 (65)	2.5 (60)	2.7 (67)

NOTE: Values are shown on 1–4 (conflicting messages to reinforcing messages) scale. The percentage of teachers reporting positive ties (i.e., similar or reinforcing messages) is shown in parenthesis. When a teacher indicated that a component was not present in their instructional system (see Tables 3 and 4), they were not asked to rate pairs containing that component. *N* = 992.

emphasize in their teaching and how to teach; however, they also perceive disconnects among system components, which may leave them to grapple with which system components to attend to and prioritize.

In Figures 5, 6, and 7, we present three instructional system diagrams to depict what a low-coherence instructional system, a moderately coherent instructional system (i.e., an instructional system with a coherence index of around 0.61), and a fully

TABLE 8

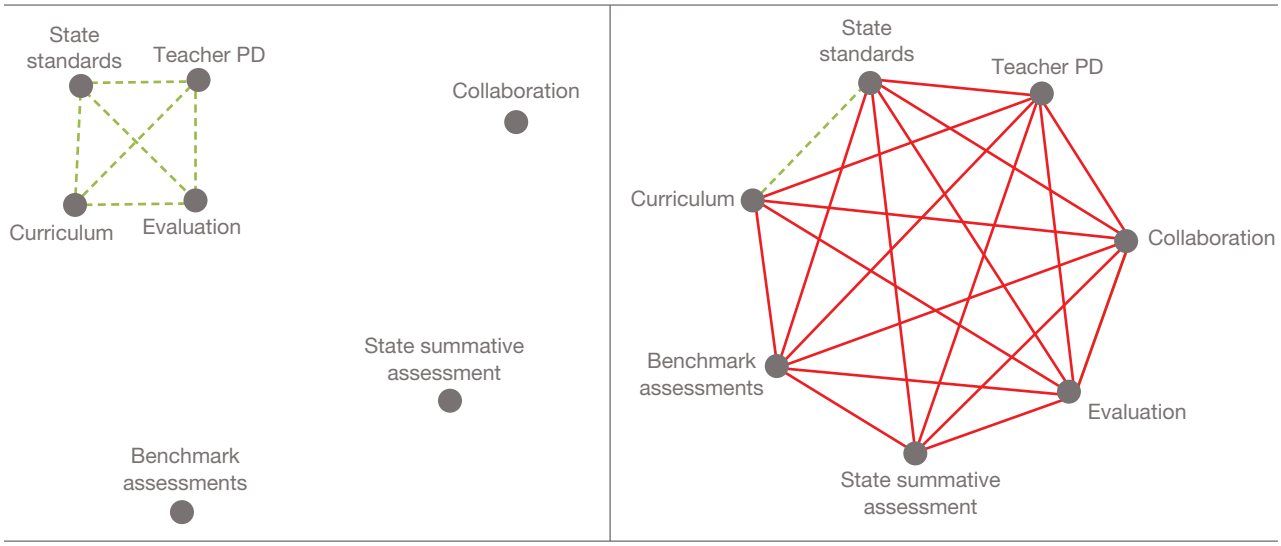
Average Rating of Similarity Between Pairs of Instructional System Components by Mathematics Teachers and Percentage of Teachers Reporting Similar or Reinforcing Messages

	State Standards	Curriculum Materials	PD	Teacher Collaboration	Evaluation Criteria	Benchmark or Interim Assessments
Curriculum	3.1 (81)					
PD	3.0 (77)	3.0 (74)				
Teacher collaboration	3.0 (77)	3.0 (78)	3.0 (79)			
Evaluation	2.8 (72)	2.8 (70)	2.8 (72)	3.0 (78)		
Benchmark assessments	2.9 (76)	2.9 (74)	2.8 (74)	3.0 (80)	2.7 (70)	
Summative assessment	2.9 (74)	2.7 (70)	2.7 (67)	2.8 (71)	2.6 (63)	2.8 (71)

NOTE: Values are shown on 1–4 (conflicting messages to reinforcing messages) scale. The percentage of teachers reporting positive ties (i.e., similar or reinforcing messages) is shown in parenthesis. When a teacher indicated that a component was not present in their instructional system (see Tables 3 and 4), they were not asked to rate pairs containing that component. *N* = 818.

FIGURE 5

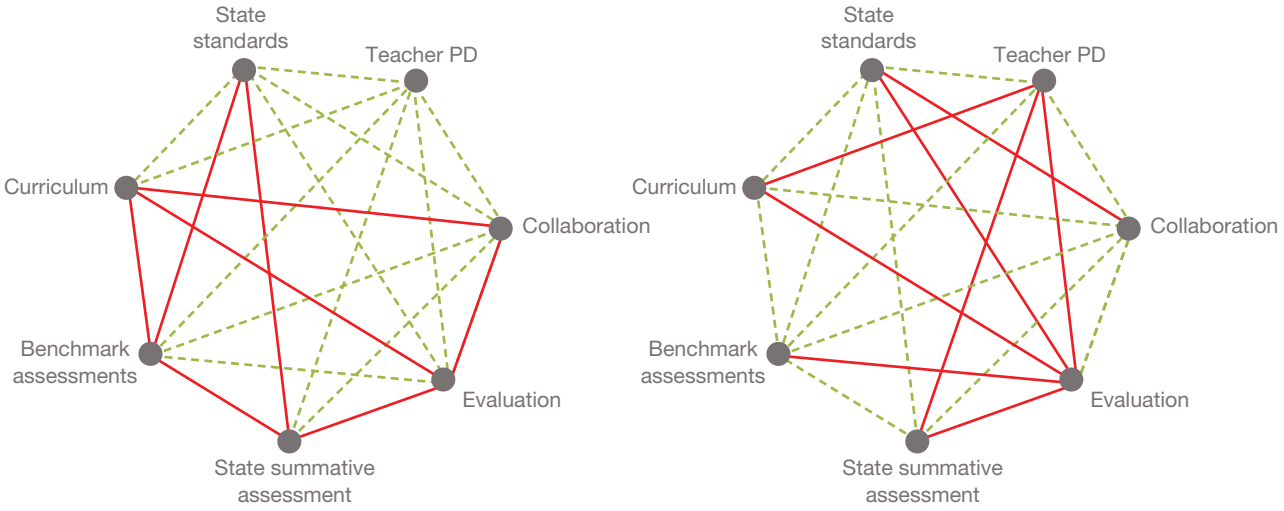
Instructional Systems Based on Teachers' Perceptions of Which Components of Their Instructional System Are Positively or Negatively Connected: Low Coherence



NOTE: This figure depicts two instructional systems (i.e., networks) in which most of the components are not similar or reinforcing. We interpret these systems as having low coherence. In the first network, the low coherence results from the fact that many elements are neither reinforcing nor conflicting with each other; they are largely disconnected. Six of the 21 possible ties are positive (shown with green dashed lines), so the coherence index, or positive density, of this instructional system is 0.29. In the second network, the low coherence results from many dissimilar or conflicting ties. One of 21 possible ties is positive, so the coherence of this instructional system is 0.05. About 5 percent of all teachers in our dataset—for both ELA and mathematics—perceived their instructional system as these depicted systems, although not necessarily with these exact ties.

FIGURE 6

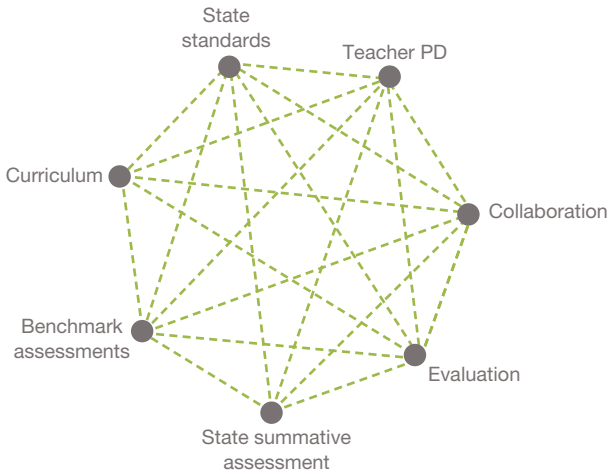
Instructional Systems Based on Teachers' Perceptions of Which Components of Their Instructional System Are Positively or Negatively Connected: Moderately Coherent



NOTE: This figure depicts two systems in which 13 of the 21 possible ties are present and positive (shown with dashed green lines) and the rest of the ties are negative (red lines). The coherence index, or density, of these instructional systems is 0.62. We interpret these systems as moderately coherent. About 13 percent of all teachers in our dataset perceived this type of system, although not necessarily with the exact ties depicted.

FIGURE 7

Instructional Systems Based on Teachers' Perceptions of Which Components of Their Instructional System Are Positively or Negatively Connected: Fully Coherent



NOTE: This figure depicts a system in which all seven instructional system components are similar to or reinforcing of each other. With 21 of 21 possible positive ties, the coherence index of this instructional system is 1. We interpret this system as fully coherent. About 20 percent of all teachers in our dataset perceived a system that fit this depiction.

coherent instructional system (with a coherence index of 1.00) look like. Each diagram represents one teacher's perception of which components of their instructional system send similar or reinforcing messages, or dissimilar or conflicting messages. In other words, these figures are visual summaries of a teacher's rating of the similarity between pairs of instructional system components.

Although all fully coherent instructional systems would produce the network diagram shown in Figure 7, the same cannot be said for either low-coherence (Figure 5) or moderately coherent (Figure 6) instructional systems. In those cases, networks with the same instructional system coherence indexes (i.e., density) can differ greatly in their patterns of connections (see, for example, Shaffer et al., 2016). To make this point, in Figure 5, we display two low-coherence instructional systems, showing qualitative differences in the patterns of connections. The first panel of Figure 5 shows an instructional system in which there are many absent ties, indicating that most instructional system components are not present. The second panel of Figure 5 shows an instructional system in which nearly all the com-

ponents provide conflicting information in relation to another component. Similarly, the first panel of Figure 6 shows a moderately coherent instructional system in which there are positive, reinforcing connections among the components of PD, teacher collaboration, and state standards (as indicated by green lines from each of these components to the other two components). The second panel of Figure 6 shows a moderately coherent instructional system in which teacher collaboration guidance and state standards are conflicting. Meanwhile, there are reinforcing relationships among standards, benchmark assessments, and state summative assessment. Because of the different possible patterns, the instructional system diagrams in Figures 5 and 6 should not be interpreted as representative or typical of low-coherence (Figure 5) or moderately coherent (Figure 6) instructional systems; these figures are meant as illustrative examples only.

Which Component Do Teachers Prioritize When They Perceive Incoherence?

In this section, we address the question of which component teachers prioritize when they perceive incoherence among system components' messaging about what and how to teach.

Teachers prioritize state academic standards when they perceive incoherence among system components. The results summarized in Table 9 show that, for both ELA and mathematics teachers, if they perceive dissimilar or conflicting messages, a majority of teachers would most likely trust or follow the guidance provided by their state academic standards. After standards, teachers would turn to teacher collaboration guidance and curricula for clarification about what and how to teach. Very few teachers would prioritize the guidance encoded in their school systems' teacher evaluation criteria, PD, summative assessment, or benchmark assessments.

Survey Question: Resolving Perceived Incoherence

Which ELA/mathematics instructional system component are you most likely to prioritize (i.e., follow its guidance) when you perceive dissimilar or conflicting messages? (Imagine, for example, that the curriculum emphasizes certain skills that are different from those emphasized on the state-mandated summative assessment. Or the instructional strategies that PD trainings focus on that are not what you are evaluated on). [Rank the top 3]

TABLE 9

Instructional System Components That Teachers Were Most Likely to Prioritize if They Perceived Dissimilar or Conflicting Messages

	Percentage of ELA Teachers		Percentage of Mathematics Teachers	
	Top 1	Top 3	Top 1	Top 3
Standards	51	77	53	78
Curriculum	15	65	14	66
PD	5	23	3	21
Teacher collaboration	19	58	19	56
Evaluation	3	16	2	13
Benchmark assessments	3	38	4	38
Summative assessment	4	23	5	27

NOTE: All percentages are weighted. *N* = 992 ELA teachers. *N* = 818 mathematics teachers.

How Were Teachers' Perceptions of Instructional System Coherence Associated with Conditions Identified Through Literature as Related to the Development of Coherence?

Next, we sought to characterize the relationship between teachers' reports of system coherence and their assessment of the presence of a set of five conditions we identified as critical for the development and maintenance of coherence.

In systems in which coherence is stronger, contextual conditions hypothesized to be associated with coherence are present to a greater extent. We used univariate regression models to explore the extent to which the presence of contextual conditions was associated with increased perceived instructional system coherence. In these models, coherence was the dependent variable, and five contextual conditions that may support the development of coherence (vision of academic improvement; culture of continuous improvement; instructional leadership; common instructional practices; and time, structure, and resources) were used one at a time as predictors of coherence. In this way, the regression coefficients can be interpreted as the predicted increase in coherence for a one-scale-point increase in a respondent's perception of the extent to which each of the contextual conditions are present in their school. As a reminder, coherence is measured on a scale from zero to 1, and a 0.05 increase in coherence would indicate that a teacher perceived one additional positive tie in their instructional system.

As shown in Table 10, we found that each of the contextual conditions we asked about is positively and statistically significantly associated (at $p < 0.001$) with our measure of instructional system coherence (i.e., density). The magnitudes of the associations are moderate, however. Therefore, it is difficult to characterize the practical implication of this relationship. Moreover, we are unable to establish the direction of causality and draw conclusions as to whether the conditions support, contribute to, or lead to the development of coherence in messaging around instruction among system components. Suffice it to say that in systems in which coherence is stronger, these contextual conditions are present to a greater extent.[5]

How Were Teachers' Perceptions of Instructional System Coherence Associated with Instructional Practice?

Finally, we explored the hypotheses that instructional system coherence matters for teachers' instructional practice and that teachers in more-coherent systems

Survey Question: Conditions Supporting Coherence

To what extent are the following present in your school this school year (2021–2022) to support your ELA/mathematics instruction?

- 1 = Not present
- 2 = Present to a slight extent
- 3 = Present to a moderate extent
- 4 = Present to a considerable extent

Condition	Sample Item
• Vision for academic improvement	• A small number of goals that are tied to ELA/mathematics student learning
• Culture of continuous improvement	• A culture focused on continually improving teaching and learning
• Instructional leadership	• Leaders who make quality instruction a priority
• Common instructional practices	• A set of teaching practices that are used by all
• Time, structure, and resources	• Structures and processes that support educator collaboration

TABLE 10

Association Between Instructional System Coherence and Five Contextual Conditions That May Support the Development of Coherence

	Coefficient (Standard Error)	
Contextual Condition	**ELA**	**Mathematics**
Vision for academic improvement	0.20*** (0.02)	0.18*** (0.02)
Culture of continuous improvement	0.20*** (0.02)	0.17*** (0.02)
Instructional leadership	0.17*** (0.02)	0.15*** (0.02)
Common instructional practices	0.19*** (0.02)	0.16*** (0.02)
Time, structure, and resources	0.22*** (0.02)	0.17*** (0.02)

NOTE: *** $p < 0.001$.

engage in strong standards-aligned instruction because they receive clearer messages from various instructional system components about what and how to teach effectively. Here, as in the analyses for research question 4, we used univariate regression models to explore the extent to which teachers' self-reports of their instructional practice were associated with increased perceived coherence. In these models, coherence was again the dependent variable, and the use of curriculum materials (Table 11), modification of curriculum materials (Table 12), and the use of specific instructional practices (Table 13) were employed one at a time as predictors of coherence. Again, we cannot establish causality between the extent of instructional system coherence and instructional practice, but we took a step toward addressing the question by examining whether and to what extent expected associations between system coherence and certain desired instructional practices are present.

Instructional system coherence does not appear to be associated with measures related to use of curriculum—regardless of whether those materials are aligned with standards. First, we explored the hypothesis that teachers in schools that favor standards-aligned materials perceive greater coherence because such materials help provide a focus for other components or that the materials potentially help anchor activities in other instructional system components. For example, schools that adopt or require the use of high-quality standards-aligned materials are likely to provide PD on the use of such materials or to require the use of accompanying formative assessments that are aligned with the materials. In these models, the regression coefficients can be interpreted as the predicted increase in perceived coherence based on the increased use of required or recommended curriculum materials, which we operationalized in five different ways. This includes a count of the number of curriculum materials—regardless of whether they are aligned with standards—that schools or districts require teachers to use, the percentage of required materials that are aligned with standards, and the reported use of standards-aligned materials either at all or for the majority of the instruction.

Survey Question: Use of Curriculum Materials Required or Recommended by the School or District

This school year (2021–2022), how regularly do you use the ELA/mathematics curriculum material(s) your school or district requires or recommends that you use for your "typical ELA/mathematics class," even if you modify or adapt the curriculum material(s)?

- 1 = Not at all
- 2 = For a few of my lessons
- 3 = For some but not the majority of my lessons
- 4 = For the majority but not all of my lessons
- 5 = For all of my lessons

Our findings generally suggest that the hypothesis does not hold (see Table 11 and descriptive statistics of curricula in Appendix Table A.1). In our

TABLE 11

Association Between Instructional System Coherence and Standards-Aligned Curriculum Material Use

	Coefficient (Standard Error)
ELA	
Number of required curriculum materials	0.00 (0.01)
Number of required standards-aligned curriculum materials	0.01 (0.02)
Percentage of required materials that are standards-aligned	–0.01 (0.06)
Any standards-aligned material use	0.03 (0.04)
Any standards-aligned material use (majority of the time)	0.05 (0.05)
Mathematics	
Number of required curriculum materials	0.03* (0.01)
Number of required standards-aligned curriculum materials	0.02 (0.02)
Percentage of required materials that are standards-aligned	0.01 (0.04)
Any standards-aligned material use	0.05 (0.03)
Any standards-aligned material use (majority of the time)	0.02 (0.04)

NOTE: * $p < 0.05$.

Survey Question: Modification of Curriculum Materials

Of the required or recommended ELA curriculum materials you reported using this school year (2021–2022) (other than what you create yourself), how much do you typically modify lessons within those materials? *By* modify*, we mean make any changes to activities within the lesson plans, skip activities, add activities, or reorder activities.*

- 1 = I typically make no modifications to lessons within these materials
- 2 = I typically modify less than half of a given lesson within these materials
- 3 = I typically modify half or more of a given lesson with these materials

data, instructional system coherence is not associated with measures related to curriculum, regardless of the measure we used for the analysis. Specifically, the findings suggest that adopting or using a standards-aligned curriculum does not (in and of itself) support or facilitate the development of coherence. We caveat this inference by noting that our analysis may not be sufficiently powered to find small differences in coherence, for example, if schools with certain patterns of curriculum material use have one more tie among components in their instructional system than other schools. Alternative explanations are possible for the lack of associations. It is possible that some schools recently adopted a new curriculum and had not yet brought other components in alignment.

Teachers making more modifications to their curriculum materials reported less instructional system coherence. Another hypothesis we examined is whether teachers who perceived greater instructional system coherence used their curriculum materials with greater fidelity (i.e., with fewer modifications). The underlying assumption is that, compared with their peers in less coherent systems, teachers in more coherent systems receive clearer and more reinforcing messages from various components that support the use of the materials they have. Teachers in less coherent systems may seek to satisfy disparate messages they get from various components and therefore make more curriculum modifications.

As shown in Table 12 (see also descriptive statistics of modifications to curriculum materials in Appendix Table A.2), we found associations between the extent of modifications that teachers

TABLE 12

Association Between Instructional System Coherence and Modifications to Curriculum Materials

	Coefficient (Standard Error)
ELA	
Any modifications to required curriculum materials	−0.11* (0.04)
Modifications to majority of lessons within materials	−0.18*** (0.04)
Mathematics	
Any modifications to required curriculum materials	−0.06 (0.04)
Modifications to majority of lessons within materials	−0.09* (0.04)

NOTE: * $p < 0.05$; *** $p < 0.001$. Because of the lack of association between instructional system coherence and standards-aligned curriculum material use, we did not break out the analysis by modifications to standards-aligned versus not-standards-aligned curriculum materials.

reported making and the extent of perceived coherence. Specifically, ELA and mathematics teachers who reported making more modifications to their materials for a majority of their lessons reported less instructional system coherence. For example, there is approximately an 11-percentage-point difference between the instructional system coherence perceived by an ELA teacher who reported making any modifications to required curriculum materials and the coherence perceived by an ELA teacher who did not make any changes. This means that teachers who reported making any modifications to required curriculum materials typically had two to three fewer similar or reinforcing ties among components in their instructional systems than those who reported making no modifications. ELA teachers who reported making modifications to a majority of their lessons had four to five fewer similar or reinforcing ties than their peers. This suggests that the hypothesis we articulated above holds, although our analysis cannot establish causality. It can establish only that an expected association is present between the extent of modifications and perceived coherence.

We found minimal associations between the perception of instructional system coherence and our measures of instructional practices. Finally, we looked beyond curriculum use to other instructional practices to explore their associations with perceived coherence. We expected that teachers who perceived greater instructional system coherence would engage more frequently in standards-aligned instructional practices, which are practices that support student learning and mastery of the state standards.

Survey Question: Instructional Practice

In a typical week this school year (2021–2022), how often did students in your "typical ELA/mathematics class" engage in each of the following activities? (See Table 13 for survey items.)

- Never or almost never
- In some but not most lessons
- In about half of my lessons
- In every or almost every lesson
- Not relevant for the grade/class I teach

We found no significant relationship between our measure of coherence and any of the 12 mathematics instructional practices we identified as supporting mastery of the standards (Table 13; see descriptive statistics of the instructional practice survey question in Appendix Tables A.3 and A.4). In ELA, we found some relationships. In classrooms of teachers who perceived greater instructional system coherence, students engaged more regularly in four particular practices: applying phonics skills in decoding words, learning and using vocabulary, applying or building on concepts learned from previous lessons, and making use of teacher feedback to improve responses.

TABLE 13

Association Between Instructional System Coherence and Instructional Practice

Instructional Practice	Coefficient (Standard Error)
ELA	
Focused on the same grade-level text as a whole class	0.02 (0.02)
Focused on different texts from other students, depending on students' reading level	0.02 (0.02)
Read and discuss/write about texts that provide meaningful information in service of building knowledge	0.03 (0.02)
Read and discuss/write about texts that include diverse perspectives	0.00 (0.02)
Apply phonics skills in decoding words	0.07*** (0.02)
Use evidence from text(s) to support written or oral analysis of text ideas	0.01 (0.03)
Explain their thinking and build on other students' thinking	0.05 (0.03)
Learn and use a range of general academic and domain-specific vocabulary (i.e., words and phrases) sufficient for college and career readiness	0.06* (0.02)
Apply or build on the concepts learned from the previous lesson in the present day's lesson (i.e., learning is linked across lessons or activities)	0.08** (0.03)
Make use of teacher feedback or probes to improve written or oral responses	0.07** (0.02)
Select and use the means (e.g., draw, write, speak) that allows each student to best demonstrate understanding	0.04 (0.02)
Productively struggle through a challenging task and persevere through difficulty	0.03 (0.02)
Mathematics	
Engage with mathematics topics addressed by the state standards for the grade level	0.05 (0.03)
Revisit previous grades' content to fill learning gaps	0.01 (0.02)
Build conceptual understanding	0.00 (0.02)
Explain their thinking and build on other students' thinking	0.03 (0.02)
Use repeated practice to improve their procedural skills	0.02 (0.03)
Apply mathematics to solve problems in real-world contexts	0.03 (0.02)
Make sense of problems that do not include clear procedures for solving	0.03 (0.02)
Persevere in solving problems that do not include clear solution procedures	0.03 (0.02)
Choose and use appropriate tools when solving a problem	0.03 (0.02)
Select and use the means (e.g., draw, write, speak) that allows each student to best demonstrate understanding	0.03 (0.02)
Apply or build on the concepts learned from the previous lesson in the present day's lesson (i.e., learning is linked across lessons or activities)	0.02 (0.03)
Make use of teacher feedback to improve written or oral responses	0.02 (0.02)

NOTE: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Summary and Implications

A coherent instructional system is thought to support standards-based reform and standards-aligned instruction because the messages teachers perceive from various instructional system components (e.g., standards, curriculum, PD, assessments) reinforce each other, providing clarity around what and how to teach. What guidance teachers perceived, from which instructional system components, and the extent to which teachers perceive system coherence are questions at the core of our study. We briefly offer some summary points on our findings from this study and their implications for districts and schools. In addition, as part of this project, we have developed a toolkit to help schools and school systems informally assess, reflect on, and improve coherence in their instructional systems (Kaufman et al., 2023). Many of the implications we offer could be acted on through the use of that toolkit.

Our findings indicate that, nationally, ELA and mathematics teachers indeed perceived that various instructional components provided guidance on aspects of their instruction. In addition to standards, curriculum and teacher collaboration were leveraged the most, or at least more teachers perceived these to be components that provided them with signals about how to teach. Because teachers tended to pick up signals from these two components, **districts and schools might want to ensure that the curricula and teacher collaboration opportunities are conveying the messages they intend**—for example, messages that align with district-identified priorities (e.g., priority students, standards, teaching strategies).

Meanwhile, considerably fewer teachers perceived guiding messages from the formal PD and teacher evaluation components about what and how to teach. Indeed, teachers were disinclined to identify these components as connected to other components or conveying messages that were coherent with those of other components. Our findings suggest that teachers' perceptions of the coherence of their instructional systems would improve if these components were brought into alignment with other components. These findings point to potential missed opportunities in using these two components to convey messages to support instruction. **Schools and districts may wish to examine their formal PD offerings**—what topics they center around, how connected they are to the subject area and curriculum, and how well they consider teachers' existing knowledge and expertise and areas of need—**and/or elicit teachers' direct feedback to understand how PD can be more helpful for teachers' instructional planning and day-to-day work**. It could be that PD offerings indeed provide such guidance, but the connections could be made more apparent to teachers. When PD centers on general topics, such as classroom management, use of technology, or a data system, for example, teachers may appreciate explicit messaging about how practices presented in PD directly support ELA curriculum use or help identify student needs in the subsequent mathematics unit. **Similarly, districts and schools may consider how to shape teacher evaluation processes and criteria to be more directly helpful for guiding classroom practice.** Ideas might include conducting informal walkthroughs with debrief conversations and using observation protocols that focus on lesson content and substantive aspects of curriculum implementation (i.e., what to teach) as well as subject-specific strategies and strategies for supporting specific students (i.e., how to teach).

Our findings about the guidance teachers desire and how supported they feel to teach to traditionally underserved populations can provide insight into what messages districts and schools should consider addressing through PD, evaluation, and other instructional system components. That is, we learned that both ELA and mathematics teachers perceived sufficient guidance on content to emphasize and pacing for their instruction; they wanted guidance on addressing diversity and equity most. Our findings suggest that such guidance is broadly needed to support learning for all student subgroups—SoCs, SWD, ELs, and students performing below grade level. In particular, teachers serving majorities of students performing below grade level desired more guidance overall. While they emphasize standardized aspects of schooling, such as academic standards, curriculum, and state assessments, **districts and schools should consider providing more guidance on strategies for differentiating instruction or leveraging students' diverse backgrounds to engage**

students and help achieve academic targets. In doing so, districts and schools should convey a coherent vision of instruction. This may entail anticipating and addressing potentially conflicting messages; for example, teachers may need help reconciling the message to "implement the curriculum with fidelity and rigor" with the message to "provide scaffolds and use differentiation to meet the needs of struggling learners." Reconciling such messages will help teachers perceive coherence in their instructional systems and guard against leaving students behind. Our findings also suggest that, although it is important to equip all teachers with strategies to address diversity and equity, teachers in settings with a large population of key subgroups are more likely to report that they feel supported. Districts and schools with smaller proportions of these student populations especially should make sure that they support teachers to address the diversity in their classrooms; it should not be the case that diversity and equity receive attention only when particular subgroups of students reach a majority.

With one notable exception, we largely observed null findings with respect to associations between instructional system coherence and a variety of standards-aligned instructional practices, including the use of standards-aligned curriculum materials. The one significant relationship we detected was between a higher degree of perceived coherence and the likelihood that teachers would not modify their lesson materials. The largely null findings suggest a need to sharpen our measures of coherence and/or instructional practices, among other considerations (see the next section for more information). Nevertheless, as they are, the findings raise questions about the central role that standards-aligned materials are hypothesized to play in promoting system coherence. Teachers indicated that curriculum materials in general were a strong source of guidance about what and how to teach, but perceptions of system coherence were not any higher or lower if a given teacher reported using materials that were rated by EdReports as aligned with most college- and career-ready standards. That is, in our data, system coherence appears to be similar in schools that use a curriculum rated as "standards-aligned" or "high quality" to that of schools with curriculum materials that are not rated as such. Of course, one could argue that what content and practices an instructional system coheres around matters; it would be better if they were standards-aligned ones. In any case, **districts and schools must be mindful that simply adopting standards-aligned materials may be insufficient for improving coherence and for propelling the implementation of desirable practices**.

We found little difference between teachers' reports about coherence and the guidance they receive about their instruction in ELA versus mathematics. We cannot draw any conclusions about the extent to which instructional systems are similar for ELA and mathematics for the same teacher because teachers were either asked about their ELA or their mathematics instruction, not both. However, these results do suggest (at the least) that instructional system components that provide teachers with messages about their instruction—and the extent of coherence regarding those messages—are not radically different for ELA and mathematics. This does not mean that coherence would be similar for other subjects, such as social studies or science, where evaluation and professional learning typically are less frequently subject-focused and teachers typically receive less guidance.

Readers should keep in mind that survey self-report measures are limited in the extent to which they can capture detailed or accurate information about teacher practice, including modifications of curriculum materials and a variety of standards-aligned practices. For that reason, we cannot draw conclusions about the various ways in which coherence may be related to teacher practice from these analyses. In the next section, we provide thoughts on additional research that will be necessary to examine the antecedents and impacts of coherence.

Directions for Future Research

Our nationally representative survey provides thought-provoking findings about the association between coherent instructional systems and school conditions. However, it was less helpful in illuminating the relationship between the coherence of the instructional system and instructional practice. Sev-

eral methodological improvements in future research may help clarify these relationships.

First, our measures of curriculum use focused on whether teachers were using required instructional materials (standards-aligned or not). Because we know that teachers supplement their required curriculum with other materials (Kaufman et al., 2020), asking about whether they are using such curriculum materials may not be a sufficient measure to explore whether there is a relationship between coherent instructional systems and curriculum use. A future measure of curriculum use should examine *the extent to which* teachers use standards-aligned curriculum materials in their lessons.

Second, we could improve understanding of the relationship between coherent instructional systems and instructional practice by enhancing our measurement of instructional practice. In this study, we asked teachers on a one-time survey about the extent to which they engaged their students in particular standards-aligned disciplinary practices. Asking about instructional practice in this way provides a less precise and more biased measure of instruction than other potential methods. For example, researchers have shown that instructional logs can measure instructional practice reasonably precisely because logs are more proximate to specific lessons that have been delivered (Rowan, Harrison, and Hayes, 2004; Schweig, Kaufman, and Opfer, 2020). Conducting observations of teaching would be another—although more costly—way to get a more accurate measure of instructional practice. If a better measure of instruction were used and we found a relationship between the practices and instructional system coherence, then exploring the relationship between coherent instructional systems and student achievement would become more plausible.

Third, other methodological changes may help our understanding of coherent instructional systems. In this study, we relied on individual teachers to tell us about the system in which they teach. Surveying multiple teachers in a system (at the school or district level) may give us a more accurate and less biased understanding of the degree to which an instructional system is coherent. Asking sets of teachers paired with school leaders may also provide better estimates of system coherence.

Finally, we employed a new measure for coherence that relied on concepts from network analysis. Because this study is the first to use such an approach, further testing and refinement of this tactic are necessary. The network-based method for measuring coherence has much promise for helping school leaders understand which components are connected and which are not. Thus, the technique could be used as a tool to support system-level improvement continuously with further validation. With further testing of the network approach, we may ultimately understand whether different components of a coherent instructional system are more critical, especially which components might be more important in teaching traditionally underserved students. This may entail explorations of potential patterns in network configurations; for example, whether moderately coherent networks with certain clusters of reinforcing components are more prominent and more associated with standards-aligned instructional practices. Future work could unpack these patterns.

Appendix. Tables of Descriptive Statistics

In Tables A.1 through A.4, we provide descriptive statistics that reflect the information presented in Tables 11, 12, and 13.

TABLE A.1

Descriptive Statistics: Standards-Aligned Curriculum Materials Use

	N	Mean	SD	Minimum	Maximum
ELA					
Number of required curriculum materials	850	2.40	2.00	0	18
Number of standards-aligned curriculum materials	850	0.42	0.84	0	8
Percentage of materials that are standards aligned	850	0.19	0.33	0	1
Any standards-aligned material use	821	0.32	0.47	0	1
Any standards-aligned material use (majority of the time)	850	0.15	0.36	0	1
Mathematics					
Number of required curriculum materials	706	1.65	1.20	0	17
Number of standards-aligned curriculum materials	706	0.60	0.80	0	7
Percentage of materials that are standards aligned	658	0.37	0.44	0	1
Any standards-aligned material use	706	0.45	0.50	0	1
Any standards-aligned material use (majority of the time)	706	0.29	0.45	0	1

TABLE A.2

Descriptive Statistics: Modifications to Curriculum Materials

	N	Mean	SD	Minimum	Maximum
ELA					
Any modifications to required curriculum materials	778	0.66	0.48	0	1
Modifications to majority of lessons within materials	784	0.45	0.50	0	1
Mathematics					
Any modifications to required curriculum materials	596	0.69	0.46	0	1
Modifications to majority of lessons within materials	596	0.36	0.48	0	1

TABLE A.3

Descriptive Statistics: Engagement in Instructional Practices Among ELA Students

Instructional Practice	Never or Almost Never	In Some But Not Most Lessons	In About Half of My Lessons	In Every or Almost Every Lesson	Not Relevant for the Grade/ Class I Teach
Focused on the same grade-level text as a whole class	4%	18%	30%	46%	2%
Focused on different texts from other students, depending on students' reading level	18%	27%	25%	26%	4%
Read and discuss/write about texts that provide meaningful information in service of building knowledge	3%	15%	26%	55%	2%
Read and discuss/write about texts that include diverse perspectives	5%	24%	34%	33%	4%
Apply phonics skills in decoding words	17%	21%	15%	41%	7%
Use evidence from text(s) to support written or oral analysis of text ideas	1%	13%	22%	58%	6%
Explain their thinking and build on other students' thinking	0%	11%	31%	54%	4%
Learn and use a range of general academic and domain-specific vocabulary (i.e., words and phrases) sufficient for college and career readiness	3%	13%	35%	47%	2%
Apply or build on the concepts learned from the previous lesson in the present day's lesson (i.e., learning is linked across lessons or activities)	0%	4%	25%	66%	4%
Make use of teacher feedback or probes to improve written or oral responses	3%	21%	38%	35%	2%
Select and use the means (e.g., draw, write, speak) that allows each student to best demonstrate understanding	4%	20%	26%	49%	2%
Productively struggle through a challenging task and persevere through difficulty	4%	17%	42%	36%	1%

NOTE: All percentages are weighted.

TABLE A.4

Descriptive Statistics: Engagement in Instructional Practices Among Mathematics Students

Instructional Practice	Never or Almost Never	In Some But Not Most Lessons	In About Half of My Lessons	In Every or Almost Every Lesson	Not Relevant for the Grade/ Class I Teach
Engage with mathematics topics addressed by the state standards for the grade level	1%	3%	9%	86%	1%
Revisit previous grades' content to fill learning gaps	6%	33%	29%	29%	4%
Build conceptual understanding	0%	8%	25%	67%	0%
Explain their thinking and build on other students' thinking	2%	12%	31%	55%	0%
Use repeated practice to improve their procedural skills	0%	9%	27%	63%	1%
Apply mathematics to solve problems in real-world contexts	1%	16%	37%	45%	1%
Make sense of problems that do not include clear procedures for solving	3%	30%	32%	31%	3%
Persevere in solving problems that do not include clear solution procedures	7%	29%	27%	34%	3%
Choose and use appropriate tools when solving a problem	2%	14%	33%	51%	0%
Select and use the means (e.g., draw, write, speak) that allows each student to best demonstrate understanding	3%	13%	30%	52%	1%
Apply or build on the concepts learned from the previous lesson in the present day's lesson (i.e., learning is linked across lessons or activities)	0%	7%	22%	70%	1%
Make use of teacher feedback to improve written or oral responses	4%	20%	32%	42%	2%

NOTE: All percentages are weighted.

Notes

[1] In the remainder of this section, we reprise text from our other reports to ensure consistency in our characterization of a coherent instructional system.

[2] Consistent with prior RAND studies and reports, we identified *standards-aligned materials* using information from EdReports, an independent organization that reviews commonly used curricula for alignment with college- and career-ready standards. For this analysis, we counted a teacher as using standards-aligned materials if at least one of the materials the teacher reported using was rated as "meets expectations" for that instructor's grade level by EdReports. Materials rated as "partially meets expectations" or "does not meet expectations" were not considered standards-aligned. District- or teacher-created materials that were not rated by EdReports were not included. For more on the focus on EdReports reviews, see EdReports, undated.

[3] Weights were constructed using a calibration method and included a model for nonresponse. The weights were calculated by first modeling response probabilities of teachers across a wide variety of teacher characteristics. The main weight was then calibrated so that the weighted sample matches the known teacher population across these characteristics in each state. For more information, see Robbins and Grant, 2020.

[4] On the survey, *SoCs* were defined as Black and/or Hispanic students. Teachers serving a majority of SoCs served in classrooms with 50 percent or more Black and/or Hispanic students.

[5] For the regressions we conducted to address research questions 4 and 5 (i.e., Tables 10–12), we conducted sensitivity analyses wherein we repeated the regressions, restricting to those teachers reporting all system components as present to see whether results are directionally consistent with results when we include all teachers in the regression (i.e., including those who reported one or more components as not present in their instructional system). The results do not change our findings and interpretations.

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About This Report

Using responses from a nationally representative sample of public school K–12 English language arts and mathematics teachers, we discuss whether state standards are aligned with curriculum materials, assessments, and teacher professional development.

The American Educator Panels (AEP) are nationally representative samples of teachers, school leaders, and district leaders across the country. The panels are a proud member of the American Association for Public Opinion Research's Transparency Initiative.

RAND Education and Labor

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More information about RAND can be found at www.rand.org. Questions about this report should be directed to ewang@rand.org, and questions about RAND Education and Labor should be directed to educationandlabor@rand.org.

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