

STATE POLICY BRIEF

From Patchwork to Precision: Strengthening Teacher Data Systems

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on Teacher Quality

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The doorbell rings and a package lands on my doorstep—right on schedule. I received five text messages about the progress of its journey to my front porch. Why is it that we can trace the progress of a package along every step of its cross-country journey, but I have no idea how many math teachers a state will need next year or which subjects have the most vacancies or whether the investments in loan forgiveness programs are yielding teachers who can fill shortage areas. We are doing a better job tracking packages than personnel. Our state teacher workforce data systems are sorely lacking. And it doesn't have to be this way.

Why care about state teacher workforce data systems?

Despite enacting well-intentioned policies to improve teacher recruitment and retention, many states continue to face significant staffing challenges, particularly in high-need schools and hard-to-staff subjects such as math, science, and special education. Better data systems can help address these persistent challenges in two ways:

1. **Identifying specific workforce needs:** While policies aimed at broadly improving the teacher workforce, such as increasing teacher pay or teacher loan forgiveness, have merit, they have not addressed the specific, pressing needs that many schools face. But what's holding back better, more targeted solutions? One key factor: a lack of timely, reliable, and actionable data.
2. **Making sure investments pay off:** States are spending millions of dollars on initiatives to improve the teacher workforce, yet we often don't have the data to understand their impact or return on investment. We don't have the data to project where our needs will be in order to align our resources. Policymakers want to know these things but are left without answers.

Two years ago, NCTQ set out to explore the challenges states face in improving their

teacher workforce data systems. To guide this effort, we assembled an advisory group of researchers, district leaders, and data experts. Our goals were twofold: (1) to understand the obstacles preventing states from achieving robust teacher workforce data systems and to identify ways to overcome those challenges, and (2) to gather examples of how strong teacher workforce data systems can help leaders make policy decisions and allocate resources more effectively. Through this work, we aimed to build a compelling case that improving teacher workforce data systems is both feasible and worthwhile.

This brief outlines key findings regarding state teacher data systems and provides recommendations for enhancing them. These improvements should help states allocate resources more effectively and make better policy decisions, ultimately equipping states to better meet the goal of an effective teacher in every classroom.

Four challenges states face in achieving a robust teacher workforce data system

1. Data availability

In our [most recent analysis](#), we found that, while states generally collect a substantial amount of teacher data, they often [lack key pieces of information](#) that would allow them to answer critical questions. For example, most states have data on the number of newly certified teachers or the number of teachers teaching out of field in the state. However, fewer states are able to disaggregate those numbers to the number of certified teachers by subject area to understand which subjects have the largest number of vacancies.

While many states have data on teachers, most do not have information on *positions*. **Few states have information on the demand side of the teacher shortage, such as the quantity and subject areas of teacher vacancies.** Only five states collect data on the number of unfilled teaching positions by subject area statewide, and even fewer track this information by region or district. Without that data, states must rely solely on supply-side metrics such as teacher prep program graduates to understand where workforce gaps may be in the future, even though those metrics provide an inadequate and incomplete picture of teacher workforce dynamics.

This lack of information prevents state leaders from understanding the scope of staffing shortages or the needs of the local workforce. It is like trying to put together a puzzle without knowing what the final picture looks like. We know we need math teachers, but how many? Which districts have the greatest need? Without key data, state and district leaders struggle to enact a strategy that ensures every classroom has an effective teacher.

While states may have some data, important gaps remain. For example, *only half of states* can provide the following essential information:

Key data element	Why it's important
Teacher vacancies	States and districts can understand which positions are of greatest need by region.
Teacher attrition by subject and school	States and districts can use this data to track mobility, particularly among high-need schools.
Teacher effectiveness by school	States and districts can determine whether all students have equitable access to effective teachers.
Links between teachers and the teacher preparation programs they attended	States and districts can use this data to understand the teacher pipeline and determine which programs produce strong teachers who stay in the classroom.

Access to reliable data is the foundation for understanding and addressing teacher workforce challenges. Without it, there can be no comprehensive understanding of the teacher workforce.

2. Connected data systems

The data that states need comes from multiple sources and is often housed in separate systems. Many states face challenges connecting these various data systems (e.g., vacancy and hiring data from districts, teacher production data from prep programs) due to limited resources, leading to fragmented or siloed data. Some of these systems were built in response to federal regulations, such as No Child Left Behind's requirement to report on highly qualified teachers, and not necessarily to provide a comprehensive understanding of the teacher workforce. Another issue is the lack of statewide systems. For example, in many states, districts use different human resource information systems, making it more challenging to pull together information about job postings or hiring rates at the state level. Teacher preparation supply data may even be divided among separate entities. In some states, information on licensure or program approval is managed by state boards or commissions, and other critical data is housed outside of the state department of education.

While states can sometimes connect data from multiple systems, the process is often cumbersome and time-consuming. Simple questions (e.g., How many first-year teachers are in the state? What teacher preparation programs did they come from?) can take weeks to answer, as a data analyst may need to find a way to connect data from the licensure system, the teacher prep data system, and the personnel information system, if the data is available at all.

Key elements of a connected system include:

- **Creating a unique identifier for each teacher candidate**, tracking them from when they enter their prep program through (and beyond) their time in the workforce. This identifier is important because it allows the state to track

candidates throughout their career and analyze patterns. This same identifier should be used in all systems (e.g., when teacher prep programs report on candidates, when states track who is earning a license, when districts track new hires and teacher evaluation ratings).

- **Following positions, not just teachers.** Tracking individual teachers can help surface issues like a district having high levels of teacher attrition or persistently low teacher evaluation ratings. States should also consider tracking positions to identify issues like those related to vacancy rates (especially for vacancies caused by the creation of new positions rather than teacher turnover) or track when open positions are eliminated due to lack of qualified applicants.

Once states make the initial investment to connect data systems, the time and resources to maintain them decrease significantly. Answering key questions can then be as simple as running a report, rather than spending weeks building one-off connections between data systems. Data systems help state departments and policymakers have more efficient access to the data on the teacher workforce and promote more targeted resources and data-driven policymaking.

3. Timeliness

Timely data is the most useful data. Unfortunately, many states face delays in obtaining and reporting workforce data, with some data lagging by one or two years. States typically gather workforce data by surveying districts and prep programs or collecting data reports, which means districts must gather and submit information. Then states need additional time to process and analyze the information. This delay reduces the value of the data for state and district leaders who need real-time insights to inform decision-making, resource allocation, and policy development.

Building a statewide data system that automatically connects with districts' data systems can drastically reduce the time needed to retrieve data and could feasibly track trends such as vacancies.

Missouri and Tennessee have partnered with [Nimble](#) to develop real-time teacher shortage data dashboards that highlight unfilled vacancies without the need for manual district surveys. This approach leverages [research-based web-scraping technology](#) to automatically collect data about unfilled vacancies multiple times a week from districts' public job boards. States using this approach can draw conclusions about which regions, schools, and subjects are experiencing the most pronounced shortages at any given time throughout the year.

4. State education agency capacity

State education agencies (SEAs) often lack the technical and human resources needed to build and maintain comprehensive teacher workforce data systems. Now more than ever, states must take the lead on educator workforce data. The challenge isn't just in

collecting data, it's dedicating the capacity to analyze, interpret, and share it effectively. Most SEAs have neither the personnel or training to create accessible dashboards for public use or policymaker review, nor the support systems to help district leaders make the most of the data if such tools were available. While there are competing priorities for finite resources, investing in teacher workforce data systems could help improve the efficiency and effectiveness of state government.

SEAs are often required to prioritize federal and state reporting requirements, leaving limited capacity to dive deeper into the data. This lack of capacity hinders their ability to use workforce data for impactful initiatives such as determining the effectiveness of loan forgiveness programs, assessing teacher residency program impacts on retention, and evaluating whether differentiated pay strategies are improving teacher recruitment and retention. Effectively, it prevents leaders from understanding the return on investment of policy strategies and resource allocation decisions.

Leveraging technology to improve the efficiency of data collection and analysis can help, rather than relying on district and prep program reporting. With one-time investments in data systems, states could make significant strides in addressing workforce challenges. Improving technology, paired with investing in staff, can help eliminate ineffective programs and policies and guide policymakers toward the most effective solutions.

Things states could do if they had better teacher workforce data systems

IF states could project which districts will have the highest early-career teacher turnover over the next three years based on past trends, then they could target resources to those districts for induction and mentorship programs. Research has shown that such programs can increase retention.¹

IF states had timely data and capacity, then they could evaluate a state differentiated pay initiative to see if it is actually helping attract and retain teachers in hard-to-staff schools and subjects.

IF states could predict the subject areas in which they will experience the most severe shortages, they could target funds for scholarships and other pipeline initiatives such as residency programs or student-teaching stipends rather than making these resources available to all aspiring educators with little knowledge about their impact.

IF states had an understanding of workforce needs by region and district, regional service centers could provide support to identified districts in a much more targeted way.

IF states could connect data systems more easily, they could understand where STEM teacher shortages are and where shortages impact the most students. The intersection of these two data points could help regional service centers and state leaders deploy resources more strategically.

States leading the way

While gathering supply and demand data can be a logistical challenge, some states have successfully addressed these gaps.

State exemplar: Colorado

Colorado took a proactive approach between 2008 and 2013 by passing [legislation](#) (i.e., Colorado House Bill 13-1219) requiring the collection of key teacher workforce data. Giving the state agency authority to collect the data was a critical first step. Several bills led to the collection of key data on teacher supply and demand, including data on [hiring needs](#) by content area and district, and on [educator effectiveness](#). To simplify the connections across multiple data systems, the state established unique educator identifiers to track teachers from their preparation programs into the workforce.

With this data in hand, Colorado positioned itself as a leader in the field, developing [dashboards](#) to track trends in teacher mobility, diversity, preparation, and other key metrics. In partnership with the Regional 12 Comprehensive Center, these dashboards became a rich resource, allowing district leaders to compare their performance with others and enabling state leaders to gauge the impact of policies and initiatives on teacher retention, working conditions, and other outcomes.

However, Colorado soon realized that creating the tool alone was not enough. The “build it and they will come” philosophy proved to be insufficient. District staff struggled to find the time needed to explore the data effectively. In response, Colorado established communities of practice for regional teams, providing structured opportunities to engage with the data meaningfully. This initiative helped build the capacity of key stakeholders—district leaders, educator preparation programs, regional service centers, and board members—enabling them to use the tools more effectively and make data-driven decisions.

State exemplar: Indiana

Indiana focused on addressing the challenge of timely data. Needing to understand more about the specific needs of districts, Indiana began a partnership with districts to create a statewide [recruitment portal](#). The state funded the job recruiting portal, and districts were invited to use it to post their job openings. The portal not only supports districts in their efforts to recruit candidates, but it also gives the state *real-time* reporting mechanisms to track job openings, which provides a way to track specific subjects in which districts face shortages and the locations of those shortages.

Initially Indiana aimed for about 30% of districts to participate in the portal. However, nearly 70% of districts across the state joined, surpassing expectations. The collaboration now allows the Indiana Department of Education to generate statewide

reports that offer insights into the most critical subject shortages and determine regional disparities in staffing needs.

Indiana’s approach leveraged technology to address data gaps without imposing additional burdens on districts. While this system does not resolve every data-related challenge, it suggests that technology can help streamline data collection and even provide a service to districts rather than imposing a burden.

State exemplar: Texas

Everything, including the data team, is bigger in Texas—but its work offers valuable lessons even for smaller states. The Texas Education Agency (TEA) dedicates significant resources to using data and making it transparent to both districts and the public. The Educator Data, Research, and Strategy division, consisting of 14 team members, is tasked with building high-quality data, reports, and visualizations, providing actionable research and policy insights to stakeholders in support of the mission and values of TEA. This includes substantial work related to efforts to improve the teacher workforce.

This robust capacity enables TEA to study the effects of various policies. Additionally, it allowed the state to track how the decision to temporarily modify certification requirements during the COVID-19 pandemic addressed short-term needs but did not impact long-term shortages, meaning many teachers hired under these modifications ultimately did not stay. They also found that it had a negative impact on student outcomes, with many teachers leaving the following year. The bandage of relaxing certification rules was not sufficient to heal the wound. This lesson could be helpful to other states considering a similar policy.

With a dedicated team, TEA also provides a deep level of transparency. It recently launched the [New Hires Dashboard](#), which provides critical data, such as the percentage of new hires in each district who are fully certified, hold interim certificates, are re-entering the workforce, are on emergency permits, or have no certification or permit at all. The dashboard also tracks the educator preparation programs from which new hires are graduating, broken down by district. TEA also created various other teacher dashboards, including public [data dashboards about prep programs](#) and password-protected dashboards for specific entities like prep programs, and it conducts its own research. This kind of data is essential for understanding the teacher workforce and making informed decisions about policy and resource allocation.

The team also produces a monthly digest about teacher data to provide transparency to various stakeholders (sign up [here](#)).

State action guide

This guide lays out specific steps states can take to address teacher workforce data challenges. While states won't be able to accomplish everything at once, they can take steps to improve the current state of affairs.

Step 1: Set the vision

Has your state identified the most critical questions to ask in recruiting and retaining a diverse, effective teacher workforce?

⇒ *If the answer is no*, check out [this outline](#) (and especially the questions in the first column) as a guide to brainstorm questions and determine the data points needed to answer them. Identify the ones that would be most helpful to district and state leaders to answer first.

⇒ *If the answer is yes*, that's great, move on to the next step!

Step 2: Determine data availability

Does your state have the data you need to answer the most critical questions (identified in Step 1) about the teacher workforce?

⇒ *If the answer is no*, identify the potential sources for each data element (e.g., district HR systems, state licensure tracking, teacher prep programs) and gaps in the data (some necessary data points may not be currently collected at all). Next, determine whether you can obtain the data through established processes (such as district reports) or whether you need to establish new ones. Third, explore whether there is technology you could leverage to obtain the data. You may consider building new technology systems that can automatically pull data from districts or prep programs rather than creating a reporting or survey mechanism, such as Indiana has done. If necessary, consider proposing legislation (e.g., [New Jersey Teacher Workforce Report S2835](#)) or regulations to require districts or prep programs to submit necessary data to the state education agency (SEA).

⇒ *If the answer is yes*, that's great, move on to the next step!

Step 3: Connect the data

Is your state able to connect data across all necessary data systems?

⇒ *If the answer is no*, identify specific pain points and rank them by priority. Determine whether challenges relate to larger technical systems or could be addressed by establishing unique identifiers. A unique identifier is a code or number assigned to each educator in a state that acts as a distinct identifier without relying on personally identifiable information (like names) and allows for accurate reporting and data analysis across multiple systems.

⇒ *If the answer is no due to multiple entities housing data*, arrange a time for the heads of

the agencies to meet. Create an MOU that identifies the data points needed to answer critical questions about the teacher workforce and the processes, format, and cadence by which each agency agrees to share the data.

⇒ *If the answer is yes*, that's great, move on!

Step 4: Make meaning

Does the state have a process to identify key data or research projects each year to improve data transparency and inform policy and resource allocation?

⇒ *If the answer is no*, establish a team of policy and data leads and prioritize the projects it should complete during the year. These projects could take many forms, such as building a dashboard showing attrition rates and trends by district or studying the impact of changes to teacher pay in hard-to-staff subjects to determine if they increased retention. If you have limited resources, consider creating a partnership with a university as [Tennessee](#) and [Delaware](#) have done. Another approach is to create a community of practice that brings together representatives from districts, prep programs, and the state education agency to evaluate data tools and make data-informed decisions. These practices could also provide user feedback to the state to help continually improve data systems and identify the data that is most helpful to districts, prep programs, and other stakeholders.

⇒ *If the answer is yes*, that's great! Consider surveying stakeholders to learn how they are using your products and identify questions your team can answer to inform policymakers and practitioners.

Step 5: Collect timely data

Are you able to collect key data points within a calendar year or less?

⇒ *If the answer is no*, consider leveraging existing processes to collect additional key data from districts. If you have a state human resource information system, establish a date on which to take an annual snapshot of the data, to generate a consistent timeline of comparative data.. Consider establishing a timeline by which all teacher prep programs report key data as well. The state could also consider incorporating new technology that allows for timely data reporting such as Indiana or web-scraping to inform vacancy data.

⇒ *If the answer is yes*, consider how the state could use technology in partnership with districts and prep programs to gather teacher workforce data and reduce or eliminate the time spent reporting it.

If you have questions, please contact Chief of Policy Shannon Holston at shannon.holston@nctq.org.

APPENDIX A: Supply and Demand Advisory Group

Chad Aldeman, *Former Policy Director, Ednomics Lab, Georgetown University*

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Endnotes

¹ Kwok, A., & Macfarlane, K. O. (2025). *Strengthening early-career teachers: Effective components of teacher induction programs*. EdResearch for Action. <https://edresearchforaction.org/research-briefs/strengthening-early-career-teachers-effective-components-of-teacher-induction-programs/>