GETTING DOWN TO FACTS II

Technical Report

A System's View of California's Teacher Education Pipeline

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About: The *Getting Down to Facts* project seeks to create a common evidence base for understanding the current state of California school systems and lay the foundation for substantive conversations about what education policies should be sustained and what might be improved to ensure increased opportunity and success for all students in California in the decades ahead. *Getting Down to Facts II* follows approximately a decade after the first Getting Down to Facts effort in 2007. This technical report is one of 36 in the set of *Getting Down to Facts II* studies that cover four main areas related to state education policy: student success, governance, personnel, and funding.

Stanford University

PACE Policy Analysis for California Education

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Abstract

California's students have generally been making slow gains on nationally representative tests over the better part of the last 10 years. While these improvements are important, the gaps between subgroups of students are large and overall achievement places California in the lowest 10 percent of states (NCES, 2015). Given that teachers matter more to student achievement than any other school-based factor (Rivkin, Hanushek, & Kain, 2000), one important policy lever for improving student learning is a strong teacher education system. If novice teachers are not prepared to meet all students' needs on day one, students' development is compromised. Novice teacher preparation is especially important to low-income, minority, and low-achieving students because their schools are disproportionately staffed by novices (Gagnon & Mattingly, 2012; Krei, 1998; Lankford, Loeb, & Wyckoff, 2002).

To support California policymakers' efforts to improve the preparation of novices, we describe California's teacher education system, offering five criteria by which California might judge its success. We then evaluate the system's alignment, what we know about the degree to which it produces beginners who are ready to teach on their first day, and the degree to which there is data that can support pipeline institutions' efforts to improve the system.

We find that the teacher pipeline should be thought of as a teacher education system comprised of institutions that provide novices with opportunities to learn the knowledge, skills, and capabilities in the California Standards for the Teaching Profession. K-12 schools play a large role in this system, teaching novices the K-12 curriculum, providing the learning context for all field placements, as well as providing mentor teachers for student teaching placements and induction mentors.

Our evaluation of the teacher education system finds that policies and regulations are aligned with the state's teaching standards at a high level. However, this high-level alignment masks wide variation in ground-level implementation. It is unclear whether this ground-level variation influences beginners' preparedness. State reports and publicly available data suggest that no matter what path a novice takes through the teacher education system they are similarly prepared if they complete that pathway. They generally pass the required knowledge and practice-based assessments and they share the perception that they are well prepared to teach across the California standards. It is worth noting, however, that a sizable minority of multiple and single subject beginning teachers – 37 percent in 2016-17 – are teaching California's students before completing a pathway, an assurance of adequate preparation.

In contrast to these patterns, principal survey data collected for this analysis suggest there are differences in the perceived preparedness of novice teachers. On average, compared to novice teachers, principals report lower levels of teacher preparedness among novices and perceive there to be variation in novices' preparedness across teaching practices. However, principals and teachers alike perceive teachers to have relatively lower levels of preparation to support students with special needs and relative strength in creating a positive classroom environment.

Current data systems provide a good deal of standardized information about the knowledge teachers have after completing a pathway, but less information and less systematic information about what teachers are able to do on their first day of teaching. In addition to sparse systematic information on novices' capabilities, there are notable data constraints on the types of data available for improvement purposes. We conclude that policymakers and pipeline institutions do not yet have the information they need to rapidly improve the teacher education system. We consider how California might leverage its system of well-aligned standards, assessments, and requirements to create the additional data necessary to improve teacher preparedness across institutions in the teacher education system.

Introduction

Between 2000 and 2011, California's performance on the nation's math and reading student assessment, the National Assessment of Educational Progress (NAEP), steadily improved. In more recent years, student achievement on the 4th grade math and 8th grade reading NAEP in California declined slightly; however, California continued to improve on 4th grade reading and 8th math NAEP scores between 2013 and 2017. NAEP is deliberately designed to be comparable over time, allowing states to compare their own policymaking efforts to a national student learning assessment. California's improvements are important – between 2000 and 2017, the state's average math and reading scores have increased even as the state has grown more racially and linguistically diverse, and weathered great economic upheaval that dramatically influenced public schools during the recession. Unfortunately, this progress is not the whole student achievement story.

In 2017, only 29 percent of California's 8th graders were proficient or advanced in mathematics on NAEP; 32 percent and 23 percent met the same standards in the most recent administrations of the reading and science NAEP, respectively (NCES, 2015, 2017). Performance of the state's 4th graders was similar, with 31, 31, and 24 percent proficient or advanced in the most recent administrations of the mathematics, reading, and science NAEP, respectively. This level of performance places California among the six lowest-achieving jurisdictions in the country. Further, California's gaps between economically advantaged and disadvantaged, black and white, and Latino and white students on the most recent administrations of the mathematics, reading and science NAEP remain unacceptably large, ranging between 22 and 38 points (NCES, 2015, 2017). Compared to the other similarly populous states of Illinois, Texas, Florida, and New York, California regularly ranks lowest in terms of achievement (NCES, 2013).[1]

Together, these facts suggest that while there has been movement in a positive direction, California's student achievement is low and gaps are large. One way to accelerate improvement is for the state to effectively intervene in the most important in-school factor shaping student learning: teacher quality (Chetty, Friedman, & Rockoff, 2014; Clotfelter, Ladd, & Vigdor, 2007; Harris & Sass, 2007). Many efforts to improve teacher quality focus on professional development programs for in-service teachers, however, the evidence of those programs' efficacy is mixed (Garet et al., 2016; Hill & Ball, 2004; Kraft, Blazar, & Hogan, in press). An exclusive focus on in-service teachers also misses a very important group of teachers, beginners.[2] Nationally, beginning teachers disproportionally teach students of color and economically disadvantaged students (Gagnon & Mattingly, 2012) and they are significantly less effective than more experienced teachers (Darling-Hammond, 1999; Hanushek, Kain, O'Brien, & Rivkin, 2005; Nye, Konstantopoulos, & Hedges, 2004; Rockoff, 2004). Thus, improving initial

[1] Given the indelible impact of non-school factors on student achievement, including socioeconomic status, native language, and mobility, it is important to note that California also has the largest share of low-income students, English learners, and recent immigrant students compared to the other states in the aforementioned report.
[2] We use beginning teacher and novice teacher synonymously throughout this report.

teacher preparation is another important way policymakers can accelerate the improvement of teaching quality in California.

The state's initial teacher preparation system – a broad set of institutions that extend beyond teacher preparation programs (TPPs) – impacts thousands of teachers every year. In 2016-17 alone, California issued 13,447 new general education preliminary teaching credentials to both in- and out-of-state prepared teachers.[3] This paper describes the initial teacher preparation system – its substantive focus, alignment, and attendant policies and regulations. We evaluate the existing evidence regarding beginners' preparedness and finally describe the nature and quality of data produced by the teacher education system. Based on these analyses we consider a handful of illustrative policy questions, investigating the degree to which they can be answered with currently available data. Based on these analyses, we suggest how California might build on system strengths and provide pipeline institutions and policymakers the strategic data they need to improve the teacher education system.

The Teacher Pipeline as Teacher Education System

If you ask a person where teachers learn to teach, they often respond with "their teacher preparation program." This is a reasonable response. Certainly a teacher learns strategies such as organizing students into groups or designing appropriate lesson plans in her TPP. But many people assume that teacher preparation happens almost exclusively in TPPs. In fact, states regulate and ask many questions of these TPPs – are they accredited? What are the GPA requirements for admission? What are their students' pass rates on certification tests? These are all important questions whose answers should be known. But the answers to these questions miss an important reality – teacher preparation involves many different institutions. The preparation of teachers does not take place inside a single program; it involves a system of educational institutions. We need only carry out a two-question thought experiment to understand this reality.

First, where does a student teacher have the opportunity to work with K-12 students? Second, where does a math teacher learn the math she teaches? In the first case, a student teacher works with K-12 students outside of her TPP, in California's K-12 classrooms. She likely does so early in her practice placements, perhaps when she tutors a small group of students, or later and more intensively, during her student teaching placement.[4] On the second question, a math teacher learns mathematics in her own K-12 schooling experience and in her undergraduate math department, if she was a math major. If the teacher seeks elementary

[3] This includes multiple- and single-subject credentials only, including both traditional and intern credentials. This does not include instructional specialist credentials.

[4] All California-prepared teachers must "complete a teacher prep program including successful student teaching." However, California has no requirement that out-of-state or internationally prepared teachers must complete a student teaching experience. To the degree this occurs, it is regulated by accreditation agencies and other country's or state's laws. Most states (41 of 50) have requirements regarding the length of student teaching, and 15 states require additional clinical experiences (EPE Research Center, 2012).

certification, there will be a heavy reliance on her learning of topics such as fractions, numbers and operations, and measurement when she was a student in K-12 classrooms. A secondary math teaching candidate might learn more about geometry and calculus in her university math major than an elementary candidate, but her K-12 education will dramatically shape the quality and depth of her knowledge of K-12 math topics such as quadratic equations and algebra.

These are relatively clear examples of two important learning opportunities all beginning teachers must successfully engage – learning to work with K-12 students and learning the subject matter. And they both occur in institutions outside of the TPP. This brief thought experiment demonstrates that teacher preparation is not confined to TPPs. Preservice teachers need to learn a wide range of technical, subject matter, and social skills in order for them to be effective beginning teachers, and that learning happens within and outside of TPPs as well as in collaborative arrangements between TPPs and other institutions.

If we shift from thinking about teacher preparation as what happens inside of relatively brief programs to the fuller range of learning experiences that happen over time in multiple institutions across states and countries, it becomes clear that policymakers should think about teacher preparation as a system. That teacher education learning system can be conceptualized as a set of learning opportunities provided by institutions, which are regulated by assessments as well as requirements. Those assessments and requirements, which come in the form of laws, statutes, rules, regulations, and policies, are designed to ensure every child has a well-prepared teacher. See Figure 1 for the institutions that participate in California's teacher education system.

Shifting from thinking about the policy target as the teacher education system versus the preparation program helps us think critically about alternative solutions to teaching quality problems. For example, take teaching shortages in science, technology, engineering, and mathematics (STEM) as one problem that impacts the supply of high-quality teachers in those subject areas. A narrow program view would focus on getting more prospective teachers to pass the subject matter tests in order to be certified. A policy intervention might decrease the required passing scores on these tests in order to increase the tests' pass rates, thereby increasing the number of certified STEM teachers. This is one potential, albeit narrow, policy solution. But if there are a relatively small number of teachers taking the tests, the policy's impact might only produce a few additional certified teachers each year, and those teachers may be underqualified.

Continuing with the STEM teacher shortage problem, a system-level view of the problem draws policy attention to at least three additional locations in the system in which to intervene to produce more STEM teachers – high schools, community colleges and other undergraduate institutions, and teacher induction programs. Policies in each location could be effective policy levers to improve the supply of qualified STEM teachers. At the high school level, there are large numbers of students interested in STEM who might be enticed into teaching through university scholarships with required teaching commitments. At the college and university level, there could be policies that educate STEM faculty members about current

teaching shortages and teaching as a profession as a way to increase the number of faculty members recommending teaching as a profession to STEM undergraduates. Policies aimed at university students who are already STEM majors but have not selected into teaching might offer forgivable loans for candidates with a bachelor's degree in a STEM field who are interested in teaching and are willing to commit to teach in schools with STEM teaching shortages. And finally, looking at induction programs, there could be additional salary, mentoring, professional learning opportunities, or reduced teaching loads for STEM teachers who stay in teaching for some amount of time. Such investments during induction's early years could reduce turnover, and therefore demand.

Viewing the teacher pipeline as a learning system pushes stakeholders to think flexibly and rigorously about policy alternatives for teaching policy problems. With a system view, policymakers have a framework through which they can lay out policy alternatives that target actors and institutions at different points along the pipeline. Policymakers can then quantify the potential number of individuals who might be eligible for each policy alternative, specify the proportion of teachers who might reasonably be expected to be certified or retained by the policy, and determine the costs of each policy alternative. This type of data-based, system-minded policymaking is the kind most likely to improve California's teaching workforce over time. Such a view also embraces the improvement science orientation that has begun to show some promise in education (Baron, 2017). This approach calls for identifying process breakdowns within a system, and engaging individuals responsible for these processes to use disciplined inquiry to improve organizational functioning (Bryk, Gomez, Grunow, & LeMahieu, 2015).

Taking this system-level view, our goal is to describe and understand California's teacher education learning system in order to identify how it might be improved. We investigate six research questions.

1. What do beginning teachers need to know and be able to do on their first day in a California classroom?
2. What are the main institutions, regulations, assessments, and policies shaping the knowledge, skills, and capabilities of California's beginning teachers?
3. How should we judge the quality of California's teacher education system?
4. How aligned is California's system?
5. How well does California's system prepare teachers for their first day?
6. What is the nature of the data in California's system and to what degree can it be used for systemwide improvement efforts and policymaking?

California's teacher education learning system supports the development of teachers who teach a wide range of subjects, grade levels, and students – teachers of all subjects in the elementary grades, teachers of one particular subject area in high schools, teachers who focus on students with special needs, and teachers who work with English learners, just to name a few. There are more than 12 types of preliminary credentials issued each year in California (CTC, 2017d) ranging from single-subject and multiple-subject credentials that are usually

required to teach secondary and elementary grades, to teaching credentials for designated subjects such as career and technical education and vocational education, to short-term staff permits, waivers, and provisional internship permits. There is a great deal of complexity and detail within the various types of certificates, and differences in learning opportunities across those certificates deserve our careful attention (e.g., Santibañez, 2018). However, in order to make the system's detail more manageable and understand the details of the learning system the state has designed, we narrow our analyses to the preparation of elementary and secondary teachers earning either a multiple-subject or single-subject credential either through a California TPP or intern program. This focus corresponds to 74 percent of new teaching credentials issued in California during the 2016-17 school year (CTC, n.d.c).[5,6] We analyze the teacher education system from where it begins in K-12 schools through to the "preliminary" and "clear" teaching credential. The preliminary credential is the non-renewable credential that allows candidates to become a teacher of record, is only good for five years, and has additional educational requirements associated with it. The clear credential acknowledges all education and program requirements have been met.

Before we begin, it is important to note that in 2016-17, California permitted 7,861 individuals to teach California's students without actually completing the requirements in the state's articulated system via a permit, waiver, and/or intern credential (see Table 1). Thus, this report cannot speak to the preparation experiences these teachers have, nor the degree to which they are prepared to support K-12 student development. Some research has shown that teachers who enter classrooms unprepared, teaching on credentials that do not meet all of the requirements of a teaching credential, are less effective than fully credentialed teachers (e.g., Goldhaber & Brewer, 2000; Darling-Hammond, Berry, & Thoreson, 2001), although the specifics of subject matter, credential, and modelling assumptions matter (Wayne & Youngs, 2003). Additional research might productively investigate the nature and quality of the learning opportunities that teachers on permits, waivers, and intern credentials have.

The Required Knowledge, Skills, and Capabilities for Day One

Understanding the teacher education system in California requires we first understand what beginners should know and be able to do once they have completed participation in that system. Beginning in the 1990s, the California Commission on Teacher Credentialing (CTC) laid out a consensus vision of the knowledge, skills, and capabilities (KSCs) all teachers should have in the *California Standards for the Teaching Profession* (hereafter referred to as the *CSTPs*) (CTC, 1997). In 2009, the *CSTPs* were revised and updated to reflect the increasingly diverse student population in California as well as a 21st century perspective that recognizes the role technology plays in society and the increasingly connected global community (CTC, 2009). The *CSTPs* apply to all phases in a teacher's development, from the content she learns as an

[5] Of all multiple-subject or single-subject preliminary credentials issued in 2016-17, 17.4 percent were recommended by out-of-state or out-of-country preparation programs.

[6] The remaining 26 percent of preliminary credentials issued in California were education specialist certificates, which allow beginners to teach students with special needs.

undergraduate student to the pedagogical capabilities and specialized teaching knowledge she develops in her student teaching experiences and induction program all the way to the KSCs she learns through the professional learning that occurs across the remaining years of her teaching career.[7]

A Professional Vision of Teaching

To understand what beginning teachers are expected to know and be able to do, it is helpful to have a common reference for what teaching at any point along a teacher's career might look like. Let us take a typical first five minutes in a hypothetical ninth grade mathematics classroom.

> *Mrs. Jones writes on the smartboard at the front of the room as roughly 25 students of various racial, ethnic, and language backgrounds walk between desks. All of the students speak English well, but Mrs. Jones knows that Sara and Chris still struggle in her class, in part because as English language learners, their academic vocabulary in mathematics is not yet strong. Additional students enter the room, find their seats and open their backpacks, setting their homework in the blue basket on Mrs. Jones' desk. The group swells to 32 students and as the last seven students are entering, turning in homework and taking out their books, the bell rings. Jose approaches Mrs. Jones and asks to speak to her privately. She squeezes his shoulder, looks up and sees Sara talking to her friend in the next desk, and notices one tear slowly sliding over Sara's cheek. Mrs. Jones looks back at Jose and asks if they can speak after class. He nods and he takes his seat.*
>
> *The learning objective is written on the board "The student will be able to graph quadratic functions from quadratic equations that are in different forms." Most students appear to be copying it in their notebooks. Mrs. Jones walks to stand beside Sara's desk, looking at the board, and Mrs. Jones begins.*
>
> *Mrs. Jones:* *John (who is not raising his hand), what does this learning objective make you remember or wonder?*
> *John:* *It makes me think of $x^2 + 2x = 0$ and $x^2+2x-3 = 0$*
> *Mrs. Jones:* *Why did you think of those two equations?*
> *John:* *They are different forms aren't they?*
>
> *(Sara raises hand)*
>
> *Mrs. Jones:* *Sara has a response to that question I think.*
> *Sara:* *No, those are not different forms. They both equal zero so they are the same form. But they do have different terms.*
> *Mrs. Jones:* *Um.*

[7] The *CSTPs* describe accomplished teaching practice; however, accomplished practice draws on a wide variety of knowledge, skills, and capabilities developed across the teacher learning pipeline.

(Chris raises his hand. Mrs. Jones nods to him.)

Chris: *I'm gonna add another different thought. That [learning] objective reminds me that I'm not sure of the difference between a function and an equation.*

Jose: *(who does not raise his hand) Yeah, we should go over that, but I think we should say what a term is. Because Sara said term and form.*

(Mrs. Jones has walked to the smartboard and written the words function, equation, term, form)

Mrs. Jones: *Alright. Thank you everyone. Who can help us with some definitions and examples? Let's start with a function. (Jose raises his hand.) Jose?*

As is clear from this brief example, classrooms have students with different needs and ideas. Mrs. Jones must make moment-to-moment decisions in this complex teaching and learning environment. For example, in the moment Jose asked to speak to her privately, Mrs. Jones had to decide whether to take a few moments to speak to him, ask Sara if she is alright, or begin class right away. Her decision was likely based, in part, on what she knows about Jose and Sara, what might happen to Sara, Jose, or the lesson if she carries out one of the three tasks, and what her goals are for her relationships with both students as well as for the whole class. Mrs. Jones decides to move forward with the lesson but asks Jose if it is ok to speak after class, leaving an opening for him to say he would rather speak now. And she goes to stand next to Sara. This type of complex decision-making based partially on prior knowledge and almost always with incomplete knowledge, is typical of the decision-making teachers carry out hundreds of times a day (Ball, 2018; Lampert, 2003).

In addition to these decisions, Mrs. Jones made other decisions about how to begin the lesson mathematically and then, which substantive aspects of students' responses to take up when they offered their thinking. But she had more decisions to make. For example, once it became clear students had questions about the terms in the learning objective, Mrs. Jones needed to make decisions. Should she quickly define each term herself? Or should she clarify the meaning of each term as a part of her planned instruction on graphing? Should she gather more student responses to her original question before having the students define terms? Should they verbally define the words or do so in writing, given the English language proficiency among her students? There are many decisions for Mrs. Jones to make.

The teaching Mrs. Jones does in just these five minutes requires KSCs around many different aspects of teaching and learning, from using smartboards, to mathematical concepts and procedures, to instructional strategies for language learners, to social-emotional supports. For Mrs. Jones and for teachers across California, this is teaching – complex, situated work that relies on knowledge, judgment, and skill. It may look different across grade levels and subjects, but it is professional work that requires the thoughtful integration of teaching practices (Bersin & Sandy, 2009). This view of teaching is consistent with current views of teaching and learning (Gitomer & Bell, 2016).

California's teacher education learning system must prepare beginners to carry out this type of complex, situated action. The *CSTPs* serve as the backbone for the learning system, specifying six domains of teaching practice that are deliberately "broad and interconnected because the professional practice of teaching must be understood comprehensively as a complex, dynamic process in which practical and conceptual elements are woven together" (CTC, 2009, p. 2). Those domains are

1. Engaging and Supporting All Students in Learning (Engaging Learners)
2. Creating and Maintaining Effective Environments for Student Learning (Creating Environments)
3. Understanding and Organizing Subject Matter for Student Learning (Understanding Subjects)
4. Planning Instruction and Designing Learning Experiences for All Students (Planning Learning)
5. Assessing Students for Learning (Assessing Learning)
6. Developing as a Professional Educator (Developing Professionalism)

(CTC, 2009)

The six *CSTPs* are broad and overlapping; we now turn to the KSCs required across all the *CSTPs* and around which California regulates the teacher education system.

The Knowledge, Skills, and Capabilities Beginning Teachers Need

If the integrated view of teaching and learning described by the *CSTPs* sounds complex, it is. Inside of these six domains there are 38 elements that together support accomplished teaching practice – teaching which allows all students to learn and develop. The *CSTPs* deliberately describe accomplished teaching practice, not beginning practice; and, the *CSTPs* take a developmental view of teaching proficiency. Therefore, to specify what a beginning teacher needs to know and be able to do on her first day as the teacher of record, the CTC has established additional standards, including the Teacher Performance Expectations, assessments, and requirements. We completed an extensive document review of these standards, assessments, and requirements, and find that beginning teachers must have the following five types of KSCs according to the guidance conveyed in these documents: 1) basic knowledge and skills, 2) content knowledge of specific subjects, 3) the KSCs necessary to enact integrated teaching practices, 4) knowledge of English language development, and 5) knowledge of reading development.

A beginning teacher must demonstrate a sufficient level of **basic knowledge and skills** signified by earning a high school diploma as well as a bachelor's degree. Basic knowledge and skills includes knowing how to use common technologies (e.g., e-mail, PowerPoint, Word, etc.) as well as knowledge for citizenship (e.g., the history of the U.S. and California, knowledge of the constitution and government). Beyond broad bodies of knowledge, the specifics of what a beginning teacher learns about a specific topic will vary by college and university. The depth of a teacher's knowledge will also vary because grading standards and expectations vary across institutions.

Teachers must also have a sufficient level of **content knowledge** in the subject matter they will teach. California's elementary teachers are certified to teach in any self-contained[8] classroom from PK to adult, although a large proportion teach in the elementary grades because that is where self-contained classrooms are frequently located (CTC, 2018a). An elementary teacher's bachelor's degree indicates she has learned the basic content knowledge and skills of a generalist. Secondary teachers are certified to teach in specific subjects – e.g., chemistry, mathematics, English, Spanish, music, etc. – in any grade from PK-adult classrooms. Like elementary teachers, for a secondary teacher, the bachelor's degree signifies competency in basic knowledge and skills, but it may also provide KSCs in an area closely tied to the candidate's certification area.

However, recent research suggests that while strong content knowledge in the subject area is necessary for teaching, it is not sufficient (Ball, Thames, & Phelps, 2008; Ma, 1999). There is specialized content knowledge related to the teaching of the subject that teachers have, but subject matter majors tend not to have. Specifically, in a recent study of physics majors and physics teachers, researchers found that on a multiple choice test of content knowledge and content knowledge for teaching, both physics majors and physics teachers had similar levels of physics knowledge, but physics teachers had additional knowledge about how to use and represent that knowledge for teaching (Iaconangelo, Phelps, & Gitomer, 2017; Phelps et al., 2017). Appendix A shows a typical item both groups scored well on as well as an item physics teachers outperformed physics majors on.

This specialized knowledge, or content knowledge for teaching (Ball et al., 2008), is just one kind of knowledge that falls into the third category of KSCs beginning teachers need on their first day. The third category, the KSCs to enact **integrated teaching practices**, is a large, important, and diverse category. Beginning teachers must, for example, be able to manage how time is used in a classroom so that students can learn. Teachers also need to know how to assess what students know and use that information while they are teaching a lesson and over time as they are planning sequences of lessons. Teachers also need to know and be able to interact productively with other adults around their professional obligations. For example, they must be able to listen to and work with parents in order to support students. They also need to understand when and how to work with teaching colleagues with specialized expertise (e.g., special education, English language, counseling, etc.). These are just four of the 45 integrated teaching practices beginners need to understand and be able to enact on their first day in the classroom. These practices are grouped into six Teaching Performance Expectations (TPEs) that delineate the specific integrated practices beginners must have their first day of teaching (CTC, 2016b). These six TPEs were recently revised, updated, and TPPs were required to implement them by the 2017-18 school year. Further, a large-scale survey was carried out to determine the degree to which they measured important aspects of teaching that beginners must be able to carry out (CTC, 2016c; Ford, D'Mello, Paullin, & Thacker, 2016).

[8] A self-contained classroom is one in which the group of students are taught many subjects by one teacher.

All beginning teachers must also have **knowledge of English language development** in children. The state's public school student population has almost 2.7 million learners for whom English is not the language spoken in their home (CDE, 2017). This is more than 42 percent of the public school population (CDE, 2017). Approximately half of those who speak a language other than English are currently considered English learners (ELs); in 2016-17, there were 1.3 million California students (21 percent) who were classified as ELs (CDE, 2017). Thus, California Education Code requires all beginning teachers with ELs in their classroom to know how children develop English language proficiency and be able to use that knowledge in their teaching practice. There are different levels of knowledge required, depending on the learning needs of the students. The lowest level – knowledge of instruction for English language development – has been integrated into initial single- and multiple-subject credentialing programs since 2002 (CTC, 2015b). Frequently there are higher levels of knowledge needed to teach ELs, such as knowledge and skill to provide "specially designed academic instruction delivered in English" and "instruction for primary language development and content instruction delivered in the primary language" (CTC, 2015b, p. 1). These levels of knowledge require additional optional authorizations.

Finally, the last category of KSCs beginning elementary teachers must have surrounds literacy. Literacy is a critical skill in the 21st century, allowing citizens to engage their democracy, solve problems, and contribute to the knowledge economy (Lievesley & Motivans, 2002; UNESCO, 2005). In school and in life, being a proficient reader allows one to learn other subjects (Mather, Bos, & Babur, 2001) and engage in our democracy. For elementary teachers, no matter what grade level is being taught, teachers must have enough knowledge and skill around teaching reading that students with a wide variety of reading levels can access the subject matter being taught. Therefore, all beginning elementary teachers must have specialized **knowledge of reading development** (CTC, 2018b; 2018c) focusing on how students learn to read and how to teach students to read (Mather et al., 2001; McCombes-Tolis & Feinn, 2008).

Together, these five categories broadly describe what teachers need to know and be able to do on their first day. Teachers must have an appropriate level of basic knowledge and skills, content knowledge, integrated teaching practices, knowledge of English language development, and knowledge of reading development. California regulates and monitors the pipeline around these categories. It is worth noticing that four of the five categories focus more on knowledge than capabilities. This focus on knowledge is a well-documented and oft-maligned aspect of teacher pipelines (Gitomer & Zisk, 2015; Goldhaber, 2007; Mitchell, Robinson, Plake, & Knowles, 2001; Wilson, 2009).

A common issue many states face is how best to prepare general education teachers for supporting students with special needs. Prior to 2016, preservice teachers working toward a single- or multiple-subject credential in California were not required to demonstrate KSCs around teaching students with special needs, nor were there requirements for general education teachers to learn specific evidence-based practices common in special education (California's Statewide Special Education Taskforce, 2015). However, with the adoption of

revised TPEs (CTC, 2016b) in 2016, the state changed this. Multiple- and single-subject beginning teachers must show proficiency on a common "core" or "trunk" of preparation experiences that cut across both special and general education practices (California's Statewide Special Education Taskforce, 2015). Two recent meetings in December 2017 and February 2018 have specified these new requirements and identified how general and special education teachers might share a common core of KSAs (CTC, 2017h; CTC, 2018e) and TPPs are required to have aligned their programs to the new TPEs by the end of the 2017-2018 school year. Because some programs will have complied with the TPE reform very recently, it will likely take some time to see any changes in general education teachers' proficiency.

Pipeline Institutions and Policies

Where and when do novices learn the five categories of KSCs required of them? As shown in Figure 1, K-12 schools, community colleges, four-year institutions of higher education (IHEs), California workplaces, and TPPs all provide prospective teachers important learning opportunities related to the KSCs required by the *CSTPs*.

There are many paths through which a teacher may travel prior to their first day in front of a classroom of students. Some students will take a direct route in which they graduate from high school, graduate with a bachelor's degree from a 4-year IHE, complete a TPP at either an institution of higher education or local education agency and receive a preliminary credential, obtain employment in a California public school, complete an induction program and obtain a clear credential. This route proceeds straight down the right side of Figure 1. Other students may attend community college for one or two years, transfer in to a 4-year IHE, and then follow the same route as those who went directly to a 4-year IHE. Still others will go directly into the workforce and then return to a community college and/or 4-year IHE to pursue a teaching career.[9] And finally, others will proceed partially down one of these paths, obtain employment in a California public school, and continue to make progress toward their teaching credential while teaching students in California's K-12 classrooms. There is diversity in the paths prospective teachers may take through the pipeline.

We first describe the general roles the institutions in Figure 1 play in developing teachers' KSCs and then provide a high-level overview of the main policies, regulations, and assessments that structure the learning opportunities provided by pipeline institutions. We then detail some of the main pathways through the teacher education system, noting the relative number of novices moving through each. In the next section, we suggest criteria that might be used to evaluate the efficacy of the teacher education system and then evaluate it against three of those criteria.

[9] California TPPs have recently been expanding a new pathway called "blended programs" that integrates a bachelor's degree with the requirements for a teaching certificate. In 2015, the state budget included $10 million in planning grants of $250,000 each for colleges to better design these programs (https://edsource.org/2017/undergraduate-education-major-banned-for-56-years-returns/585830). The programs are new and therefore there is little publicly available information about these programs or their efficacy.

Main Teacher Education Institutions and Roles

K-12 schools. K-12 public schools play a critically important and under-recognized role in the provision of preservice teachers' learning opportunities at the beginning, middle, and end of the teacher education pipeline. At the beginning of the pipeline, K-12 schools are the institutions that provide opportunities for aspiring teachers to develop the KSCs necessary to teach effectively. In particular, the **basic knowledge and skills** as well as the **subject-specific content knowledge** that a teacher eventually brings to her own classroom reflects the knowledge that she gained from the K-12 schools she herself attended.

In the middle of the pipeline, K-12 schools provide the practice-based settings in which teachers enrolled in a TPP practice **integrated teaching practices** as well as apply their content knowledge under the guidance of IHE faculty/staff members and K-12 teacher mentors. As has been written about extensively, the classrooms in which candidates work with K-12 students provide critical learning experiences for beginning teachers (e.g., student teaching) (Grossman, 2010; Grossman, Hammerness, & McDonald, 2009; Hollins, 2015). And despite varied models to support the collaboration of TPPs and K-12 professionals, those learning experiences are profoundly shaped and often controlled by K-12 professionals. This may be especially true for beginners participating in intern programs in which they are "student teaching" in the form of being a teacher of record.

Finally, at the end of the teacher education pipeline, K-12 schools provide newly certified teachers with the mentors and induction program curricula necessary to complete the induction phase of teacher preparation, and further develop their capability in carrying out **integrated teaching practices**. Of course, K-12 schools are also a beginner's workplace, which can provide varied learning opportunities, ranging from more to less productive. Given this frequent involvement in three locations on the teacher education pipeline and the nature of the learning opportunities provided in these locations, K-12 schools are a very important institution participating in the preparation of beginning teachers.

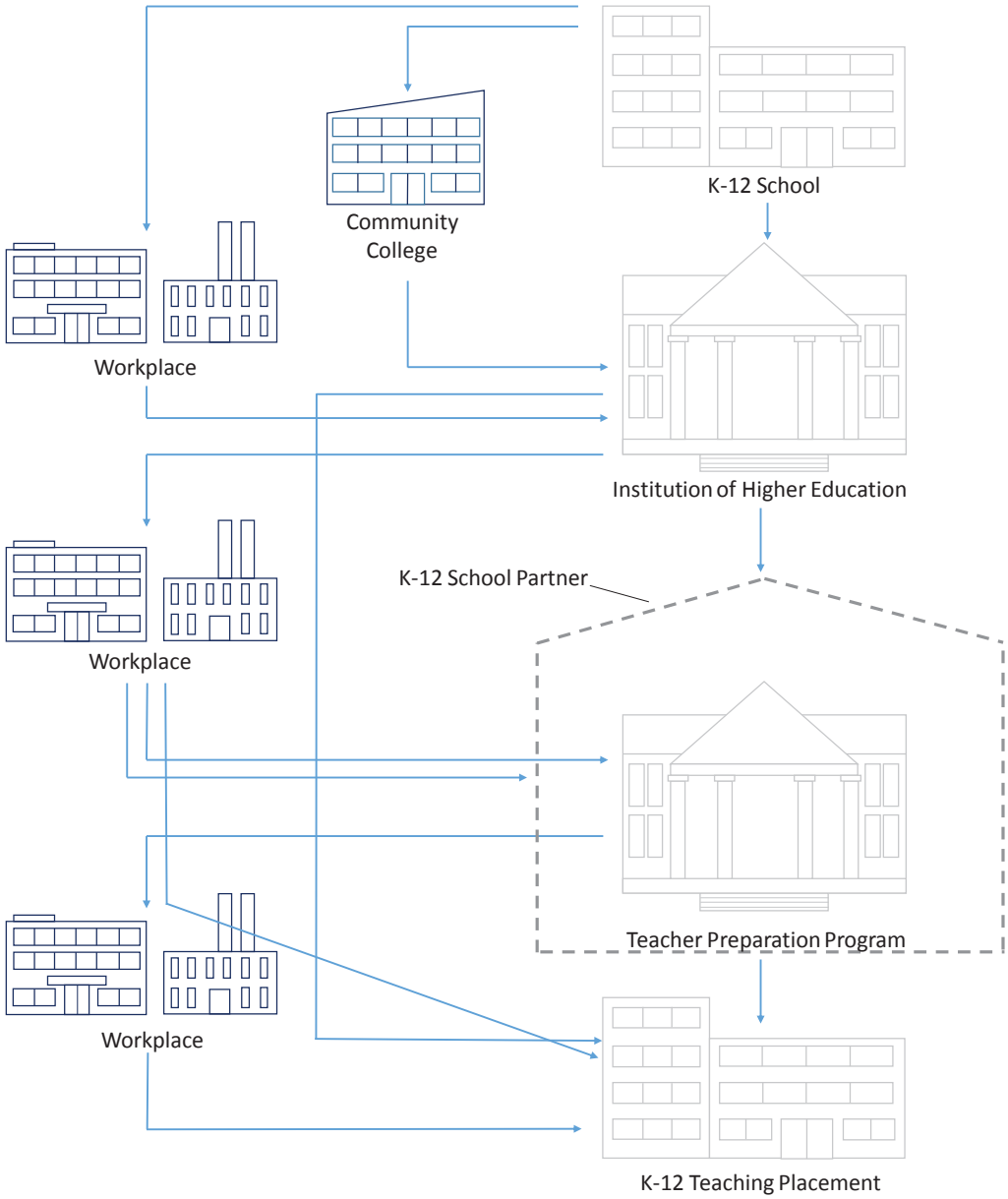


Figure 1. Institutions in the teacher education learning system

Community colleges and 4-year IHEs. Community colleges and 4-year IHEs provide additional learning opportunities for aspiring teachers to further develop their **basic knowledge and skills**; they also provide teachers their primary learning opportunities to learn more advanced **content knowledge**. For example, a teacher seeking a single-subject certification in mathematics, English, history, etc. will likely deepen the content knowledge initially developed in her K-12 years in community colleges and 4-year IHEs. These institutions also provide aspiring multiple-subject teachers an extended opportunity to develop the broad **content knowledge** for teaching elementary-aged students. To varying degrees, these institutions will provide additional learning opportunities around other important KSCs, such as knowledge and proficiency in a second language, capabilities of working with other adults, and general knowledge of national and global social, economic, and political issues. All California teachers are required to have a bachelor's degree, therefore, all beginning teachers rely on 2- and 4-year IHEs to provide important learning opportunities.

California's workplaces. Many beginning teachers will have interacted with California's workplaces and the attendant learning opportunities they provide. These workplaces provide learning opportunities that are necessarily specific to the particular business or industry of that workplace. Some prospective teachers may have opportunities to learn interpersonal skills from working at fast food restaurants or grocery stores. Such skills might be useful for learning how to work with other school professionals or students' families. Other prospective teachers will have the opportunity to learn how students understand content from tutoring K-12 students for test preparation companies, tutoring through neighborhood social networks, teaching in a private school or early childhood center, or even teaching in a public school on an emergency permit. Still others will have the opportunity to learn KSCs through careers such as banking, IT, engineering, and marketing. The quality and nature of the learning opportunities provided in California's workplaces vary dramatically and may or may not be important to the ultimate KSCs a beginning teacher has on day one. These workplace learning opportunities can occur anywhere along the teacher pipeline, beginning when the aspiring teacher is in high school all the way through to when the teacher has her own classroom. Such learning opportunities are critical to some of California's alternative certification or intern pathways.

Teacher preparation programs. Among the preliminary single- or multiple-subject teaching credentials issued in California, the majority (63 percent) are awarded to candidates that completed a post-baccalaureate TPP (referred to as a "traditional" program). As shown in Table 1, in 2016-17, 9,742 California teachers received a multiple- or single-subject preliminary credential through a post-baccalaureate TPP in the state of California. This represents just over 72 percent of all newly single- and multiple-subject preliminary credentialed California teachers. When broken down by preliminary credential type, 70 percent of single-subject credentialed teachers and 74 percent of multiple-subject credentialed teachers were credentialed through a California-accredited post-baccalaureate TPP in 2016-17. The remaining newly preliminary credentialed single- and multiple-subject teachers, respectively, were

credentialed through TPPs outside of California or in another state, another country, or a non-specified entity.

TPPs provide critical, and in many cases the only, opportunity to learn the specialized KSCs teachers need for teaching: **integrated teaching practices, knowledge of English language development, and knowledge of reading development**. TPPs collaborate intensively with K-12 professionals in the provision of these learning opportunities, shown in Figure 1 as the K-12 school providing the practice-based context for preservice teacher learning.

Assessments and Requirements

California regulates these institutions that make up the teacher education pipeline and the learning opportunities they provide through varied assessments and requirements. To simplify, we focus on the main assessments and requirements, pointing the reader to reports and websites for additional information.

Accreditation of pipeline institutions. Accreditation is a process used across many public sectors to ensure both quality and standardization of services. Police departments, medical schools, and hospitals all use accreditation to ensure that their respective professional standards are implemented by practitioners. The same is true in the teacher pipeline; in particular, 4-year IHEs, TPPs,[10] and induction programs all must be accredited. Accreditation of K-12 public schools is not required; however, all K-12 public schools must adhere to the California Department of Education's (CDE) requirements as well as state administrative codes and statutes. This leaves only California workplaces as unaccredited, although some workplaces are accredited within their own fields. State law requires aspiring teachers to obtain a bachelor's degree from a regionally accredited IHE. Accreditation requirements therefore shape the KSCs that students develop while pursuing a bachelor's degree. For example, Western Association of Schools and Colleges (WASC), the primary regional accreditation agency for colleges and universities in the state of California, requires all accredited IHEs to (a) "define and incorporate into all of its undergraduate degree programs a substantial component of general education designed to ensure basic collegiate skills, breadth of knowledge, and the structures of intellectual inquiry"; and (b) design "educational objectives for the general education program that include demonstrated competence in writing, critical thinking, scientific literacy, computational skills, and an introduction to the broad domains of knowledge" (WASC, 2015, p. 28).

TPPs are accredited by the CTC and only accredited programs can recommend teacher candidates to be licensed.[11] The CTC has recently revised its TPP accreditation policy but these revisions are just beginning to impact the teacher education system. Program accreditation

[10] There is one exception to this. The Teacher Preparation Pipeline program, established in 2006-07 to provide more certified STEM and career and technical education teachers, is not accredited by CTC.

[11] National accreditation can be substituted for state accreditation as stipulated by Education Code 44374 (f). However, substitution requires alignment studies of both standards and accreditation activities, a program review, and a site visit (CTC, 2018a). This means that from a practical perspective, the CTC still reviews and accredits preparation programs.

takes places in seven-year cycles, with annual reporting requirements, document reviews in each of four years, and one site visit in a sixth year. Programs must meet six standards as well as subject-specific pedagogical standards (CTC, 2017b). Standards focus on the curriculum of TPPs, how well candidates are prepared for the TPEs, clinical practice, monitoring candidates over time, implementing a Teaching Performance Assessment (TPA) (CTC, 2015a), and providing each candidate with an individual learning plan (ILP) that is used during the induction phase of the pipeline.

Finally, induction programs – state mandated programs that continue a beginning teacher's learning from the time a preliminary credential is issued to the time a clear credential is issued – must also be accredited by the CTC. Accreditation occurs around six standards including the program's purpose, the components of the mentoring design, the implementation of well-designed ILPs, the quality of mentors, determining candidate competence for the purposes of recommending a clear license, and program responsibilities for assuring program quality (CTC, 2017a). Accreditation also requires specific induction program features such as the length of the program and frequency of mentoring, among others.

Institutional requirements. In addition to accreditation requirements, pipeline institutions specify varied institutional requirements that provide learning opportunities for beginning teachers. For example, IHEs determine how many hours of coursework are required for a specific major as well as how the hours are distributed across subtopics within the major. IHEs can also specify minimum GPA requirements for certain majors or for entry into the university. TPPs, through their admissions requirements, might specify that candidates applying to the program must have completed a certain number of hours working with school-aged children or they may specify a minimum GPA. Two-year and 4-year IHEs, as well as TPPs have the freedom to specify course requirements and assessments, both of which play a crucial role in shaping KSCs.

Assessments. California has assessments or substitutions for those assessments in each of the previously discussed five categories that broadly describe what teachers need to know and be able to do on their first day. The most commonly completed assessments for preservice teachers in traditional and intern pathways are shown in Figure 2. Appendix B lists the requirements and substitutions exhaustively and shows differences between traditional and intern pathways to certification. In order to meet the **basic knowledge and skills** requirement, preservice teachers can either take and pass the California Basic Educational Skills Test (CBEST) or score high enough on one of a few other assessments (SAT, ACT, or AP). To meet the **content knowledge** requirement, beginners must complete a CTC-approved subject matter program or take and pass the California Subject Examination for Teachers (CSET). The content knowledge requirement must be met before an aspiring teacher can begin student teaching, although some TPPs may encourage students to pass the exam before entry into the program. Once enrolled in a TPP, preservice teachers complete integrated coursework and practice-based placements that support the candidates' **knowledge of English language development**. Candidates also learn about and practice **integrated teaching practices**. Candidates' proficiency on some of these teaching practices are assessed by the Teaching Performance Assessment

(TPA) used by the program. Finally, candidates seeking a multiple-subject credential must demonstrate **knowledge of reading development** by passing the Reading Instruction Competence Assessment (RICA) prior to program completion. The last of these assessments – the TPA and RICA – must be passed before the TPP recommends the candidate for a credential.

Graduated licensure policy. California has a graduated licensure policy that treats California teachers as continuous learners. Specifically, a prospective teacher must first successfully complete the preliminary certificate requirements that are set by the preparation program (shown in red in Figure 2) as well as the CTC assessment requirements (shown in green and blue in Figure 2). After the preservice requirements are complete, a candidate is recommended to the CTC for certification and granted a preliminary certificate. In the spirit of supporting continuous novice learning, the novice teacher then has five years to complete an accredited induction program (red outline in the K-12 school in the lower right corner of Figure 2) as well as the successful completion of the ILP. Once both of these requirements are met, the teacher is eligible for a clear credential.

Induction policy. In contrast to many states, California has a formal induction program that is regulated by the CTC and implemented by roughly 160 institutions, including universities, districts, charter management organizations, and county offices of education. In order to earn a clear teaching credential (i.e., one for which there are no further academic requirements), all beginning teachers must complete a two-year accredited induction program (CTC, 2017a). Induction programs pair beginners with appropriate mentors to receive an average of one hour per week of mentoring. Before leaving a California TPP, a beginning teacher develops an ILP that is used as the basis of the work mentors and beginners do together. All ILPs must align to the 6 TPEs and over the two years of the program, the beginner must show demonstrated proficiency in all six CSTPs standards, which guide in-service teachers' growth.

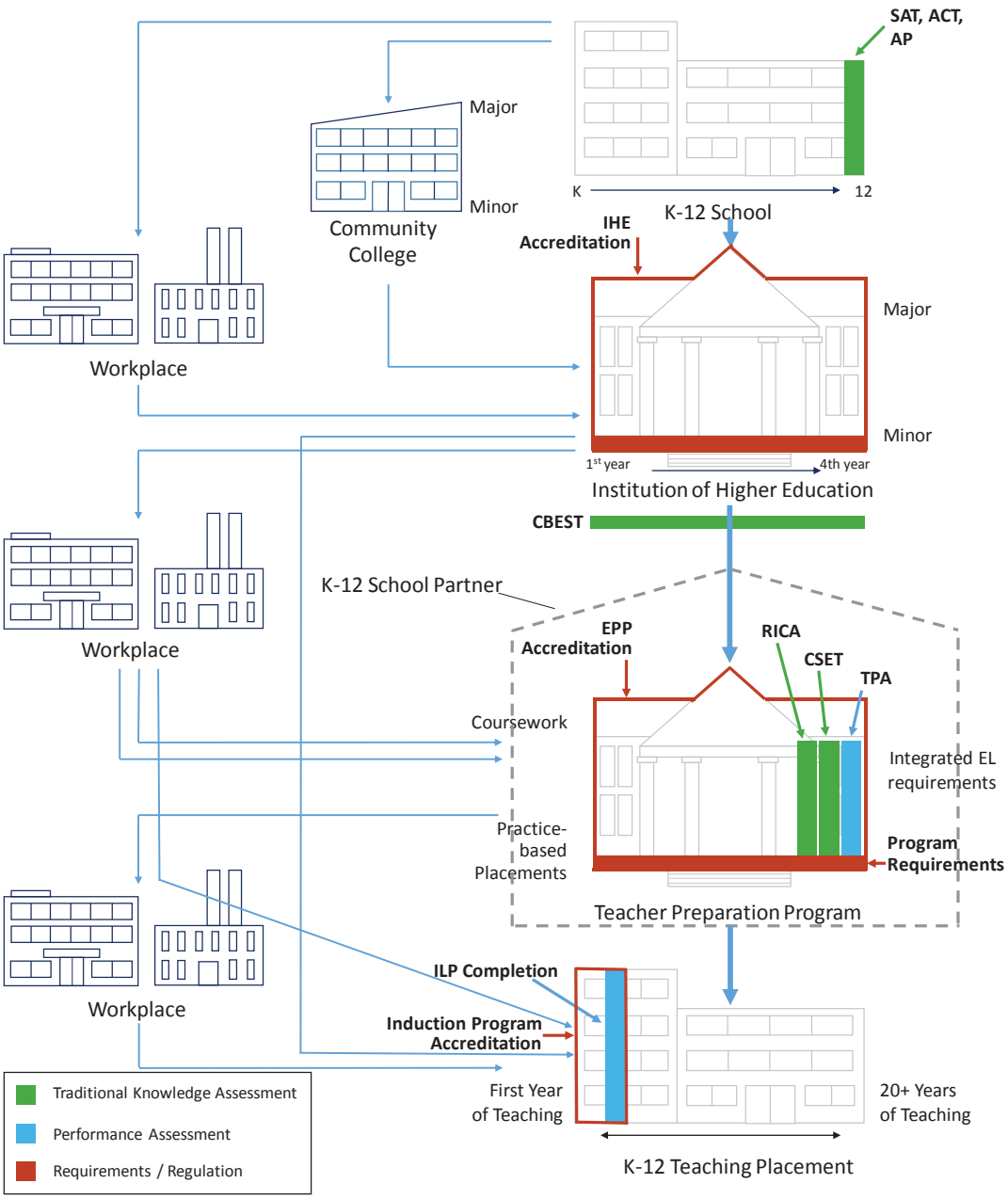


Figure 2. Teacher education learning system with assessments and requirements

Multiple Pathways

There are multiple pathways through Figure 1, as noted previously. Many teachers move down the right side of the figure from high school through a post-baccalaureate TPP to induction and a clear credential. But many others have pathways that skip over preparation

programs as we tend to think of them. For example, an individual might earn a bachelor's degree and then go work for a district full-time as a paraprofessional and then enter a district-based intern program that results in a preliminary certificate, which then leads, through induction, to a clear credential.

Pathways that eventually move through traditional TPPs may or may not be better than other pathways, but they do carry state-designed assurances of first-day preparedness. Intern pathways, short-term staff permits, provisional internship permits, or waivers do not provide citizens the same assurances. As such, novices working on waivers, permits, and intern credentials are often referred to as teachers working on "substandard" credentials.

In the case of the intern pathway, intern beginning teachers are concurrently teaching children and completing the necessary coursework and requirements to earn either a multiple- or single-subject preliminary teaching credential. This is a significant and growing group of teachers: 16 percent (2,566 teachers) of preservice teachers were working toward their multiple- or single-subject teaching credential through a California-based intern program in 2016-17. These individuals with an intern teaching credential (a) possess at least a bachelor's degree from a regionally accredited institution of higher education; (b) met the basic skills requirement, unless exempt by statute or regulation; (c) demonstrated knowledge of the Constitution of the United States; (d) demonstrated subject matter knowledge; and (e) are enrolled in a CTC-approved TPP. As of their first day of teaching, these individuals with intern credentials must have completed intern preservice preparation provided by a CTC-approved program sponsor, and received a recommendation from a CTC-approved intern program. Prior to teachers assuming daily teaching responsibilities, a signed Memorandum of Understanding must be in place between the CTC-approved program sponsor and the school district employing the teacher with the intern teaching credentialing, detailing the support and supervision that will be provided to the individual with an intern teaching credential. Additionally, prior to assuming daily teaching responsibilities, a teacher with an intern teaching credential must be assigned a mentor teacher. A minimum of 144 hours of support/mentoring and supervision must be provided to each intern teacher per school year with 45 hours of additional support and supervision focused on supporting English learners (Intern Teaching Credentials, 2014).

Two other ways a novice might begin teaching a group of students without the state-designed assurances result from the need to fill a temporary staffing vacancy or need. In 2016-17, another 38 percent (5,061) of beginning teachers had a permit for these purposes. Such permits, which are issued for no more than one year, may be a short-term staff permit or a provisional internship permit. To obtain either, an individual must (a) hold at least a bachelor's degree from a regionally accredited college or university; (b) meet the basic skills requirement, unless exempt by statutes or regulations; (c) successfully complete specific coursework[12] with a

[12] For the single-subject, short-term staff permit, at least 18 semester units of course work in the subject to be listed. For the multiple-subject, short-term staff permit, at least 10 semester units of course work in each of at least four of the subject areas (i.e., language studies, history, literature, humanities, mathematics, the arts, science, physical education, social science and human development) or at least 10 semester units of course work in

grade of “C” or higher, “Pass,” or “Credit”; and (d) complete the background check process (CTC, n.d.a). In contrast to the traditional pathway, these permits allow novices to work with students, without having fully met the subject matter requirement, the reading or EL requirements, nor having demonstrated proficiency on integrated teaching practice. While current state data does not allow us to compare the effectiveness of various pathways, at a minimum we know that these novices have not had the learning opportunities nor met the proficiency standards the state has designed to ensure novices are adequately prepared.

A final category of preservice teachers is those with waivers. In 2016-17, 2 percent (234) of preservice teachers in California classrooms had a waiver. A waiver means the candidate (a) holds a teaching credential but is teaching outside of their credentialed authorization(s), (b) has been permitted additional time to complete a credential requirement, or (c) has been placed in a teaching position, potentially without a credential, when all other hiring efforts have been exhausted by the employing agency (CTC, n.d.d). More specifically, there are two types of waivers: short term and variable term. Short-term waivers may be approved at the local level to provide the district with one semester or less to address unanticipated, immediate, short-term organizational needs by assigning only individuals who hold basic teaching credentials to teach outside their credentialed authorizations, with the consent of the teacher. Short-term waivers may be issued once to any individual teacher and only once for a given class. Variable-term waivers are reviewed by CTC staff and acted upon by the CTC at a regularly scheduled meeting. They provide the district up to one year for a specific period of time set by the CTC to: (a) allow individuals additional time to complete a credential requirement, (b) facilitate assignment in school programs addressing issues of educational reform, (c) allow geographically isolated regions with severely limited ability to develop personnel time to hire and develop personnel, or (d) obtain waivers for situations when all other hiring efforts have been exhausted (CTC, n.d.d).

It is clear that the number of teachers entering teaching with substandard credentials has grown markedly from 2012-13 to 2016-17. Table 1 describes patterns in the credentials of teachers entering California schools over time. In 2016-17, over one-third of newly single- and multiple-subject certified California teachers had either not met all of California’s teacher credentialing requirements or were not credentialed in the subject area that they were teaching but were permitted to teach in California K-12 classrooms through waivers, permits, or as interns (CTC, n.d.d). Second, 17 percent of newly multiple- or single-subject certified California teachers were prepared by out-of-state or out-of-country programs for which California cannot regulate the experiences of preservice teachers (CTC, n.d.c). However, California does regulate the credentialing of these teachers upon entering California.

For an out-of-state prepared teacher to qualify for a California teaching credential, they must have a bachelor’s degree and an out-of-state teaching license; however, they are eligible to receive initial certification in California without having completed an out-of-state exam that

each of three subject areas and an additional 10 semester units of course work in a combination of two of the remaining subject areas.

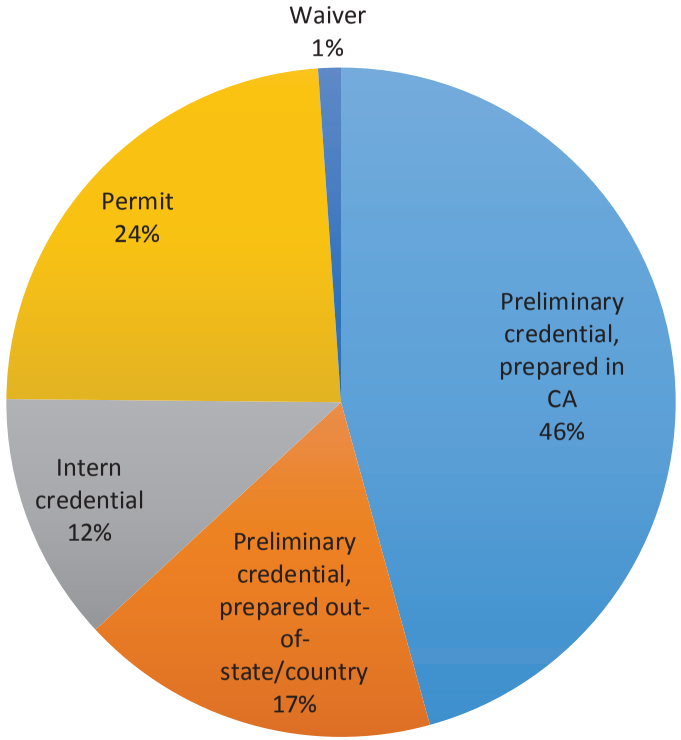
meets the requirements of the California Basic Skills Examination (CTC, n.d.b). Out-of-state prepared teachers have up to one year after submission of their application to complete the California Basic Skills Requirement (CTC, n.d.b). These two groups of teachers – those teaching on substandard credentials and out-of-state teachers – made up over half of California's "new" teacher workforce in 2016-17 (see Figure 3). These teachers may have either different learning opportunities in teacher preparation programs not regulated by California *or* not yet engaged in the full range of learning opportunities that California policies deem to be important. This reality further emphasizes that learning opportunities in pathways differ and to have a full understanding of California's teacher education system, one must trace those pathways and the learning opportunities inherent in them.

Table 1. Trends in California Teacher Credentialing, by Credential Type

	2012-13	2013-14	2014-15	2015-16	2016-17	% Change 2012-13 to 2016-17
Number of Multiple- and Single-Subject Preliminary Credentials/Authorizations Issued, by Type						
Multiple-subject preliminary credential	5,937	6,011	6,277	6,463	6,933	+16.7%
California prepared	4,579	4,498	4,736	4,718	5,152	+12.5%
Out-of-state/country prepared	1,358	1,513	1,541	1,745	1,781	+31.1%
Multiple-subject intern credential	303	377	617	914	1,288	+325.1%
Multiple-subject permit	197	345	824	1,441	2,145	+988.8%
Multiple-subject waiver	7	10	15	45	91	+1,200.0%
Single-subject preliminary credential	6,324	6,121	6,211	6,342	6,514	+3.0%
California prepared	4,708	4,446	4,390	4,515	4,590	-2.5%
Out-of-state/out-of-country prepared	1,616	1,675	1,821	1,827	1,924	+19.1%
Single-subject intern credential	596	761	888	1,081	1,278	+114.4%
Single-subject permit	1,060	1,227	1,840	2,444	2,916	+175.1%
Single-subject waiver	9	19	34	93	143	+1,488.9%
Number of Credentials/Authorizations Issued, by Type						
Total working toward or issued a multiple- or single-subject credential	14,433	14,871	16,706	18,823	21,308	47.6%
Total preliminary credentialed	12,261	12,132	12,488	12,805	13,447	+9.7%
Total California prepared	9,287	8,944	9,126	9,233	9,742	+4.9%
Total out-of-state/country prepared	2,974	3,188	3,362	3,572	3,705	+24.6%
Total working toward credentials	2,172	2,739	4,218	6,018	7,861	+261.9%
Total intern	899	1,138	1,505	1,995	2,566	+185.4%
Total permit	1,257	1,572	2,664	3,885	5,061	+302.6%
Total waiver	16	29	49	138	234	+1,362.5%
Multiple and Single Subject Preliminary Credentials						
Among Multiple- and Single-Subject Credentials						
Percent preliminary credentialed	85.0%	81.6%	74.8%	68.0%	63.1%	-21.9%
Percent California prepared	64.3%	60.1%	54.6%	49.1%	45.7%	-18.6%
Percent out-of-state/country prepared	20.6%	21.4%	20.1%	19.0%	17.4%	-3.2%

Percent working toward credentials	15.0%	18.4%	25.2%	32.0%	36.9%	+21.9%
Percent interns	6.2%	7.7%	9.0%	10.6%	12.0%	+5.8%
Percent permits	8.7%	10.6%	15.9%	20.6%	23.8%	+15.1%
Percent waivers	0.1%	0.2%	0.3%	0.7%	1.1%	+1.0%

Figure 3. Proportion of Single- and Multiple-Subject Credentials/Authorizations Issued, by Type, 2016-17



Criteria to Judge the Teacher Education Pipeline

Having described what beginning teachers are expected to know and be able to do as well as the institutions, assessments, and regulations that guide and ensure such learning, we now turn to a consideration of the quality of that learning system. Drawing from decades of research in education policy, we suggest five broad criteria that can be used to answer the research question "How should we judge the quality of California's teacher education system?" Those criteria are the degree to which the pipeline 1) has aligned policy messages for stakeholders, 2) prepares capable novice teachers, 3) generates relevant data, 4) prepares enough teachers, and 5) is cost-effective. In this section, we describe these broad criteria. Subsequently, we evaluate the system on the first three criteria. The issue of teacher supply is addressed in a series of recent reports (Carver-Thomas & Darling-Hammond, 2017; Darling-Hammond, Furger, Shields, & Sutcher, 2016) as well as a *Getting Down to Facts II* paper (Darling-Hammond & Sutcher, 2018), and the under-researched and exceedingly complex issue of the system's cost-effectiveness is beyond the scope of this already lengthy paper.

Aligned Policies

For the better part of the last 30 years, education research emphasizes the importance of alignment and coherence in any system that is designed to improve teaching and learning (e.g., Coburn, Hill, & Spillane, 2016; Cohen & Hill, 2001; McLaughlin, 1987; Penuel et al., 2010; Spillane, 2006). Without alignment of policies, curricula, assessments, and other policy tools, one is likely to have an incoherent system, prone to uneven outcomes and ongoing stakeholder dissatisfaction. There are many ways for a system to be misaligned. Teaching standards may be out of date with new student learning standards or teacher tests might measure static content knowledge, not the situated and dynamic content knowledge for teaching beginners need on their first day of teaching. This suggests that a necessary, but not sufficient condition for an effective teacher education system is an aligned and coherent system.

Capable Teachers

Any teacher pipeline must produce teachers who are ready to begin teaching on their first day in the classroom (Ball & Forzani, 2009). They must be able to carry out common tasks – correctly interpreting what students know and do not know, explaining subject matter, and discussing students' progress with their parents or guardians. While beginning teachers are just that – beginners – the teacher education pipeline must prepare them enough to be *safe* for all children on their first days as the teacher of record. The idea that beginners must be "safe to practice" comes from a long history in the licensure of professionals that suggests the state's role is to ensure that a person charged with carrying out a professional task will do so safely. It is not the state's role to judge whether a beginning professional is excellent or even effective. Instead the state's role is to protect the public by ensuring safety.

This distinction is easily understood in the restaurant industry. Through regulations around food storage, food preparation, hand washing and the like, the state ensures that restaurants will serve food that will not make the public sick. The state does not ensure the food will be delicious, or even good. Those criteria are left to professional and economic forces. The state protects the public from food that endangers their health; it ensures the food is safe.

The same is true in law and medicine. A medical or law licensure does not ensure a high-quality lawyer or doctor. Instead, the state ensures competent lawyers and doctors, both of whom know important knowledge and are proficient in their respective fields. In teaching, the state's role is to ensure that on their first day, teachers are ready to teach all children and will not inflict educational harm on them.

But how does the state know if a beginner teacher is safe? This requires judgment based on expert understandings of the KSCs necessary for beginner teachers as well as knowledge of the specific students the teacher will encounter on her first day. California, like other states, regulates what teachers must know and be able to do. In most states, there is a heavy regulatory emphasis on what teachers know as measured by multiple-choice teacher tests (Gitomer, Brown, & Bonnett, 2011; Gitomer & Qi, 2010). Increasingly there are standardized requirements compelling candidates to demonstrate their capabilities through performance-based assessments administered during their TPPs (e.g., Goldhaber, Cowan, & Theobald, 2017; Henry et al., 2013). To guarantee teachers learn what they need to across the pipeline, the assessments and regulations used by the state must ensure all teachers know and can carry out enough teaching practices in their subject areas so that children are protected from unsafe practice. Or in the words of the Teacher Performance Expectations, "establish, maintain, and monitor inclusive learning environments that are physically, mentally, intellectually, and emotionally healthy and safe to enable all students to learn…" (TPE 2, element 3, CTC, 2016b).

If we accept these premises, then programs, and thereby the state, must have a body of standardized, detailed, relevant, performance information upon which to judge a candidate's mastery of the relevant knowledge and integrated teaching practices necessary to teach on the first day of school. Such information can be used both summatively and formatively to improve programs and identify any programs that are producing candidates deemed unsafe to practice. The state can evaluate the quality of these regulations and assessments by considering how performance on the state's preservice requirements and assessments are related to beginners' teaching practice. They can also do so by seeking out other validity evidence that creates a strong argument for the reasonableness of the assessment being used (Kane, 2013). Not all assessments or requirements will be predictive of beginners' eventual teaching practices, but wise policy should seek to understand the relationships between preservice requirements and assessments and those eventual teaching practices.

Relevant Data

Evidence-based policymaking and improvement processes require data that can help diagnose problems and inform appropriate action (Bryk et al., 2015). A teacher education pipeline data system must provide critical information that is linked to the outcomes the system values. These valued outcomes may vary – perhaps at one time, there is a need for more mathematics teachers and at another time, the focus is on credentialing teachers with stronger skills in serving bilingual students or teachers more likely to stay in the profession. One system may value teachers with specific social-emotional skills or specific content knowledge. Irrespective of the specific valued system outcome(s), the system's data must provide *critical disaggregated information* known to be related to teaching quality. *Critical information* is data logically related to valued outcomes of the system. If, for example, a system values the number of bilingual teachers in the public schools, it will not only provide data on how many bilingual

credentials are completed; it will also trace the progress of subgroups of individuals most likely to earn bilingual credentials, which requires *disaggregated information* – information provided at the proper level of detail such that it can inform improvement efforts and policymaking. To continue with the bilingual teachers' example, it is helpful to know the number of bilingual candidates that earn a preliminary credential, but it would be even more helpful to know what pathways and programs those bilingual candidates came through in order to determine whether and how those pathways should be strengthened or incentivized in some way. It would also help to know how many of those credentialed bilingual candidates took jobs in bilingual placements versus taking more general teaching placements and how long they stayed in those placements. Such critical, disaggregated data across the teacher pipeline is necessary to support both system improvement and policy goals.

This type of investigation – tracing the progress of specific groups through a pipeline – also requires *linked data*. For example, linked data in this case might be data that traces back to the community college and IHE populations to determine who was bilingual, how many of those individuals were interested in education and which ones eventually completed a teaching certificiate and took a job. Without that critical information, it is impossible for the state, community colleges, IHEs, and TPPs to know how best to increase the number and quality of bilingually certified teachers. Linked data can inform improvement efforts by allowing TPPs to understand students' incoming knowledge and skills, their progress through various majors and certification programs, and their eventual employment in K-12 classrooms. Linked accessible data are required by the national teacher preparation accrediting body, the Council for the Accreditation of Educator Preparation (CAEP, 2016).[13] They are also the subject of national reports by advocacy and scholarly organizations (Deans for Impact, 2016; Feuer, Floden, Chudowsky, & Ahn, 2013) as well as the target of foundation-based reform efforts (Carnegie Corporation of New York, 2001). Such data must, however, protect both individual's confidentiality and pipeline institutions' independence if they are to be used to guide improvement efforts.

Enough Teachers

The state is responsible for providing free education to California's children (CA. Const. art. IX, § 5). To the degree that this constitutionally mandated responsibility is unfulfilled because there are not enough teachers for the state's classrooms, the state must act. This means that the state has a role to play in monitoring and ensuring the adequacy of the supply of teachers across the pipeline and over time. The event of not having enough teachers is of particular concern. In California, like many other states, there are specific subjects and geographic locations that regularly suffer from teacher shortages (Carver-Thomas & Darling-Hammond, 2017; Darling-Hammond, Furger, Shields, & Sutcher, 2016; Darling-Hammond & Sutcher, 2018). To the degree that there are chronic teacher shortages that adversely impact groups of students' educational opportunities (e.g., African American students, students in rural districts, etc.), legal scholarship suggests the state is not fulfilling its duty to provide a "free"

[13] CAEP standards 4 and 5 require TPPs gather data on the effectiveness of program completers and the satisfaction of completers and employers, as a part of each program's continuous improvement efforts that make use of multiple valid and reliable measures.

and adequate public education as guaranteed by the California constitution and subsequent court rulings (Gordon, 2016).

The event of preparing too many teachers may be of some, albeit less, concern. There is an implicit social contract between the state and citizens preparing to be teachers. That contract implicitly suggests that the state will not prepare professionals for jobs that do not exist. This concern, however, is not usually a large concern because of specific shortages, turnover, and geography. In addition to chronic shortages (Darling-Hammond et al., 2016), there are a significant number of teachers who leave teaching every year, making those jobs available for beginners. Frequently, there are also nearby geographic areas or states that are able to employ teachers who cannot find a job close to home. Thus, as long as the social contract is generally upheld, the event of the teacher pipeline producing too many teachers is less of a concern than producing too few teachers.

Cost-Effective

A teacher pipeline system should be cost-effective for both the candidates seeking to become teachers and the taxpayers supporting the development of a teacher pipeline. From a candidate's perspective, the cost of certification should be reasonable in terms of dollars and the time necessary to become certified. Cost-effectiveness is a notoriously challenging criterion to fully quantify, but there is precedent for doing so in other areas of education (e.g., Denton & Smith, 1985; Borman & Hewes, 2002; Knight, 2013). Citizens also bear the cost of preparing teachers because their tax dollars are used to provide support to public IHEs in their own states and through the federal government for subsidized loans for higher education. Thus, it is helpful to understand the degree to which the provision of teacher education is cost-effective for the teacher workforce and the economy more generally. Such information must be put into the context of similar human improvement professions that serve the common good – nurses, civil servants, psychologists – in order to help citizens and policymakers make sense of any cost-effectiveness estimates.

Given these five criteria by which a teacher education system might be judged, we now turn to an assessment of the first three of those five criteria: a system that is aligned, produces capable teachers, and generates relevant data for improvement purposes. We focus on these three criteria because another *Getting Down to Facts II* paper takes up the question of whether the system produces enough teachers (Darling-Hammond & Sutcher, 2018), and a fair treatment of the system's cost-effectiveness requires its own report.

System Alignment

To investigate the alignment of California's teacher education system, we carried out an extensive document analysis and review of publicly available data. We find that California's teacher education system, regulations, assessments, and policies are aligned at a high level around the *CSTPs*. However, this high-level alignment masks variation in ground-level implementation. This ground-level variation may mean that candidates have varying opportunities to learn and practice important KSCs, however, there is little data available to determine whether and how this variation might influence the preparedness of beginners. The document analysis also suggests that there is strong standardization around the specific

knowledge candidates are responsible for prior to entering the classroom. There is less specification and standardization around the specific **integrated teaching practices** candidates are required to demonstrate.

High-Level Policy Alignment

Looking across the institution and policy descriptions of the teacher education system detailed previously, the most important source of high-level alignment comes from the *CSTPs.* California's teaching standards are used in institutions before and after preliminary certification to orient the regulations, assessments, and policies toward common standards. This creates alignment in the system because all of the policies and assessments must refer back to this single set of six standards. For example, induction and preparation programs are required to link the learning opportunities they offer candidates back to the *CSTPs* through the TPEs (CTC, 2016d; 2016e).

Looking more deeply at specific requirements, there is also high-level alignment in the system, created by similar organizational structures and a common substantive focus on the same areas of teaching. This high-level alignment is accomplished by requiring that important regulations and assessments be organized into the six TPEs that specify what beginning teachers should know and be able to do. Specifically, the system is aligned across the preservice and induction phases of teacher education through the alignment of TPP accreditation regulations, the TPA required by the end of candidates' program, accreditation regulations for induction programs, and successful progress on an ILP prior to earning a clear credential. This alignment is visible in Figure 4, a figure modified from other similar figures found in TPP documentation. Reading horizontally across Figure 4, the colors substantively show how the six TPEs (and 46 elements) used by preparation programs to guide their curriculum and accreditation are grouped into six domains that are aligned with the six *CSTPs* and the *CSTPs'* associated 38 elements. The left side of the figure shows the six TPEs and elements that are a part of preservice accreditation and program design. The right side shows the six teaching standards and elements that guide induction accreditation and design. In the middle of the figure, one TPA, the CalTPA, was selected as an example. The CalTPA is also aligned to the TPEs, and by extension the *CSTPs*. The other TPAs are also similarly aligned. The elements marked in the center of the diagram are taken from the four types of rubrics in the revised CalTPA.

The high-level alignment of the system is clear reading across any horizontal color panel. For example, one *CSTP* that guides induction policy and assessment is *Understanding and organizing subject matter for student learning*, shown in the third horizontal panel in tan. This *CSTP* is aligned with the related preservice TPE of the same name. Despite two additional elements in the TPE domain, the standards are very similar – both focus on how teachers understand and use subject matter to support student learning. High-level alignment is further strengthened because this standard is measured in three of the four TPA tasks that are a part of the CalTPA.

We acknowledge, however, that there are many teaching practices that might demonstrate a beginner has reached a certain level of proficiency in making subject matter comprehensible to students. For example, a program might require candidates to model and explain how to write a five-paragraph essay, actually requiring candidates to give a brief lecture

in which the candidate generates written text in front of the class, narrating and modeling how she is thinking about writing the essay as she goes. This approach would align with TPE 1: *engaging and supporting all students in learning* in the preservice program and could be evidence of preservice teacher competency. During induction, however, a mentor might see the same person carrying out a different brief lecture in which the teacher might compare two essays that use different approaches to gain the attention of the reader in the first paragraph. The teacher's explanation of how the two essays compare to one another could also show the teacher's proficiency with *understanding and organizing subject matter for student learning*. Being able to write an essay in front of students while thinking aloud is a different practice than comparing two essays' opening paragraphs. Both would align at the level of the TPEs and the *CSTPs*, but they are different teaching practices.

The high-level alignment and coherence this analysis finds in the teacher education system is an important asset to the state's efforts to create an effective teacher education pipeline. The accomplishment of creating such a system should not be underestimated. However, given the relatively low level of student performance in California compared to other similar states (NCES, 2015, 2017), it is necessary to analyze what teachers are required to know and be able to do at a finer grainsize. It is this analysis to which we turn now.

Standardization and Variation in Knowledge Requirements

Within each of the pipeline institutions that influence teacher development (depicted in Figure 2) there are policies and procedures that shape the KSCs that teachers gain in California's teacher education learning system. We review the requirements in a sequential manner – from policies that influence the basic knowledge and skills that teachers obtain while still in high school to the content knowledge obtained in high schools, universities, and colleges, and finally to the institutions that impact the integrated teaching practices that teachers learn and apply during their teacher preparation program and induction experiences.

The knowledge required to earn a single- or multiple-subject teaching credential is standardized. All credential holders must have a high school diploma (or equivalent), a bachelor's degree, and they need to demonstrate proficient levels of knowledge in basic knowledge and skills, content knowledge, knowledge of reading development, and knowledge of English language development. The demonstration of these latter bodies of knowledge is usually accomplished through the passing of assessments or coursework, or both.

Further, all of the state's knowledge assessments have been created through well-established test development processes and the test blueprints, sample items, and various supporting validity documents are available online (CTC, 2007; California Educator Credentialing Examinations, n.d.; Le & Buddin, 2005; Pearson Education, 2014). Also, required teacher knowledge assessments are aligned to the *CSTPs* (Sandy, 2016).

While there is strong standardization of requisite knowledge, there is also variation in the particular learning opportunities that pipeline institutions provide to aspiring teachers. We begin with the earliest pipeline institutions, K-12 secondary schools, followed by community colleges and 4-year IHEs.

K-12 secondary schools. Current course requirements for California high school graduates are listed in Appendix C. These requirements vary by subject and, given our review, vary by school and school district. In the case of subject matter variation, there are different knowledge requirements for different subjects. Although high school graduates may obtain relatively broad knowledge in the fields of English and social studies because they are required to successfully complete three years of coursework in these content areas, students' mastery of subjects like math, science, the arts, and career/technical education may be narrower due to lower coursework requirements. Additional variation in aspiring teachers' knowledge may occur because both K-12 school districts and IHEs may set higher graduation requirements and admissions standards, respectively, contributing to aspiring teachers' mastery of the KSCs. For one, public and private 4-year colleges and universities in California often set admissions requirements that exceed California high school graduation requirements. For example, admission standards for the California State University (CSU) and University of California (UC) systems, which issued over 40 percent of California's multiple- and single-subject preliminary and intern credentials in 2016-17, call for students to complete, with a grade of "C" or better, what are commonly known as the "A-G" subject requirements – a set of courses that are "academically challenging, involving substantial reading, writing, problems and laboratory work, and show serious attention to analytical thinking, factual content and developing students' oral and listening skills" (The California State University, n.d.; University of California, n.d.). So, whereas California state statute requires K-12 students to complete two years of mathematics, including one year in algebra I, to obtain a high school diploma, admissions into the UC and CSU systems requires the completion of three years of mathematics courses, including algebra, intermediate algebra, and geometry.

While completion of UC and CSU's "A-G" subject requirements is not mandated by state law, many school districts across the state of California have enacted local graduation policies that require their students to meet the "A-G" subject requirements in order to receive a high school diploma from the district. For example, San Francisco Public Schools requires all students – regardless of whether they will pursue a postsecondary degree in the UC or CSU system – to complete the "A-G" subject requirements with a grade of "D" or better in order to earn a high school diploma (SFUSD, n.d.a). Yet, the level of mastery a student gains upon achieving a "D" in a class is questionable. For example, the SFUSD mathematics department suggests that math teachers use a 4-point holistic rubric to evaluate student work. The math department states that if a teacher wants to convert rubric scores to grades, a grade of "D" corresponds with "minimal understanding" – a "1" on the 4-point holistic rubric. Moreover, "many teachers require students revise their work when they receive a score of 0, 1, or 2 so that they can show progress toward mastery of the standards" (SFUSD, n.d.b). As such, it is likely that a student that obtains a grade of "D," and even "C," may have quite limited mastery of the content knowledge in a particular mathematics course.

Local school districts also may set higher graduation requirements in other areas that impact students' attainment of specific KSCs that are necessary for effective teaching. For example, students in Los Angeles Unified School District and seven other California school districts are required to complete an ethnic studies course to be eligible for high school graduation. Such a policy undoubtedly influences students' KSCs, particularly those related to the *CSTP* domains of *Engaging and Supporting All Students in Learning*, *Creating and Maintaining Effective Environments for Student Learning*, and *Planning Instruction and*

Designing Learning Experiences for All Classrooms. Current publicly available data does not link aspiring, preservice, or practicing teachers to their K-12 secondary school, so we neither know whether certain high schools are disproportionately contributing to the state's teacher workforce nor whether or how certain preparation pathways are shaped by the quality of secondary education in the state.

Community colleges and 4-year IHEs. California state law requires aspiring K-12 teachers to possess both a high school diploma and a bachelor's degree. Outside of the accreditation process and previously discussed institutional policies around admissions requirements, institutional rules related to course and graduation requirements play a substantial role in the KSCs that aspiring teachers develop as they are pursuing a postsecondary degree. At a broad institutional level, community colleges and IHEs set course-hour requirements and grade point average (GPA) requirements in order to obtain, in the case of community colleges, an associate's degree or to transfer into an IHE or, in the case of IHEs, to obtain a bachelor's degree.

Teacher Preparation		Teaching Performance Assessment (Revised CalTPA)				Induction	
		Plan	Teach & Assess	Reflect	Apply		
1.1 Apply knowledge of students…	TPE 1: Engaging and supporting all students in learning	X	X			CSTP 1: Engaging and supporting all students in learning	1.1 Using knowledge of students to engage them in…
1.2 Maintain communication with students…							1.2 Connecting learning to students' prior…
1.3 Connect to real life contexts…							
1.4 Use appropriate instructional strategies…		X					1.3 Connecting subject matter to meaningful, real…
1.5 Promote critical and creative thinking…		X	X		X		1.4 Using a variety of instructional strategies…
1.6 Provide supportive learning environment…		X					1.5 Promoting critical thinking through inquiry…
1.7 Provide students opportunities…							1.6 Monitoring student learning and adjusting…
1.8 Monitor learning and adjust…			X		X		
2.1 Promote social development and…	TPE 2: Creating and maintaining effective environments for student learning	X	X			CSTP 2: Creating and maintaining effective environments for student learning	2.1 Promoting social development and…
2.2 Create learning environments…			X				2.2 Creating physical or virtual learning…
2.3 Establish and maintain learning…		X	X				2.3 Establishing and maintaining learning…
2.4 Know how to access resources…		X					2.4 Creating a rigorous learning environment…
2.5 Maintain high expectations…			X				2.5 Developing, communicating, and…
2.6 Clear expectations for positive….							2.6 Employing classroom routines, procedures,…
			X				2.7 Using instructional time to optimize learning…
3.1 Demonstrate knowledge of subject matter…	TPE3: Understanding and organizing subject matter for student learning	X				CSTP 3: Understanding and organizing subject matter for student learning	3.1 Demonstrating knowledge of subject matter…
3.2 Use knowledge about students…		X					3.2 Applying knowledge of student development…
3.3 Plan, design, implement…		X	X				3.3 Organizing curriculum to facilitate student…
3.4 Consult and collaborate for…							3.4 Utilizing instructional strategies that are…
3.5 Adapt curriculum to support…		X					3.5 Using and adapting resources, technologies…
3.6 Use and adapt resources…		X	X				3.6 Addressing the needs of English learners and…
3.7 Model and develop digital literacy…			X				
3.8 Demonstrate knowledge of strategies…			X				
4.1 Locate and apply information about…	TPE 4: Planning instruction and designing learning experiences for all students	X	X		X	CSTP 4: Planning instruction and designing learning experiences for all students	4.1 Using knowledge of students' academic…
4.2 Understand and apply child development….		X					4.2 Establishing and articulating goals for student…
4.3 Design and implement interconnected…			X				4.3 Developing and sequencing long-term and…
4.4 Plan instruction for all students…		X	X		X		4.4 Planning instructional plans and curricular…
4.5 Promote student success by providing…		X					4.5 Adapting instructional plans and curricular…
4.6 Access resources for planning and instruction…							
4.7 Plan instruction with range of communication…		X	X				
4.8 Use digital tools and technologies…							
5.1 Apply knowledge of the purposes…	TPE 5: Assessing student learning	X	X			CSTP 5: Assessing students for learning	5.1 Applying knowledge of the purposes,…
5.2 Collect and analyze assessment data…		X	X	X	X		5.2 Collecting and analyzing assessment data from…
5.3 Involve students in self-assessment…		X	X		X		5.3 Reviewing data, both individually and with...
5.4 Use technology to support…							5.4 Using assessment data to establish learning…
5.5 Use assessment information in timely way…			X				5.5 Involving all students in self-assessment, goal…
5.6 Work with specialists…		X					5.6 Using available technologies to assist in…
5.7 Interpret EL assessment data…		X		X			5.7 Using assessment information to share timely…
5.8 Use IEP, IFSP, ITP, and 504 assessment data…		X	X		X		
6.1 Reflect on teaching practice…	TPE 6: Developing as a professional educator		X	X	X	CSTP 6: Developing as a professional educator	6.1 Reflecting on teaching practice in support of…
6.2 Recognize own values and biases…							6.2 Establishing professional goals and engaging…
6.3 Establish professional goals…							6.3 Collaborating with colleagues and the broader…
6.4 Demonstrate how and when to involve….							6.4 Working with families to support student…
6.5 Demonstrate professional responsibility…		X					6.5 Engaging local communities to support student…
6.6 Understand and enact professional roles…							6.6 Managing professional responsibilities to…
6.7 Critically analyze how context, structure…							6.7 Demonstrating professional responsibility…

Figure 4. California TPEs, TPA, and CSTPs in Preservice and Induction Programs

While data related to the number of teaching credentials issued by each institution in a given school year is publicly available, data related to the undergraduate institutions that California teachers attend is currently not publicly available. As such, it is impossible to review the coursework requirements and graduation requirements of, say, the top five IHEs where novice teachers obtain their bachelor's degree. It is also impossible to know the proportion of teachers who obtained a bachelor's degree that started in a community college and transferred to an IHE. From publicly available data on the CTC data dashboard, we do know that, in 2016-17, the CalStateTEACH program[14] issued the largest number of multiple-subject credentials, followed by Fresno State, National University, Loyola Marymount University (LMU), and CSU Fullerton. We do not know what these candidates' majors were so we cannot assess the degree to which there is variation or similarity in learning opportunities provided to aspiring teachers. Given this lack of data, we explored coursework and graduation requirements for students pursuing a liberal studies/interdisciplinary major at two institutions that issue a large number of multiple-subject teaching credentials each year: Fresno State and LMU. Table 2 summarizes the undergraduate coursework and graduation requirements for candidates at the two aforementioned institutions. We present this information with the understanding that these institutions that award large numbers of teaching credentials may or may not be the institutions with a large number of undergraduates who complete their bachelor's degree and then pursue a teaching credential.

At Fresno State and LMU there are many similar required learning opportunities as well as differences. Both IHEs require general education coursework that is divided into various types of knowledge – foundations, explorations, breadth, integrated, etc. Both institutions emphasize opportunities to learn to write as well as learn history, mathematics, science, and literature in the blended parts of the liberal studies/interdisciplinary major. There is, however, variation as well. LMU requires 25 more units than does Fresno State in order to graduate. Fresno State requires courses in physical education, linguistics, secondary language learning, and students with special needs. LMU does not require these courses as a part of the major; however, LMU includes psychology, geography, world history, as well as American and California history as well as more required hours in science and the visual arts, music, dance, and movement arts for children. While these two institutions are a small number of the many that educate aspiring teachers, it is clear that there is significant variation in the learning opportunities undergraduates might experience on their path to becoming a teacher.

[14] See https://www.calstateteach.net/ for information about this online teacher education program.

Table 2. Graduation Requirements for Liberal Studies/Interdisciplinary Majors and Multiple-Subject Teacher Credential Students in Two IHEs

	Fresno State	LMU
Total course hours	**120 units**	**145 units**
Overall graduation requirements	• 91-92 requirements specific to the blended liberal studies major including 51 general education requirements • 9-12 units towards a concentration • 16-21 units of electives	• 48 semester hours in LMU's core curriculum • 55 semester hours in the liberal studies major • 21 semester hours in the education program • 9-12 elective semester hours • 12 semester hours in a subject taught in elementary schools
General education hours required	51 units total 12 units in Foundation, 27 in Breadth, 9 in Integration, 3 in Multicultural/International	48 hours total 4 courses in Foundations, 3 in Explorations, 3 in Integration, 6 in Flagged
Writing course/ exam	Pass with C or higher	Pass with C or higher
Blended liberal/interdisciplinary studies major	39 units total • 3 units in computer concepts/applications; • 3 units in physical education; • 3 units in linguistics; • 3 units in teaching first and second language reading in English; • 3 units in a math course focused on counting methods, elementary probability and statistics; • 3 units in the development of mathematical reasoning, problem solving, and communication skills; • 3 units focused on diverse populations and/or students with special needs; • 3 units focused on development of artistic expression in children; • 3 units in children's literature; • 3 units in the use of multiple applications to increase subject matter knowledge and understanding; • 3 units in communication; • 3 units in a course that includes an overview of major economic forces that shape everyday experiences; and • 3 units in earth science	55 units total • 3 units in visual arts; • 6 units in music, dance and movement arts for children; • 4 units in children's literature; • 4 units in world geography; • 8 units in pre-modern and modern world history; • 4 units in American history; • 4 units in the history of California; • 4 units in education and global issues; • 6 units in mathematics for elementary teachers; • 4 units in general psychology; and • 8 units in experimenting in science
Required major GPA	2.0	2.0

Planned Variation and Professional Choice in Integrated Teaching Practices

Knowing the specific subject matter one will teach is necessary, but not sufficient for being able to teach it (Ball et al., 2008). One must also be able to make that knowledge useable in the classroom in the teaching practices delineated in the *CSTPs.* California's current policies implicitly acknowledge this; using member-only *Certification Data Maps* from the National Association of State Directors of Teacher Education and Certification, we found that California is one of 27 states that require novices to meet a state requirement concerning performance assessment (NASDTEC, 2018). It is unclear how many of these states require a performance assessment like California's TPA; however, a recent scholarly article suggests only seven states require candidates pass a TPA for certification (Goldhaber et al., 2017). Our document analysis suggests that while knowledge is highly standardized in the teacher education pipeline, there is significant variation in the specific practices for which a candidate must demonstrate competency prior to her becoming the teacher of record. It would be difficult to say, for example, whether every 8th grade science teacher can plan engaging lessons equally well in the subtopics of geology, force and motion, and energy, or whether all elementary teachers are able to carry out a whole class discussion on the theme of loss, or whether teachers of all grades are able to communicate the academic progress of a student with a learning disability to that student's parent. So, while the *CSTPs* describe the general KSCs beginning teachers need to know and be able to do on their first day, the learning system allows for a good deal of variation around the exact KSCs any one teacher will be able to competently carry out on her first day.

That variation stems, in part, from sanctioned professional choices embedded throughout California's teacher education pipeline. These choices allow for variation in the specific teaching practices, topics, and in some cases, subject areas in which candidates demonstrate their KSCs. Systematic professional choice exists at three locations in the teacher education system. There is choice about how to demonstrate competency in the specific coursework and field-based experiences candidates have during the TPPs. There is choice within and across the performance assessments that are a part of preparation programs. And, when a candidate continues her early career learning during her induction program, there is professional choice about exactly which TPEs she will focus on in her ILP.

Programs align their learning opportunities to the TPEs during the accreditation process. However, there is significant flexibility in how the TPEs are met. As just one example, LMU, a large private TPP, requires prospective elementary teachers to take a three-credit course prior to entry into the program focused on cultural paradigms in education, including culturally relevant pedagogy. In contrast, CSU Fullerton does not have a stand-alone course on multicultural education and instead integrates this course content into more than one course. Research suggests that structural differences may matter to preservice teacher learning (e.g., Heafner & Petty, 2016); however, we are unaware of empirical evidence to support one structure versus another. Despite this gap in the literature, it seems possible that different structures may lead candidates to develop different levels of KSCs around teaching diverse learners.

Second, while TPPs are all accredited on the basis of California's TPEs, which are aligned with the *CSTPs*, and all preservice teachers must pass a TPA (CTC, 2017b), there are three different TPAs used in California at this time (Campbell et al., 2016).[15] The actual tasks candidates carry out as a part of their TPA must address all six of the TPE domains, but tasks vary and programs and candidates decide exactly how they will carry out the tasks within a given TPA model (Campbell et al., 2016). For example, for edTPA, used by approximately 3,500 candidates in CA during 2015-16 (CTC, 2017c), candidates are allowed to make different decisions about the specific teaching practices and topics submitted for evaluation across the four tasks, each of which is carried out with a focal class of students. The edTPA's second task for multiple-subject candidates focuses on instructing and engaging students in literacy learning. Preservice teachers are allowed to select the essential literacy practice they wish to focus on as well as whether the practice occurs in a writing or reading lesson. Candidates can choose strategies as diverse as using a rubric to revise a written essay or identifying a character's personality traits based on what they say and do. In contrast, the CalTPA, a TPA used by 9,000 candidates in CA during 2015-16, has three tasks that require work with K-12 students – designing instruction, assessing learning, and a culminating teaching task. Each task requires novices to show a variety of TPEs. For multiple subject candidates, they must carry out these tasks in ELA and math, but they can choose which subject they will do for each task, and there is no requirement to focus on a specific essential literacy practice. And just as with edTPA, CalTPA candidates are allowed to show their competency in either a reading or a writing lesson. This variation means that a candidate assessed on CalTPA might show evidence of competency teaching students to distinguish common forms of literature while another candidate shows evidence she can support students learning to tell time. These are different practices and likely require the use of different pedagogical strategies. It is important for all candidates to be able to competently teach both of these practices, but the current TPA allows the candidate to select which one they choose.

[15] There were at one time four TPAs: The California Teaching Performance Assessment (CalTPA; CTC, 2018d) which is currently undergoing revision and field testing; the Fresno Assessment of Student Teachers (FAST; Torgerson, Macy, Beare, & Tanner, 2009); the Performance Assessment for California Teachers (PACT, 2018); and the edTPA (2018). PACT was the precursor assessment to the edTPA, however, PACT is no longer supported by its developers. Stanford, the developers of PACT, own edTPA (Campbell et al., 2016).

Table 3. Tasks, Topics, and Examples of Allowable Teaching Practices in Two TPAs

	edTPA	CalTPA[16]
Tasks	**1. Planning for instruction and assessment** 2. Instructing and engaging students in literacy learning 3. Assessing student learning	1. Subject-specific pedagogy **2. Designing instruction** 3. Assessing learning 4. Culminating teaching task
Topic	Reading or writing	Reading or writing or math
Examples of allowable teaching practices	Revise a written essay, or determine what characters are like by comprehending what they say and do	Tell or write time, create a paragraph and include simple details, distinguish common forms of literature

The opportunity to make choices about the specific teaching practices to focus on and demonstrate competency in continues during the induction phase of the pipeline. In order to be granted a clear credential, beginners must continue to learn and develop their KSCs through progress on a personalized ILP. ILPs are developed at the end of the preservice program and serve as the starting point for the mentor and beginning teacher to identify areas of strength and weakness, set measurable goals, and work together to improve the beginner's teaching practice (CTC, 2017a). Over the induction program, teachers must work on each of the six TPE domains; however, the specific practices within these domains are allowed to vary. Here again, there is a focus on **integrated teaching practices**; however, there is little standardization around the specific KSCs a new teacher will be able to carry out at the end of the induction phase.

To understand the degree to which this variation might matter for novices' skills, we looked for research articles that link performance on the three California TPAs to beginning teaching practice. We were unable to find any such articles in peer-reviewed journals, however, we found one article that documents a relationship between preservice teacher performance and student achievement on one of the TPA assessments. On the edTPA in Washington state, a mixed, but positive relationship was found between teachers' edTPA and value-added (VAM) scores taken from the classrooms in which they became the teacher of record (Goldhaber et al., 2017). The report found that passing the edTPA was predictive of a teacher's later VAM score in math when using continuous scores from the edTPA. When using the pass/fail distinction Washington uses for certification, edTPA scores were predictive of VAM in reading, but not in math. Scores in both subjects predicted whether a candidate was employed in the next year. These mixed findings that are sensitive to subject matter differences and statistical modelling and measurement assumptions typify the complexities of understanding the relationship between teaching practice and other related constructs (c.f., Rowan & Raudenbush, 2017). If

[16] The CalTPA is under revision. During 2017-18 it was undergoing a field test and will be implemented in revised form in 2018-19. This information is based on the current version.

the findings in Washington generalize to California, it is possible that the choices allowed within California's TPA assessments produce performances that are related to the strength of a beginner's teaching practice. While we were unable to find evidence in California on the current edTPA, its precursor, PACT, does have two small scale studies linking PACT scores to value-added estimates of the first years of teaching (Darling-Hammond, Newton, & Wei, 2013; Newton, 2010). However, there is very little research that would establish that relationship and no research that has specifically investigated how choices within TPAs relate to actual differences in quality teaching or their eventual students' learning. Additional research will need to investigate these potential relationships to better understand the importance of this allowable variation. At this point we know that the allowable variation means that teachers can pass their TPAs by demonstrating significantly different practices and that many teaching practices are not assessed by the TPA.

Looking systematically at policies that guide implementation of the *CSTPs*, it is clear that, at a high level, there is standardization in what teachers are required to know and be able to do. There is also allowable variation based on professional discretion and individual learning needs at the more detailed level of specific practices and topics in the K-12 curriculum.

There is one final source of variation in the KSCs beginners develop: the pathway they follow. As candidates make their way through traditional and intern pathways, they engage different pipeline institutions. The pipeline institutions' ability to provide candidates appropriate learning opportunities add additional variation to on-the-ground implementation of the *CSTPs.*

Similarity and Variation in Traditional and Intern Pathways

While 72 percent of California's 2016-17 single- and multiple-subject credentialed teachers completed a California-based traditional pathway described previously, the intern pathway was completed by 16 percent of newly credentialed teachers in 2016-17. Like traditional programs, intern programs are accredited by the CTC. There are two types of intern programs: district and university. As of 2016-17, there were seven local education agencies[17] with CTC-accredited district intern programs for single-subject and multiple-subject teaching credentials, from which just 284 credentials were issued (129 single subject and 155 multiple subject). Tulare County Office of Education credentialed the largest proportion (27 percent) of district intern-credentialed teachers in 2016-17. In contrast to district intern programs, there are many more CTC-approved institutions that offer a university intern program: 21 CSU institutions,[18] three UC institutions, and 25 private/independent institutions. In 2016-17, university intern programs produced 2,281 credentialed teachers.

[17] Bay Area School of Enterprise (Reach Institute), High Tech High, Los Angeles County Office of Education, Los Angeles Unified School District, Mt. Diablo Unified School District, Sacramento County Office of Education, San Joaquin County Office of Education, and Tulare County Office of Education.
[18] This figure does not include the CalTEACH program.

Intern programs are a path to a teaching credential that allows an individual to complete her teacher preparation coursework concurrent with her first year or two in a paid teaching position and after completion of 120 hours of preservice coursework (CTC, 2008; 2013). All of the assessment requirements for traditional pathways (e.g., CBEST or similar, CSET, RICA, TPA, etc.) apply to the intern pathway. However, the learning opportunities in specific education courses, student teaching experiences, and other mentoring and practice teaching experiences are different for an intern candidate. Perhaps most importantly, the education of the intern largely takes place in the daily context of the intern's own classroom and school building. Thus the K-12 school largely provides the candidates with their opportunities to learn from practical placements. Further, additional coursework is frequently carried out while the individual is a teacher of record. This means the candidate has a full-time teaching job and is a novice, circumstances that we know anecdotally can be challenging.

Intern programs conceptualize and monitor candidates' learning opportunities in different ways than do traditional programs. In traditional pathways, there are courses that specify what the preservice teacher should learn, providing specific learning opportunities organized around topics. In the intern pathway, school districts that employ interns in CTC-accredited intern programs are required to develop and implement a Professional Development Plan for interns in consultation with a CTC-accredited TPP that includes an annual evaluation, plans to complete necessary courses, additional instruction in child development and teaching methods, special education programs for pupils with mild or moderate disabilities (for K-6 interns only), and additional instruction in the culture and methods of teaching bilingual children (bilingual interns only). There are traditional courses in interns' professional development plans, but courses can be augmented with other learning structures as well.

In addition to these broad requirements, district intern programs must provide 144 hours of support and supervision per school year including coaching, modeling, and demonstrating within the classroom, assistance with course planning and problem solving regarding students, curriculum, and development of effective teaching methods. In doing so, the mentor must provide a minimum of two hours of support/mentoring and supervision every five instructional days (Intern Teaching Credentials, 2014).

While beginners pursuing a teaching credential through the intern program must complete these requirements, it is important to recognize that interns are in classrooms and teaching students prior to the mastery and completion of the milestones that contribute toward the accumulation of the KSCs necessary to be an effective teacher. Interns do, however, have many more hours interacting with students prior to the candidate being certified than do candidates pursuing traditional pathways. Unfortunately, we are unable to examine the efficacy of either pathway due to data constraints; a point we return to later.

To summarize, California has a teacher education pipeline characterized by a professional, developmental view of teaching that is embodied in the *CSTPs*. This view of teaching is implemented through various policies including assessment and accreditation requirements that generally produce high-level system alignment with the *CSTPs*. The

knowledge teachers are required to have is also tightly regulated and available for public inspection through various testing documents and state reports. There is, however, a good deal of variation in the specific knowledge candidates develop that falls outside the state's teacher tests. All across the pipeline, from high school to IHEs to TPPs, there are differences in how many courses, which courses, what institution is providing the beginner learning opportunities, and what levels of achievement a candidate is required to reach. Further, there is significant allowable variation in the specific **integrated teaching practices** beginners are required to demonstrate. Such ground-level variation begs the question: does this variation influence how well beginners are prepared? We now turn to the relatively small amount of empirical data we can bring to bear on this question.

Judging the Preparedness of Beginning Teachers

One goal of any teacher education system is to prepare teachers who are ready to teach all children without doing educational harm on their first day as the teacher of record. There is disagreement in the field as to the most reasonable ways to judge this. Educational reformers, national accreditation regulations and state officials often argue that the preparation of teachers should be judged based in part, on the beginner's impact on student achievement. Any such metric can then be aggregated up to the program level to identify areas of strength and weakness in programs (CAEP, 2016; Deans for Impact, 2016). Others reject using student achievement data for individual teachers or for programs as methodologically fraught and therefore ill-advised, due in part, to the strong sorting of prospective teachers to TPPs as well as sorting that occurs after the candidates leave their programs – sorting that occurs at the district, school, and student level (Koedel, Parsons, Podgursky, & Ehlert, 2012; Goldhalber, Liddle, & Theobald, 2013; Mihaly et al., 2013). Additional methods of judging the preparedness of beginners include using the classroom observation scores of beginning teachers, survey data from the beginners and their supervisors (Allen, Coble, & Crowe, 2014), and assessments of candidates' knowledge (Gitomer & Qi, 2010).

Regardless of one's views of linking beginners to their K-12 students' academic success, California does not have a statewide database that links TPP completer records with their students' performance data, nor is there systematic classroom observation data with common instruments collected in the state. Thus, to gain insight into the preparedness of beginning teachers in the state, we first review publicly available data and published reports on candidates' performance on knowledge tests. These data suggest that no matter what path beginners take through the teacher education system, if they complete that path, they are similarly prepared. It is important to note that by requirement, completing a pathway means the novice has passed the mandated knowledge and practice-based assessments (see p. 30 for a recent report [CTC, 2017i]).

We subsequently draw on two different bodies of stakeholder survey evidence on how well beginners are prepared. These survey data, like the publicly available data and published reports on candidates' performance on knowledge tests, similarly suggest similar levels of preparation across specific CSTPs. That is, the variation in institutional and assessment

requirements documented in the previous section does not appear to produce much variation in beginners' perceptions of their preparedness. Program completer survey data suggests novices have similarly positive perceptions of their preparation across all teaching practices. New survey data collected by the *Getting Down to Facts II* project suggests that principals do not agree with the level of beginner preparedness reported by beginners themselves. In particular, principals perceive beginner preparedness as systematically lower than do beginners and principals perceive greater variation in beginner teachers' preparedness across teaching practices. However, beginning teachers and principals agree on the specific *CSTPs* for which beginner teachers are most and least prepared.

Knowledge

Based on publicly available data on the CTC's Title II dashboard, preservice teachers generally pass the knowledge assessments required by the state for both multiple- and single-subject candidates. Candidates preparing for elementary teaching are required to pass RICA, CBEST, and three CSET exams. In Table 4, we again profile the two TPPs that produce a large number of teacher candidates across their intern and traditional pathways – Fresno State and Loyola Marymount University. These data show that across the four pathways, between 85-100 percent of candidates pass all of their required assessments. CBEST and CSET pass rates are all 100 percent, with a small proportion of candidates failing the RICA assessment. All of the average program scaled scores are well above the state's mandated cut scores, although there is some variation within and across programs.

For example, although pass rates across assessments are relatively similar between institutions within pathways, the average scale scores of LMU students across all assessments are higher than those of students at Fresno State, across both the traditional and intern pathways. Within institutions, Fresno State students in the traditional pathway have higher CSET but lower CBEST and RICA scores than those in the intern pathway. In contrast, LMU students in the intern pathway have higher average scale scores than those in the traditional pathway. Despite this variation, what is striking in Table 4 is the high pass rates across assessments, institutions, and pathways. Further, all institutions and pathways' average scale scores are substantially higher than the state-mandated cut scores.

Table 4. CBEST, RICA, and CSET Scores and Passing Rates for Traditional and Intern Pathway Multiple-Subject Teacher Credential Students in Two Large IHEs, 2015-16

	Multiple-Subject Teacher Credential Students						
	Takers	Passers	Pass Rate	Low Score	High Score	Cut Score	Average Scale Score
Fresno State - Traditional							
CBEST	264	264	100%	60	240	123	147
RICA	126	107	85%	100	300	220	230
CSET Multiple Subjects Subtest I	133	133	100%	100	300	220	236
CSET Multiple Subjects Subtest II	133	133	100%	100	300	220	245
CSET Multiple Subjects Subtest III	133	133	100%	100	300	220	238
Fresno State - Intern							
CBEST	77	77	100%	60	240	123	149
RICA	26	25	96%	100	300	220	233
CSET Multiple Subjects Subtest I	30	30	100%	100	300	220	231
CSET Multiple Subjects Subtest II	30	30	100%	100	300	220	238
CSET Multiple Subjects Subtest III	30	30	100%	100	300	220	234
LMU - Traditional							
CBEST	155	155	100%	60	240	123	160
RICA	87	76	87%	100	300	220	233
CSET Multiple Subjects Subtest I	91	90	99%	100	300	220	242
CSET Multiple Subjects Subtest II	91	90	99%	100	300	220	249
CSET Multiple Subjects Subtest III	90	90	100%	100	300	220	242
LMU - Intern							
CBEST	268	268	100%	60	240	123	169
RICA	166	156	94%	100	300	220	236
CSET Multiple Subjects Subtest I	154	154	100%	100	300	220	244
CSET Multiple Subjects Subtest II	154	154	100%	100	300	220	252
CSET Multiple Subjects Subtest III	154	154	100%	100	300	220	243

The high pass rates and similarities within programs in the publicly available Title II data mask variation in candidates' actual knowledge due to how scores are reported as well as state

policy. First, state policy requires a beginning teacher to pass all the required exams (or have met alternative thresholds). This means that by definition, all credentialed teachers will eventually pass these tests and higher scores are not rewarded in any way – passing by 1 point or passing by 20 points are the same, from a policy perspective. The fact that all candidates pass their required assessments is not particularly helpful information for improving the pipeline. What is more helpful is knowing how many times candidates take these assessments, the variation in candidate's knowledge within and across programs and pathways, as well as the particular tests and areas of the tests with which they struggle. If, for example, beginners preparing to teach elementary school-aged students in California have the same difficulties with mathematics that teachers in a nationally representative sample do (Hill, 2010), such difficulties should inform program faculty and policymakers as they attempt to support preservice teacher mathematical knowledge. If some pathways' candidates take assessments an average of 1-2 times, and other pathways' candidates take assessments an average of 2-3 times, this has implications for how the institutions in those respective pathways need to support candidates with additional learning opportunities or other types of program-level policy changes. The Title II data report very limited variation in candidates' knowledge at the program or pathway level and provide no information on the number of times candidates take the required assessments before passing.

A second reason there is limited information in the Title II data is because programs have generally moved to policies that require candidates to have passed specific assessments before the TPP reports on those students for Title II. For instance, many programs require candidates to have passed CBEST before the candidate begins the TPP. This results in a 100 percent passing rate on CBEST. This masks variation that might exist within and across programs and pathways. A recent report shows that there can be stark differences between first time and cumulative passing rates at the state level. On the multiple-subject CSET exam, almost 20 percent more candidates eventually passed than passed the first time they took the exam (CTC, 2016a, p. 21). This report suggests there is variation in test scores for at least some candidates and that there are differences in passing rates for candidates of different racial and ethnic backgrounds, with African American candidates generally having the lowest first-time and cumulative passing rates. Despite these important state-level data that show variation beneath the Title II high pass rates, the report is difficult to use for program and system improvement because it does little to trace trajectories of candidates through programs or system pathways.

Publicly available Title II data also show some differences in scaled scores across these same knowledge assessments. The state publishes data associated with a number of content knowledge assessments – e.g., CBEST, CSET, and RICA scores. It is possible to disaggregate these data by program type (TPP, district intern, university intern) as well as program sponsor (e.g., a university of other educational organization accredited to administer a teacher preparation program). These data, shown in Table 5, suggest that there is some variation in mean scaled

score by program sponsor and type. The UC and "other sponsors"[19] programs tend to have the highest mean scores. And in traditional programs in California, which produced 72 percent of preliminary single- and multiple-subject teaching credentials in California in 2016-17, the highest scores are in the UC system, followed by independent schools and then the CSU system.

This pattern does not hold across these institutions in the "alternative pathway." For example, on the CSET I, the two highest mean scores were in "other program sponsors" programs and CSU programs. In contrast, the highest two mean scores on the CBEST were in "other program sponsors" programs and the UC programs. It is unclear what to make of these patterns. They could be the result of specific curricular interventions programs have implemented to support preservice teacher learning. They could also be the result of candidates being sorting into TPPs such that candidates with stronger **basic knowledge and subject-specific knowledge** wind up in specific TPPs or pathways. Alternatively, specific K-12 and higher education pipeline institutions may be educating future teachers in more or less effective ways, and this is visible in the knowledge scores of preservice teachers. The publicly available data does not allow us to sort between these hypotheses, a point to which we return later.[20]

The data also suggest that on average, candidates who have not yet completed their clinical coursework (i.e., candidates in earlier stages of their program) have lower scores on the required RICA, CBEST, and CSET assessments than the scores of other candidates who were further along in their programs. This may imply that mean scores rise to passing levels by the time the candidate has completed her TPP. Depending on whether preservice teachers are studying for the assessment or simply learning the relevant content assessed by the test, we may view this shift in scores as either short-term test preparation or valuable learning.

Finally, publicly available reports provide CBEST, CSET, and RICA first-time and cumulative passing rates by demographic variables of test takers (CTC, 2016a). In particular, the reports provide participation data as well as first-time and cumulative pass rates across all teachers pursuing a credential between 2010 and 2015 based on the following categories: highest level of high school math completed, number of high school literature courses, number of high school writing courses, number of high school oral language courses, high school GPA, high school attendance, college math-taking, college GPA, number of college literature courses, number of college writing courses, number of college oral language courses, education level, years away from college, professional preparation, test preparation course taking, employment status, reason for taking the exam, type of credential sought, father and mother's education, best language, gender, and ethnicity.

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[19] "Other sponsors" are local education authorities such as the Bay Area School of Enterprise (Reach institute), High Tech High, districts (e.g., San Diego Unified School District and Mt. Diablo School District), and county offices of education (e.g., Santa Clara and Stanislaus County Offices of Education).

[20] The state's teacher knowledge assessments are criterion-referenced assessments and focus on reliability at the cut score that determines passing or failing. Scores far from the test's cut score may be less reliable than those around the cut score and should be interpreted cautiously.

These data provide valuable information on the demographic characteristics of students who take and pass the basic skills, content knowledge, and knowledge of reading development assessments. However, it is impossible to ascertain the extent to which different types of undergraduate institutions or TPPs better prepare different types of students. For example, do students with a high school GPA of less than 3.0 cluster into certain TPPs? Do some TPPs do a better job of preparing students with a high school GPA of less than 3.0? Currently, the publicly available data do not allow for an understanding of the correlations between assessment pass rates for students of different demographic backgrounds pursuing different routes within the teacher preparation pipeline. Additionally, the publicly available data are pooled across years (2010 to 2015). As such, it is not possible to explore variation in assessment success across years. In short, we can neither see if California is getting better or worse at helping to prepare certain demographics of teachers, nor whether certain types of programs or pathways are getting better or worse at preparing certain demographic groups of teachers.

Table 5. State CBEST, RICA, and CSET Mean Scores for Program Completers and Students Who Have Completed Non-Clinical Coursework, 2013-14, by TPP Sponsor

	CBEST			RICA			CSET								
	Alternative Program Avg CBEST Score	Traditional Program Avg CBEST Score	State Avg CBEST score	Alternative Program Avg RICA Score	Traditional Program Avg RICA Score	State Avg	Alternative Program Avg CSET I Score	Traditional Program Avg CSET I Score	State Avg	Alternative Program Avg CSET II Score	Traditional Program Avg CSET II Score	State Avg	Alternative Program Avg CSET III Score	Traditional Program Avg CSET III Score	State Avg
Program Completers															
CSU	156	154	160	237	236	235	249	242	243	250	248	249	245	241	243
District*	151	.		231	.		241	.		243	.		240	.	
Independent	158	159		234	237		243	245		247	250		243	246	
University of California**	161	169		238	243		248	250		245	257		243	248	
Other	164	.		248	.		255	.		262	.		250	.	
Enrolled Students, Completed Non-Clinical															
CSU	150	149	149	NA	228	228	NA	237	236	NA	247	241	NA	238	238
District†	NA	.		NA	.		NA	.		NA	.		NA	.	
Independent	154	150		222	227		238	236		238	240		237	239	
UC††	NA	162		NA	NA		NA	245		NA	250		NA	241	
Other	174			NA	.		NA	.		NA	.		NA	.	

Note. *Only 1 district reported CBEST and RICA scores for alt program. **Only one UC campus reported RICA scores. †Only 1 district reported CBEST and RICA scores for alt program. †† Only one campus reported CBEST and CSET scores, none reported RICA scores.

Perceptions of Preparedness

Another source of information regarding the preparedness of beginners comes from stakeholder's views of preparedness. Publicly available data suggest beginners generally view their programs and pathways positively. Data gathered for the Getting Down to Facts II project suggest administrators tend to have less positive views of beginners' preparedness. Despite these differences, there is some agreement between novices and administrators about the *CSTPs* teachers are most and least prepared to carry out.

Beginning teacher perceptions of preparedness. Currently, the only data publicly available from which we can ascertain beginning teachers' perceptions of preparedness to carry out CSTPs comes from the CTC multiple and single subject credential program completer surveys.21 These statewide reports include responses from beginning teachers who were recommended for a credential during the academic school year (September 1 to August 31). According to the CTC reports, 97 percent of those who were recommended for a credential in 2017 responded to the 2017 survey. Every institution that sponsored a single or multiple subject program and had ten or more completers, or five completers with a 100 percent response rate during the survey administration time, was sent a program-level report of their own completers who responded to the survey. These program-level reports are not publicly available. Moreover, the reports do not provide any way to investigate how teachers' perceptions vary by TPP, the teacher's gender or race/ethnicity, or other relevant characteristics (e.g., undergraduate major, certification pathway, etc.). As shown in Table 6, newly credentialed teachers that responded to the 2017 CTC completer survey, on average, felt that their TPP prepared them "well." Average perceptions across both multiple and single subject teachers aggregated to the domains of the *CSTPs* ranged from 4.0 to 4.3 on a 5-point Likert scale in which a 5 means they felt that they were "very well prepared." We find little variation in preparedness across the various elements of *CSTPs.* When averaging responses from both multiple and single subject teachers, the elements that newly credentialed teachers felt their TPPs prepared them best for are associated with *Standard 2*: Creating and Maintain Effective Environments for Student Learning. The elements they feel least prepared for are associated with developing as a professional educator. Among specific *CSTP* elements, we find that beginning teachers felt most prepared to create a productive learning environment with high expectations for all students and to use effective instructional strategies to teach subject matter and skills; and they felt least prepared to identify and address special learning needs with appropriate teaching strategies and plan for instruction by incorporating all relevant IFSP/IEP behavior and academic information.

We do find some variation between how well multiple and single subject credentialed teachers felt their TPP prepared them in relation to the *CSTPs*. Across all six *CSTPs*, single subject teachers, on average, had lower ratings of preparedness than multiple subject teachers. Differences between single and multiple credentialed teachers were largest in the following *CSTP* elements: meeting the needs of English learners; using knowledge of students' strengths

21 Available at https://www.ctc.ca.gov/educator-prep/completer-surveys

and prior experiences to engage them in learning; planning instruction based on students' prior knowledge, academic readiness, language proficiency, cultural background, and individual development; and working with families to better understand and to support their learning. For each of these elements, single subject teachers had lower perceptions of preparedness than multiple subject teachers. It is also important to note that, across all *CSTP* elements, the variation in perceived preparedness among single subject teachers is greater than the variation in perceived preparedness among multiple subject teachers.

Table 6. CTC Completer Survey Results for "How well did your teacher preparation program prepare you to do the following…", by Credential Type

	CTC Completer Survey									*RAND ASLP Survey*		
	Multiple Subject			*Single Subject*			*All (Average of Multiple & Single Subject Responses)*					
	n	Mean	Std. Dev.	n	Mean	Std. Dev.	N	Mean	Std. Dev.	n	Mean	Std.Dev.
CSTP 1: Engaging & Supporting All Students in Learning		***4.23***	***0.85***		***4.04***	***0.91***		***4.23***	***0.85***		**2.94**	**0.82**
Meet the instructional needs of English learners	1,160	4.22	0.85	1,465	3.97	0.95	2,625	4.10	0.90	316	2.88	0.81
Engage students in inquiry, problem solving, and reflection to promote their critical thinking	1,155	4.30	0.81	1,474	4.14	0.87	2,629	4.22	0.84	316	3.10	0.87
Use knowledge of students' strengths and prior experiences to engage them in learning	1,158	4.38	0.78	1,474	4.17	0.86	2,632	4.28	0.82	316	3.16	0.75
Identify and address special learning needs with appropriate teaching strategies	1,160	4.01	0.96	1,472	3.89	0.96	2,632	3.95	0.96	316	2.62	0.83
CSTP 2: Creating & Maintaining Effective Environments for Student Learning		***4.41***	***0.75***		***4.22***	***0.86***		***4.31***	***0.80***		**3.15**	**0.84**
Create a productive learning environment with high expectations for all students	1,156	4.41	0.73	1,471	4.22	0.85	2,627	4.32	0.79	316	3.34	0.84
Engage students in cooperative group work as well as independent learning	1,155	4.40	0.77	1,471	4.22	0.86	2,626	4.31	0.82	316	3.33	0.83
Prevent behavior problems by intervening early using strategies matched to student's current learning and behavior level	na	na	na	na	na	na	Na	na	na	316	2.78	0.86
CSTP 3: Understanding and Organizing Subject Matter for Student Learning		***4.25***	***0.82***		***4.09***	***0.92***		***4.17***	***0.87***		**3.21**	**0.79**
Use effective instructional strategies to teach subject matter and skills	1,149	4.31	0.78	1,468	4.14	0.92	2,617	4.23	0.85	316	3.32	0.76
Select, adapt, and develop materials, resources, and technologies to make subject matter accessible to all students	1,142	4.19	0.85	1,465	4.03	0.92	2,607	4.11	0.89	316	3.10	0.81

CSTP 4: Planning Instruction and Designing Learning Experiences for All Students		***4.35***	***0.78***		***4.16***	***0.86***		***4.25***	***0.82***		**2.96**	**0.82**
Plan instruction based on students' prior knowledge, academic readiness, language proficiency, cultural background, and individual development	1,147	4.36	0.77	1,464	4.16	0.86	2,611	4.26	0.82	316	3.11	0.8
Plan and adapt instruction that incorporates appropriate strategies, resources, and technologies to meet the learning needs of all students	1,148	4.33	0.78	1,467	4.15	0.86	2,615	4.24	0.82	315	3.10	0.83
Plan for instruction by incorporating all relevant IFSP/IEP behavior and academic information	na	na	na	na	na	na	Na	na	na	316	2.66	0.83
CSTP 5: Assess Students for Learning		***4.14***	***0.89***		***4.02***	***0.94***		***4.08***	***0.92***		**2.94**	**0.82**
Involve all students in self-assessment, goal setting, and monitoring progress	1,145	4.06	0.92	1,460	3.93	1.00	2,605	4.00	0.96	315	2.81	0.85
Develop and use assessment data from a variety of sources to establish learning goals and to plan, differentiate, and modify instruction	1,147	4.16	0.89	1,464	4.01	0.94	2,611	4.09	0.92	316	2.94	0.82
Give productive feedback to students to guide their learning	1,148	4.21	0.85	1,467	4.13	0.89	2,615	4.17	0.87	316	3.08	0.79
CSTP 6: Developing as a Professional Educator		***4.03***	***0.92***		***3.84***	***0.97***		***3.93***	***0.94***		**3.00**	**0.83**
Work with families to better understand students and to support their learning	1,136	3.84	1.00	1,451	3.60	1.06	2,587	3.72	1.03	316	2.97	0.84
Evaluate the effects of your actions on students learning and modify plans accordingly	1,140	4.21	0.83	1,462	4.08	0.88	2,602	4.15	0.86	316	3.03	0.82

Principals' Perceptions of Preparedness. In addition to the CTC Completer Surveys, the Getting Down to Facts II project gained access to data from a survey of RAND's American School Leader Panel (ASLP) in October 2017. While not publicly available, these data provide additional insight into principals' perceptions of teachers' preparedness to perform the CSTPs. The RAND ASLP are nationally representative panels of practicing K-12 public school principals who have agreed to participate in online surveys several times each school year. This survey administration had a response rate of 31 percent. However, sampling weights were generated for the ASLP survey to (a) help to adjust for nonresponse at both the panel recruitment and survey stages and (b) adjust for oversampling. Additional information about the principal sample, including information about non-response bias, is available in the Appendix D. Descriptive statistics from the ASLP data reveal that principals' perceptions of teachers' preparedness to meet the *CSTPs* are substantially lower than the perceptions of those teachers completing the CTC completer survey in the spring of 2017 (see far-right columns of Table 6). The elements that had the greatest teacher-principal gap in perceptions of preparedness were not isolated to a single *CSTP*, but rather cut across elements associated with all six *CSTPs.* However, as shown in Table 6, the highest and lowest rated elements for which beginning teachers and principals felt most and least prepared were relatively consistent across the RAND ASLP and CTC survey.

Similar to the CTC completer surveys, we find that principals' perceptions of teacher preparedness among the *CSTP* elements are lowest for teachers' preparedness to identifying and addressing special learning needs with appropriate teaching strategies and to plan for instruction by incorporating all relevant IFSP/IEP behavior and academic information. This agreement is particularly important given that California TPPs were required only this year to integrate special education standards into the general education curriculum. Survey responses suggest that teachers and principals felt the preparation of generalists needed additional support. The new policies that integrate special education KSCs into general education courses can now be evaluated against the previous trend documented here. Overall, these results suggest that teachers and principals may be in general agreement about the areas in which teachers are the least and most prepared; however, there is wide variation in their agreement about preparedness in many other teaching practices.

We also see a slight difference in the absolute agreement levels among RAND ASLP survey respondents and beginning teachers responding to the CTC completer survey. In particular, beginning teachers' highest rated elements were associated with being "very well" prepared and the principals' highest rated elements were associated with being on the low end of "adequately" prepared. In addition to the average ratings of preparedness, we also looked at differences in the variation among beginning teachers' and principals' perceptions of preparedness. We found slightly more variation among beginning teachers' than among principals' perceptions of preparedness: across all survey questions, the average standard deviation was 0.88 units for beginning teachers and 0.82 for all principals.

To gain further insight the gaps between principals' and beginning teachers' perceptions of preparedness, we also investigated the extent to which differences in principals' and beginning teachers' perceptions of preparedness were associated with differences in the schooling environments in which the teachers and principals were located. We were able to link the schools of the principals with school-level student demographic data derived from the CDE and compiled by members of Stanford's GDTF II, Dr. Lucrecia Santibañez and Erika Nakamatsu Byun. Specifically, we linked the RAND data with CDE data and then categorized the principals into quartiles based on four school-level student demographic characteristics from the CDE data: percent EL students, percent White student, percent of students proficient or above on state standardized ELA assessment, and percent of students proficient or above on state standardized mathematics assessment. We then looked descriptively at principals' perceptions of beginning teachers' preparedness to perform the *CSTP*s across the quartiles of school-level student demographics. The figures generally show there is a slight positive trend between principals' perceptions of preparedness and lower percentages of EL students, higher percentages of white students, and higher percentages of proficient students on the state's ELA tests.

Looking for carefully, we find one notable exception to this slight trend. Figure 5 shows that principals in the second quartile on percent EL students in the school consistently had higher perceptions of teacher preparedness across nearly all *CSTPs.* Given this finding and the relatively small sample size of respondents in the ASLP survey, we looked specifically at all respondents from the second quartile on percent EL students in the school to see if the higher ratings were driven by a small number of principals. We found that principals in two to four schools within the second quartile of the percent EL students in the school drove up the average for the second quartile group. Additionally, we found that the standard deviation for principal respondents in the quartile 2 of the percent EL students group approached 1.0 on nearly every *CSTP,* which was substantially larger than the standard deviations for the other quartiles (standard deviations, on average, between 0.55 and 0.80).

Figure 6 shows that principals in the third and fourth quartiles of percent of White students in the school consistently had higher perceptions of teacher preparedness across nearly all *CSTPs*. This means that principals in schools that had higher proportions of White students had higher perceptions of teacher preparedness. A similar trend is found for principals in the third and fourth quartile on percent of students proficient or above on the state standardized ELA exam (Figure 7). However, we do not see similar trends among the different quartiles of percent of students proficient or above on the state standardized mathematics exam (Figure 8).

These findings may suggest that school-level student demographics may mediate principals' perceptions of beginning teacher preparedness. However, due to the small sample size and, thus, lack of analytical power, we are not able to more deeply engage in analyses that

would better inform the magnitude and significance of this relationship. Nonetheless, if additional data were collected and made available, it would be possible to better understand whether both principals' and teachers' perceptions of teacher preparedness are associated with the schooling contexts in which they come to work.

Figure 5. Principals' Average Ratings of Teacher Preparedness in CSTPs, by Percent of EL Students in School Quartile

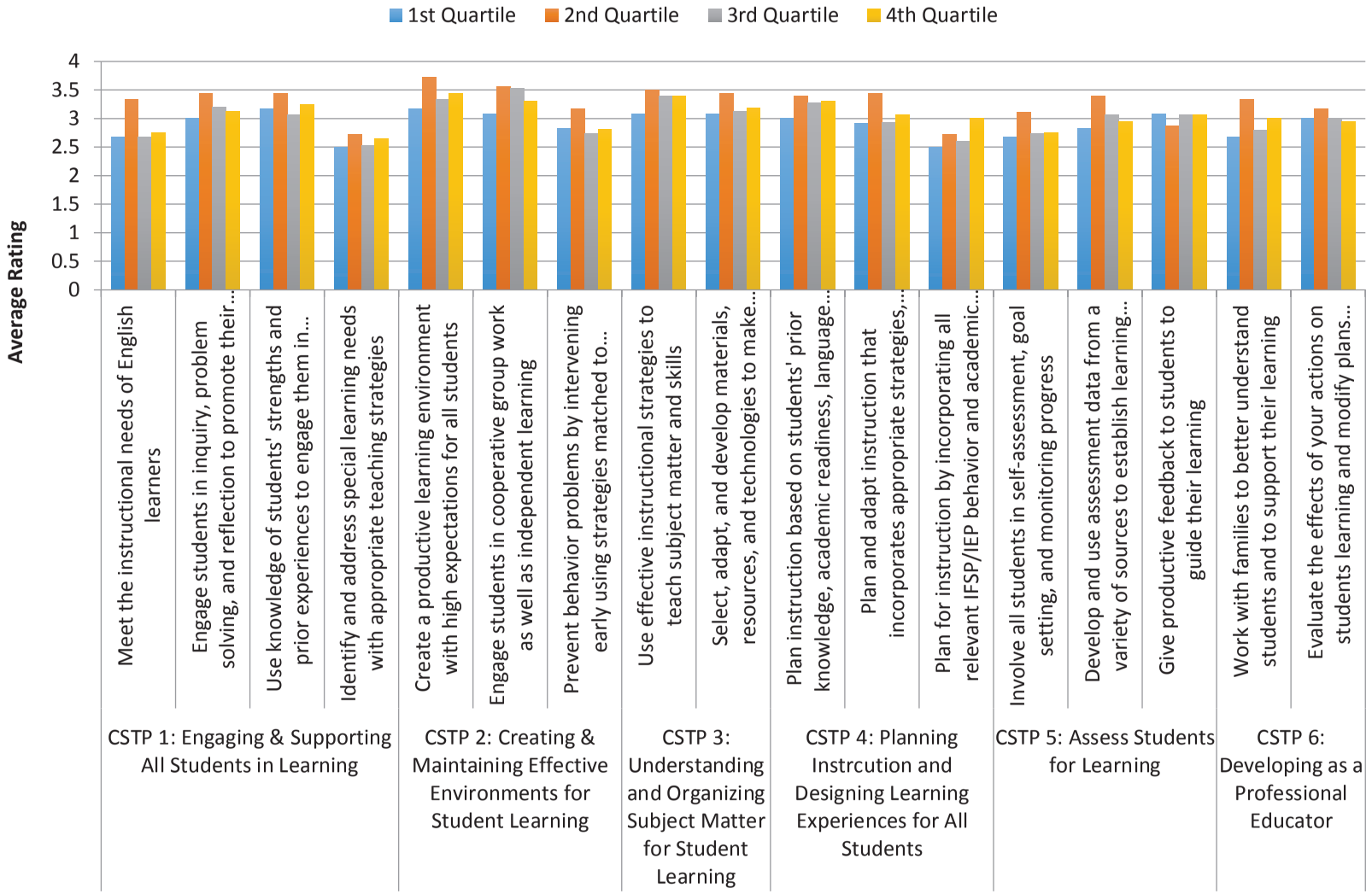


Figure 6. Principals' Average Ratings of Teacher Preparedness in CSTPs, by Percent of White Students in School Quartile

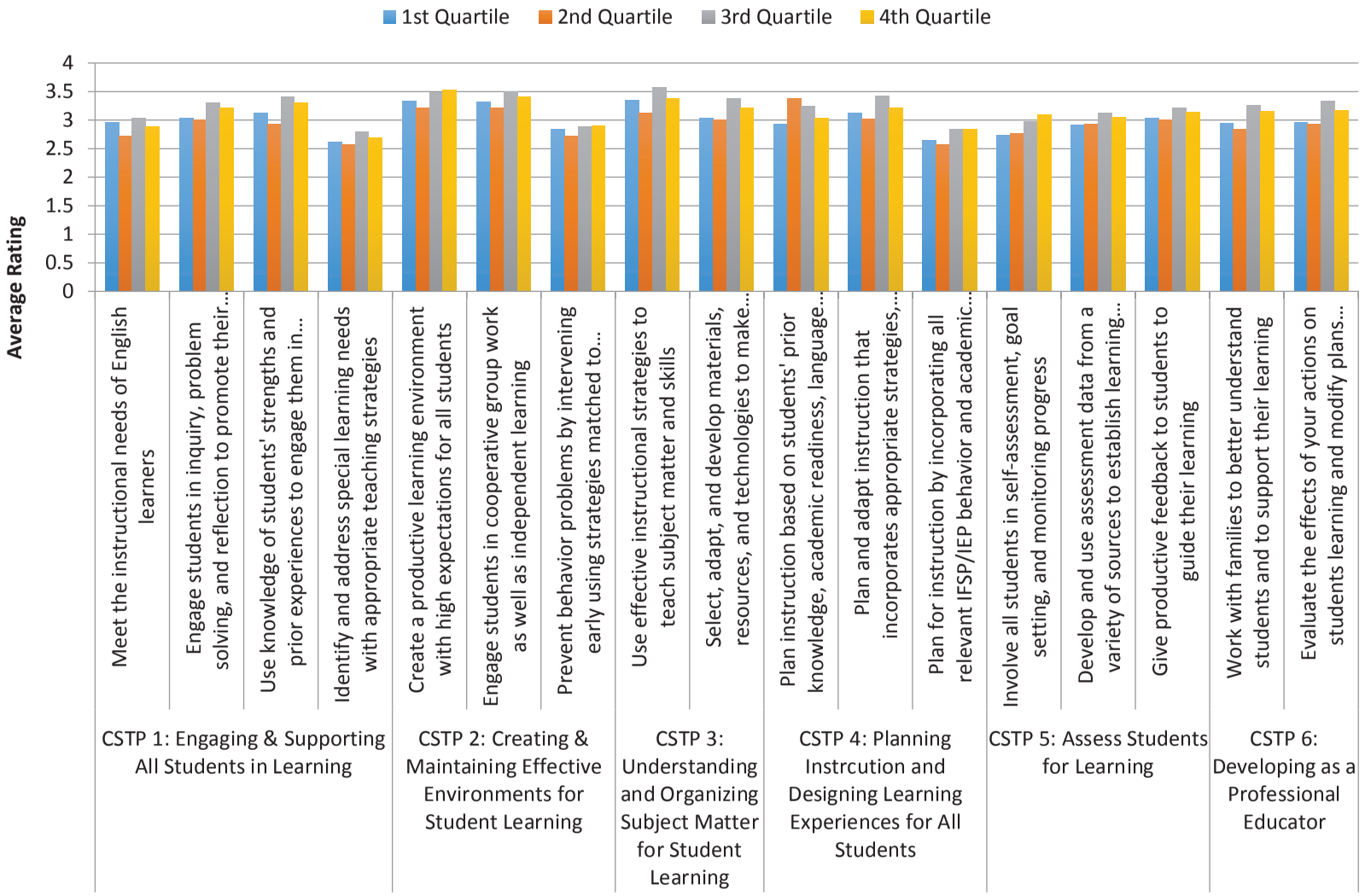


Figure 7. Principals' Average Ratings of Teacher Preparedness in CSTPs, by Percent of Students Proficient or Higher in ELA in School Quartile

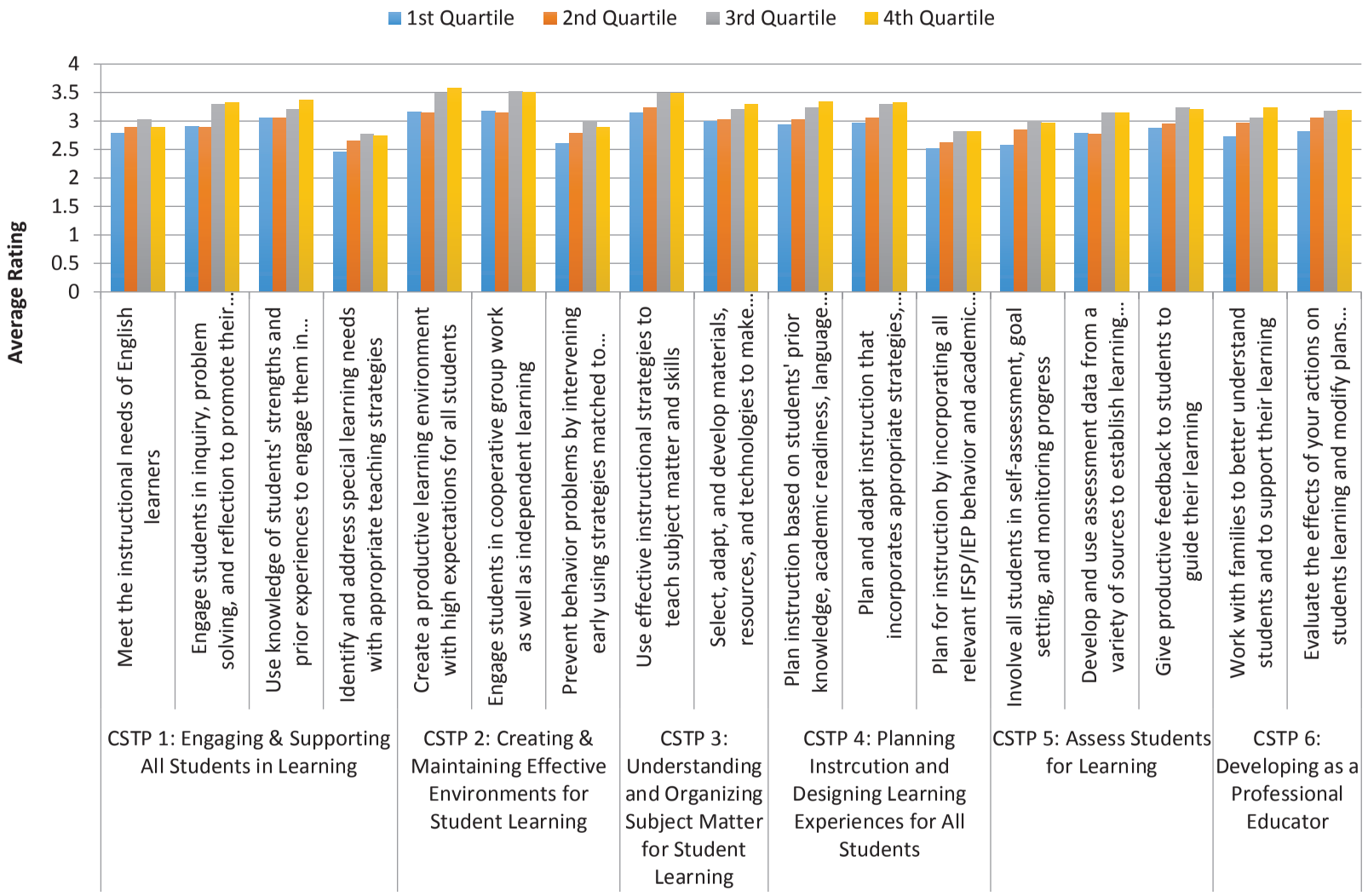
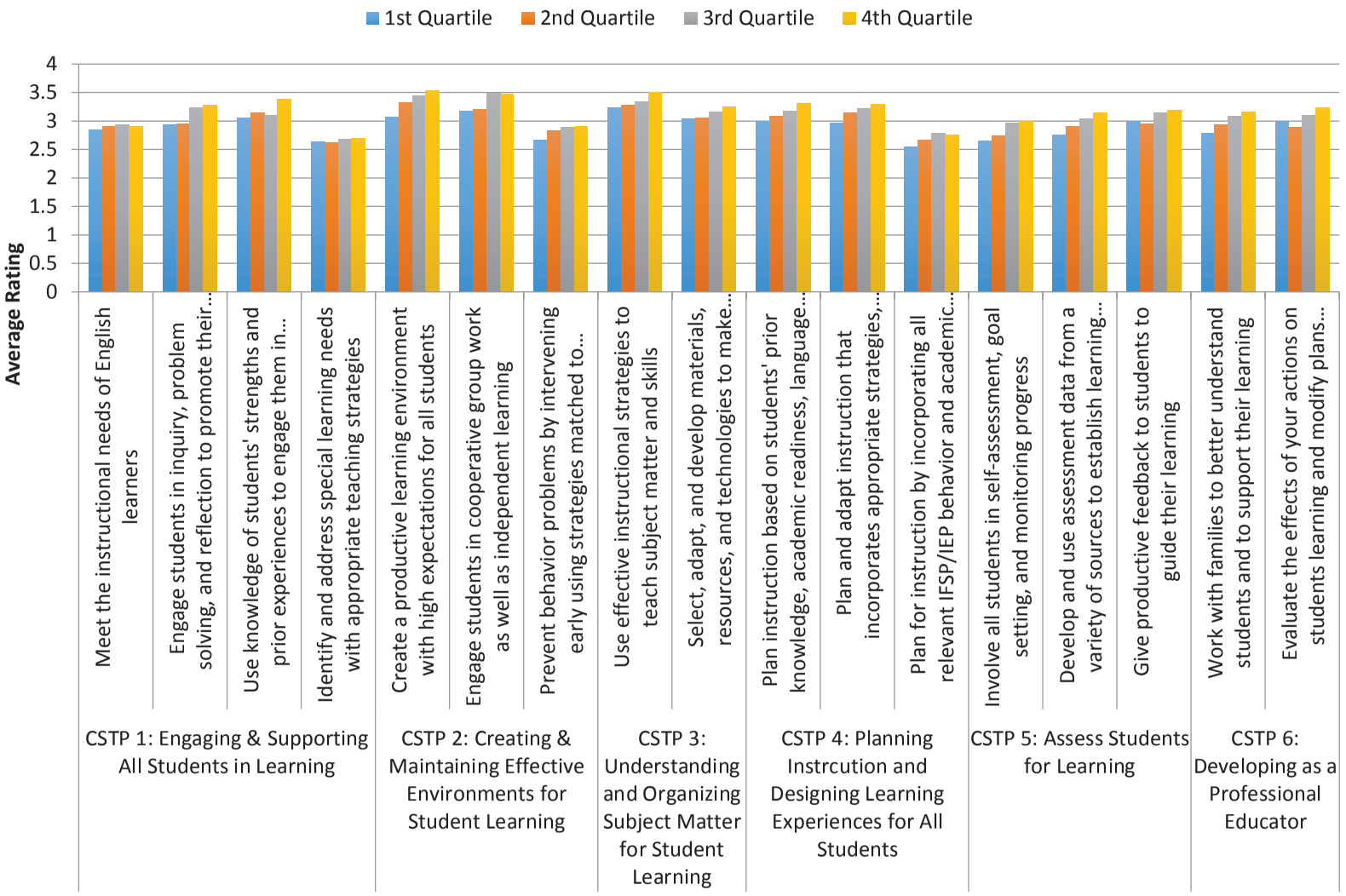


Figure 8. Principals' Average Ratings of Teacher Preparedness in CSTPs, by Percent of Students Proficient or Higher in Math in School Quartile



Data to Inform Pipeline Improvement Efforts

In recent years, much emphasis has been placed on the need to have better data to inform the improvement of teacher education nationally (Deans for Impact, 2016; Feuer et al., 2013; Southern Regional Education Board Teacher Preparation Commission, 2017). These reports, and others like them, suggest that disaggregated data related to a state's valued educational outcomes is critical to improving teacher preparation, both within TPPs and across the institutions that participate in the teacher education pipeline.

California collects and makes available a great deal of information that might be used to judge the quality of the teacher education system against the five criteria proposed previously. A full analysis of all the state's data surrounding the teacher education pipeline is beyond the scope of this paper, but we reviewed the main publicly available data sources related to the pipeline to determine the degree to which these sources provide the information needed to improve candidates' learning opportunities and outcomes. Information can support improvement efforts in two important ways, by a) allowing stakeholders assess to the level of performance on a valued outcome—or put another way, an overall level of success; and b) allowing stakeholders to identify where and for whom breakdowns in the system are happening. Assessing the level of performance on a valued outcome enables people to identify the gap between current and desired performance and can motivate improvement efforts. Data that helps identify where process breakdowns are happening and for whom helps system leaders to know where to focus their improvement efforts, and how to apply the limited time and resources they have towards high-leverage problems (Bryk et al., 2015).

Using only the publicly available data sources about the California learning to teach pipeline we find that it would be difficult to answer some of the foundational questions a policy maker, researcher, or pipeline institution leader might find central to system improvement efforts. In particular, around these foundational questions, a stakeholder would have difficulty monitoring whether the system is producing the capable novice teachers that students need or whether parts of the system are functioning as intended.

We begin by briefly summarizing the public data that are currently available. We then ask four foundational questions pertaining to the alignment of the system and its ability to prepare capable beginners. Subsequently, we describe how existing data and new data might be used to answer these questions. There are, of course, many other questions policy makers might need or want to ask of the system. The four questions we describe are illustrative examples that point to how the state might leverage data to provide the information necessary to support data-based decision making to improve the teacher education learning system.

Current Data

The California teacher pipeline system produces a plethora of data, much of which is publicly available. The data include a variety of online PDF documents indicating accreditation decisions for TPPs and induction programs; online displays of various data on the supply and demand of teachers; dashboards that display the information that is required for federal Title II reporting; and results from the CTC's annual statewide "Credential Program Completer Surveys." These data, dashboards and reports provide pipeline institutions and policy makers with important descriptive data aggregated at a relatively high level, such as the number of certificates of a specific type granted by each CTC-accredited TPP and participation and average scores of program enrollees for the various teaching assessments, including a breakdown of scores by teacher demographics. A fuller description of the publicly available data can be found in Appendix E. Most of these data are available on the CTC's website.

The Data to Support Continuous Improvement

Previously we argued that one criterion against which we might judge the teacher eduction system is the degree to which it provides critical information that is linked to the outcomes the system values. Two other critera—system alignment and the capabilty of beginning teachers – specify areas around which information for improvement would be very useful to stakeholders.

We begin with a few notes. Consistent with the current data system and standards, any additional data should take extreme care to protect individuals and maintain their confidentiality. Pipeline institutions generally have experience with treating data confidentially, protecting its transfer, and using it for appropriate purposes. All additional data that institutions might share with or link to other data sets should be subject to the same scrutiny and careful treatment as existing data. In addition, given the current achievement levels of California's students, we believe that any expansion of data collection or improvement in data reporting should focus on system improvement, as opposed to accountability.

Given these caveats, we now turn to a consideration of whether the teacher education system is performing against the criteria we have introduced in this paper. We begin a focus on assessing system alignment, framed in terms of the first two illustrative questions.

To what degree does ground level variation in institutions create unequal subject matter learning opportunities for prospective teachers in similar pathways? To help answer this question, we might start by looking at the different pass rates on various credentialing exams in teacher preparation. While we have noted that the CTC's dashboard shows limited variation in the candidate pass rates on various knowledge assessments, a recent CTC report shows significant differences between first time and cumulative passing rates at the state level (CTC, 2016a). As noted in this same report, there are differences in passing rates for candidates of different racial and ethnic backgrounds. To understand why these pass rates differ or some students have to take the assessments multiple times in order to pass, it is necessary to look at the

nature of the key educational experiences within and across pathways to ascertain what might explain the differences. Are weaknesses in content knowledge a result of gaps in novices' opportunities to learn the necessary content in their undergraduate institutions? Or did the gap begin back in their K-12 school? Or did the TPP not provide adequate learning opportunities?

The specific details about what content a specific knowledge assessment measures and where in the pipeline that knowledge should have been developed, are important. For example, recall from Figure 2 that the CBEST is often required before entering a TPP. Thus, if candidates are struggling to pass CBEST, it makes sense to examine data from their higher education and K-12 experiences to pinpoint where learning opportunities were insufficient. Similarly, the CSET assesses a candidate's subject-specific knowledge in the relevant certification area and such knowledge is frequently taught in K-12 schools and college majors. Conversely, RICA measures what a candidate knows about reading development. That knowledge likely comes almost exclusively from TPPs. Understanding where in the pipeline specific KSCs were not developed as intended and the specific groups of prospective teachers most affected, could help to target improvement efforts to the institutions most likely to be able to affect improvements. That ideally would prompt the next stages of inquiry to understand where high leverage changes could be made within the appropriate institutions to improve candidate content knowledge.

Current reports that provide the scores on the first and cumulative testing attempts, are helpful for improvement. However, the data underlying these reports is not available publicly and it is unclear whether and how such data are used by pipeline institutions. Systematic institutional data on testing could be used formatively, to support institutions as they try to understand how remediation efforts such as courses and test preparation activities are (or are not) supporting novice learning. Information about the number of attempts candidates make before passing as well as information about those who never passed would also be useful. If such data could be linked to course taking patterns, college majors, or prior/future pipeline institutions, each institution could understand its role in supporting candidate learning and ultimate success. In addition, the state's dashboards do not show key disaggregations – data at a level of detail that can help pipeline institutions understand the sources of the variation underlying the Title II data. For example, data about the extent to which types of undergraduate institutions, TPPs, or pathways help explain variation in number of testing attempts could be useful for targeting supports to the right groups of candidates and institutions. Additionally, pooling data across years makes it impossible to see how patterns change year over year.

Linked, disaggregated data would allow better diagnosis of the sources of undesirable variation. For example, if there is consensus that fail rates on CSET exams are unacceptably high, linked disaggregated data could help reveal whether fail rates are related to candidates' college majors, their course-taking patterns, or their high school experiences. Do candidates master KSCs early on and keep those KSCs differentially or did they never learn them at all? Do these learning opportunities vary by pathway (e.g., intern, traditional, etc.)? Policy makers, researchers, and leaders of pipeline institutions could all use this information to determine for whom and how to best improve content knowledge learning opportunities.

To what degree are novices working on the teaching skills most likely to improve student cognitive and non-cognitive development during induction? It is important for novices to be learning the KSCs most likely to support K-12 students' development—both cognitive and non-cognitive. These skills are identified in the CSTPs. As a candidate leaves her preservice program, the TPP is responsible for preparing an ILP identifying areas of strength and weakness that serve as the starting point in that candidate's induction program. Those plans are individualized to each candidate. As induction begins, the induction mentor and novice set measurable goals and work together to improve these specific areas of the novice's teaching practice. Individual learning plans are maintained as individual level documents, and are not publicly available in a deidentified form. Nor, to our knowledge, are they aggregated to illuminate patterns of strengths/weakness across beginning teachers by TPP or employing districts. Knowing the variation in completers' KSCs across specific practices could help TPPs and program sponsors to know whether there are certain areas in which their completers are consistently struggling; induction providers to know what supports and training mentors might need; and districts to know what types of professional development and supports might be particularly useful to novices. Finally, given the reality that many teacher labor markets are local, if there are differences between what TPPs and K-12 schools see as candidates' weakness – e.g., schools notice that novices need stronger skills working with English learners but TPPs see candidates' skills as adequate in that area—those differences are important to know and address.

There are similar foundational questions stakeholders might like to answer with existing data that concern the degree to which California's teacher education system is supporting the development of capable teachers. We now turn to the second two of four illustrative questions.

Where do we lose our most capable and desirable teachers across the pipeline? We have documented that close to 40 percent of multiple- and single-subject credentialed teachers in the state are teaching with "substandard" credentials (intern credentials, waivers, and permits) and we know that many districts in the state experience challenges in staffing classrooms periodically, and the state's most academically vulnerable students are disproportionately impacted by these shortages (Carver-Thomas & Darling-Hammond, 2017). The state collects and reports on trends related to supply and demand in the annual CTC report, which includes the number of teachers who received credentials, certificates, permits and waivers (CTC, 2017d). Specifically, it includes information about how many new credentials were issued by type, pathway, and program sponsor, TPP enrollment data, demographic data, and estimated teacher hires by region, county, and subject areas, among other information. The CTC has also recently released an Educator Supply and Demand dashboard, which displays this information (in addition to other information) online (CTC, n.d.c., n.d.d.). While useful, these resources are missing the data to help diagnose the drivers of these shortages, which could then inform improvement efforts. While teacher shortages may be a demand-side problem, i.e. driven by retention rates that are lower than desirable, the state does not have linked data that allows ongoing monitoring of the dynamics and trends associated with teacher retention. For example, what types of districts struggle most with teacher retention? Are there any types of programs that systematically produce teachers who stay in the profession? If so, which ones and how can other programs learn from these successful programs?

Data that provide insight into the nature of the supply side of the teacher labor market are also unavailable publicly. Where are the leaks in the teacher education pipeline? If we take a cohort of young people who express interest in teaching on their undergraduate applications to CSU, who opts into Liberal Studies or other majors that are common in teacher pathways? Where and when do they drop out of those pathways? How many enroll in a TPP? For those that dropout of the pipeline, what can we learn about their experiences that might help plug the major leaks in the pipeline, especially for those who could be on track to take jobs in shortage fields or are candidates of color or bilingual candidates?

Much of the data needed to answer these questions exist in administrative data sets held by TPP program sponsors and state data sets at CDE and CTC. The fields needed to link those data sets to one another also exist. However, the data sharing agreements are yet not established to link the necessary data. More than a decade ago the state planned for a teacher data system that would help with many of these questions, however, due to a series of technical and other challenges, the system was not built. [22] In recent years there has been an increased effort to at least link the data, even if there is no funding for a new online system.[23] Again, progress on this foundational question requires existing data to be linked across pipeline institutions and disaggregated to the levels deemed most useful for informing improvement.

A second question about the capabilities of beginning teachers underscores the need for linked and disaggregated data, but also illuminates the need for a reorganization of existing data.

Are there certain pathways that show evidence of producing more capable teachers? California offers different formal pathways into teaching (e.g. traditional, university intern, district intern) and is adding more, for example the Integrated Teacher Education Programs[24] and a potential new residency in special education.[25] A given TPP may play a role in several of these preparation pathways. Whatever their role, TPPs and K-12 schools provide essential opportunities to learn the specialized KSCs teachers need for teaching: integrated teaching practices, knowledge of English language development, and knowledge of reading development. Each program works on these integrated teaching practices with their own curriculum and programs verify candidate mastery over some of these practices through one of the three TPAs.

What is not systematically available is information that might provide insight into the relative capabilities of the teachers trained through different pathways—though some of this information could be available with updates to current data collection and reporting. Take for example the new CTC's Credential Program Completer Surveys, which collect statewide data

[22] https://edsource.org/2016/renewed-call-to-create-statewide-database-on-teachers/95339?utm_source=March+1+daily+digest+-+Michael&utm_campaign=Daily+email&utm_medium=email
[23] http://www.lao.ca.gov/Reports/2016/3355/prop-98-analysis-021816.pdf
[24] https://edsource.org/2017/undergraduate-education-major-banned-for-56-years-returns/585830
[25] https://edsource.org/2018/gov-browns-california-budget-proposes-fully-paying-for-k-12-funding-formula-in-his-last-year/592432

from (1) individuals recommended for a teaching credential, (2) master teachers, and (3) employers. The teacher surveys are broken down by credential type (e.g., single-subject, multiple-subject) and include data on credentialed teachers' perceptions of how effective their TPP was at developing the skills and tools necessary to become an effective teacher, with a specific focus on how well their TPP prepared them to adequately perform the six domains of teaching practice within the *CSTPs.* The master teacher surveys provide data on the perceptions of experienced teachers serving as mentors related to the extent to which the student teachers with whom they worked will step in to a classroom on the first day of work able to adequately perform the six domains of teaching practice within the *CSTPs* (CTC, 2017f). The employer surveys ask employers who have hired and seen at least two new teachers in-person over the past 3-5 years to complete a survey for a TPP from which those candidates graduated. The employer survey is focused on TPPs, not teacher candidates and asks about the degree to which program completers are prepared to teach in the six *CSTP* domains (CTC, 2017g). Response rates for all these surveys are reportedly very high (CTC, 2017e).[26]

Currently, data from the teacher, master teacher, and employer surveys are not disaggregated by type of preparation pathway (traditional, university intern, district intern) or program sponsor. Adding the option for disaggregation by pathway (and if needed some revision to the data collection to elicit responses that could be disaggregated by pathway), might provide some insight into the perceived effectiveness of these pathways and the strengths and weakness of candidates in specific pathways.

Direct assessments of KSCs provide a different lens on capabilities. The CTC dashboards show pass rates broken down by pathway for CSET, CBEST and RICA. These dashboards even can be disaggregated by all those who have "completed non-clinical courses" and "other enrollees" -- in addition to completers. As noted however, what can be learned from the data is constrained by limited variation in the publicly reported data. Another significant gap in this information concerns what candidates can actually do—i.e. their mastery of integrated teaching practices.

At the broadest level, there is evidence beginning teachers can carry out some practices that align to the *CSTPs*. This evidence comes from accreditation reports for TPPs and induction programs and the successful completion of a TPA. But there are many practices that can align with any one *CSTP* or TPE. There is no data that would help programs or other stakeholders know that all candidates can carry out any specific teaching practice before being allowed to serve as a teacher of record. Practices might include carrying out a parent teacher conference or modeling how to write a grade appropriate paragraph in ELA or managing a classroom of students through an inquiry-oriented science laboratory. Further, because professional choice regarding the specific practices candidates must demonstrate occurs in TPPs as well as induction programs, we know little about what teachers can do when they are granted their

[26] The employer survey response rate is reported as 100 percent but it is unclear whether this represents all programs in the state or simply that every employer filled out a survey for at least one program.

clear credential. While TPA data exist and are used to support recommending a novice for certification, it is not available publicly in ways that could help stakeholders improve a TPP, a cooperating K-12 district, or other pipeline institutions. To the extent that the data on the integrated teaching practices that candidates demonstrate before receiving a preliminary credential can be analyzed by pathway, there would be a particularly fruitful source of data because integrated teaching practices are meant to be developed during the TPP time. Pathway data about completers' capabilities, measured by stakeholder surveys or direct assessment, could allow policy makers to be more strategic about when and how to expand, add, or discontinue certain pathways.

In summary, our review suggests that there are important data than can be built upon, linked, specified at the level of teaching practices, and disaggregated to answer at least four foundational questions that could help California improve its teacher education pipeline. Gathering, manipulating, aggregating, or disaggregating data in ways that lead to wiser, more efficacious policy would support the state's efforts to close the wide gaps in students' learning opportunities and outcomes. While beyond the scope of this paper, we must also note that to ensure that new and improved data is used to drive improvement, the importance of timeliness and accessibility of the data cannot be understated nor can the importance of a safe professional environment for stakeholders to be transparent about where processes are not working well and take risks by making informed changes to key processes.

Conclusion & Policy Implications

This description and analysis of the teacher education system in California, which has focused on the learning progression through which candidates move from high schools through Community colleges, IHEs, California's workplaces, preparation, and induction programs, arguably reflects the CTC's conceptualization of teaching as complex interactional work carried out by well-trained professionals.

Our analysis of these well-articulated learning pathway(s) suggests there are many features that can be built upon to maximize the state's positive momentum in student achievement while also addressing the relatively low levels of student proficiency. In considering options for strengthening California's teacher education pipeline, we return to the three criteria we used to judge the effectiveness of the system: the degree to which the pipeline has aligned policy messages for stakeholders, prepares capable beginning teachers, and generates relevant data. As noted, the fourth criterion, the supply of teachers is taken up in another Getting Down to Facts II white paper and the fifth criterion is beyond the scope of this paper.

Aligned Policies

We find that California's teacher education pipeline is, at a high level, an aligned system of standards, assessments, and requirements oriented around a professional view of teaching

quality that is consistent with foundational research on teaching and learning. This alignment is the result of years of work that span more than 20 years. Policy makers should continue to protect and strengthen that alignment moving forward to maximize clear policy messages to stakeholders across the pipeline.

It is important to note, however, that while the system is aligned, the state allowed over one-third of beginning teachers in 2016-17 to be the teacher of record before having met those aligned requirements (CTC, n.d.d). So the system may or may not function as intended if half of new teachers have not actually gone through the intended system. This is a critical area for the state to investigate systematically so that is can understand the positive and negative consequences of the increased use of substandard credentials on their ultimate audience, K-12 students. It may be the case that such policies provide a much needed source of excellent teachers of color who stay in the profession or it may be that they generally serve a large group of teachers who do not complete the credential process and therefore are learning on the job, while students suffer for their inexperience and lack of skills. The state should investigate these and other potential outcomes with all due haste.

Capable Teachers

Our analysis suggests there is room for improvement in the area of the demonstrated capabilities teachers have on their first day teaching. There are five types of KSCs that beginners need for their first day, four of which focus on knowledge. The fifth KSC focuses on integrated teaching practices. We find there is standardization around the specific knowledge candidates are responsible for prior to entering the classroom, however there is much less standardization around the specific integrated teaching practices candidates are required to demonstrate before entering a classroom. This leaves stakeholders with high levels of assurance that teachers know certain things, but lower levels of assurance that all beginners can carry out the set of common practices all beginners need (Ball & Forzani, 2009). Contemporary research on teaching and learning has documented that knowledge is necessary but not sufficient for competent beginning teaching (c.f., Ball et al., 2008). It has also documented that practice-based aspects of teacher education are related to retention as well as where one student teaches (e.g., Ingersoll, Merrill, & May, 2014; Ronfeldt, 2012). California's policies have already begun to work on this issue by mandating a TPA for every novice. But there is enough variation and choice in the specific practices and topics in which candidates demonstrate skill, that policy makers might profitably consider how to better balance knowledge and capability within the learning system.

Teaching candidates primarily learn and practice *integrated teaching practices* in their TPPs and the districts in which they are placed for clinical work and subsequently in the districts in which they take jobs. Our survey evidence suggests that one area of improvement surrounds supporting general education teachers' capabilities in working with students with special needs. This is being addressed in the new TPEs, however, it is likely too early to see statewide

improvement. Said in a more general way, another implication of our work is that policy makers could consider incentivizing and supporting TPPs, districts, and induction programs to clearly articulate the specific *integrated teaching practices* they want candidates to be able to carry out and then collect data indicating whether candidates have learned those practices. Given the limited number of practices any one TPA can assess, in order for programs to see marked improvement across the 47 elements of the TPEs – a necessary condition for large scale improvement, there will need to be additional standardization efforts within programs around the focus and measurement of these novices' learning. Several CSU TPPs, in partnerships with their district partners, are already making strides in this area.

Finally, to the extent the state considers options for strengthening support for the development of KSCs, we offer the reminder that the primary institutions where teachers would be expected to learn many of the KSCs are not always the TPPs, and so the roles of institutions along the entire the pipeline require attention. This is certainly true of California's universities and community colleges who teach teachers their more advanced subject matter. And it is especially true for California's K-12 schools, who 1) teach teachers the content they eventually teach children, 2) supply the learning context and mentors for student teaching experiences or intern experiences, and 3) provide the learning opportunities and mentors who guide beginning teachers to their clear credentials during the induction period.

Relevant Data

Our review suggests that the data infrastructure in the state is not optimally targeted towards supporting understanding of key valued outcomes. Further, we do not yet have a system of high quality, linked data that can be disaggregated to the levels needed to inform understanding and action. As a result, our teacher data is limited in the extent to which it can shed light on whether and how significant ground-level variation may be influencing the system's overall success. It is also limited in its ability to support data-based improvement efforts.

Given the breadth of institutions in the teacher education system and the urgent need for improved teaching across the state, we suggest developing systems and data with a primary focus on their ability to inform improvement efforts. There is ever-increasing empirical evidence in varied fields of social science that suggests high-stakes accountability policies carry unacceptably high risks of failure and problematic unintended consequences. To paraphrase the oft-cited Campbell's law: The more a quantitative indicator is used for social decision-making, the more likely it will be to distort and corrupt the social processes it is intended to monitor. Thus, policy makers will need to make judgments about what information is most likely to provide useful improvement information for specific pipeline institutions, the CTC, citizens, and the state.

A first step toward developing data sources that can support improvement might be clarifying specific valued outcomes, given the criteria for judging the system's performance

introduced in this paper. Valued outcomes may shift over time, however, consensus around an initial set of valued outcomes could serve to focus improvement efforts in the near term. An organizational learning perspective suggests that the valued outcome itself is not enough to help focus improvement efforts and inform specific action that will lead to improvements--what is needed is insight into particular processes that make up the related systems.

Learning from other states that have made strides in their efforts towards developing robust teacher pipeline data systems offers lessons California can build on. These lessons are about starting with the development of clear theories regarding how the state will use data to help achieve valued outcomes, engaging a range of stakeholders in the development of the systems, and taking an iterative, continuous learning approach to the development process (TNTP, 2017). California's teacher learning system has many strengths that can and should be built upon in order to close the pernicious gaps the state's children experience. If California chooses to work on developing a sense of valued outcomes and orienting the teacher learning system around producing information about the state of the teacher learning across the pipeline, the state will be well on its way to developing beginners who are ready to teach all children on the first day.

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Appendix A

CKTE Physics Test | Question 8 of 21

Three questions refer to the following information.

Two students in Ms. Engel's physics class are discussing the energetics of dribbling a basketball on a wooden floor. They agree that all of the kinetic energy gets converted into elastic energy for an instant when the basketball is compressed the most. They also recognize that many objects can be modeled as springs, even basketballs and wooden floors. They are uncertain about whether there would be equal amounts of elastic energy in the ball and the floor. They call Ms. Engel over to share their ideas with her and get some help.

Marcos says, "We were thinking that when the ball compresses against the floor, the forces that the ball and the floor exert on each other would be equal and opposite, so maybe the amount of elastic energy in the floor is the same as the elastic energy in the ball."

Louisa responds, "I get that the forces are the same, but I am thinking that the ball compresses more than the floor, so shouldn't there be more energy stored in the ball?"

Marcos replies, "But the floor is more rigid and would have a higher spring constant. I think the larger k of the floor compensates for the smaller Δx in the $\frac{1}{2}k(\Delta x)^2$ equation, and the elastic energies are the same."

Question 1 of 3 is on this screen. Questions 2 and 3 are on the following screen.

Is Marcos correct that the elastic energy of the floor and the ball would be the same?

- Yes.
- No. The elastic energy of the ball would be greater.
- No. The elastic energy of the floor would be greater.
- There is not enough information to compare these energies.

In a situation with a number of interacting objects, one may select any subset of them as the system of interest. The objects that have not been selected as belonging to the chosen system are therefore external to the system.

A bowling ball is dropped from a height of 1 m above a small trampoline. It lands and stretches the trampoline downward. Describe the energy changes in this process from the time the ball is dropped until it reaches the lowest point of the motion.

For each of the following student responses, select the system for which the student response is correct.

Record your answers by clicking on the appropriate cells.

Student Response	System Choices			
	Ball and Earth	Ball and Trampoline	Ball, Earth, and Trampoline	None of these systems is consistent with the response.
First there is gravitational potential energy. Then Earth does work and the ball gains kinetic energy. The trampoline does negative work on it and we have elastic energy.				
The gravitational potential energy is converted gradually to kinetic energy as the ball falls and ends up as elastic energy.				
First there is gravitational potential energy, which is converted to kinetic energy as the ball falls. Finally, the trampoline does negative work and there is no more kinetic energy.				
There is no mechanical energy at the beginning and then Earth does positive work on the ball and it gains kinetic energy. Then the trampoline does negative work on it and kinetic energy decreases to zero.				
There is no mechanical energy at the beginning, then Earth does positive work on the ball and it gains kinetic energy. Finally, all kinetic energy goes to elastic energy.				

Appendix B

Requirements and Assessments for Single and Multiple Subject Credentials in Traditional and Intern Pathways

Knowledge, Skill, Capability	Assessment, Metric, or Requirement			
	Traditional Route		Intern Route	
	Multiple Subject Credential	Single Subject Credential	Multiple Subject Credential	Single Subject Credential
Basic knowledge and skills	High school diploma, bachelor's degree	High school diploma, bachelor's degree	High school diploma, bachelor's degree	High school diploma, bachelor's degree
	Pass the CBEST with a score of at least 41 on the reading, writing, and math sections or a score as low as 37 on an individual section if total scaled score is at least 123. OR	Pass the CBEST with a score of at least 41 on the reading, writing, and math sections or a score as low as 37 on an individual section if total scaled score is at least 123. OR	Pass the CBEST with a score of at least 41 on the reading, writing, and math sections or a score as low as 37 on an individual section if total scaled score is at least 123. OR	Pass the CBEST with a score of at least 41 on the reading, writing, and math sections or a score as low as 37 on an individual section if total scaled score is at least 123. OR
	Pass the CSET multiple subjects + writing with a score of 220 per subtest OR	Pass the CSET multiple subjects + writing with a score of 220 per subtest OR	Pass the CSET multiple subjects + writing with a score of 220 per subtest OR	Pass the CSET multiple subjects + writing with a score of 220 per subtest OR
	Pass the CSU Early Assessment Program with a score of 'college ready' or 'exempt' or the CSU Placement Examinations with a score of 50 on math and 151 on English OR	Pass the CSU Early Assessment Program with a score of 'college ready' or 'exempt' or the CSU Placement Examinations with a score of 50 on math and 151 on English OR	Pass the CSU Early Assessment Program with a score of 'college ready' or 'exempt' or the CSU Placement Examinations with a score of 50 on math and 151 on English OR	Pass the CSU Early Assessment Program with a score of 'college ready' or 'exempt' or the CSU Placement Examinations with a score of 50 on math and 151 on English OR
	Achieve scores of 550 in math and 500 in English on the SAT or scores of 23 in math and 22 in English on the ACT OR	Achieve scores of 550 in math and 500 in English on the SAT or scores of 23 in math and 22 in English on the ACT OR	Achieve scores of 550 in math and 500 in English on the SAT or scores of 23 in math and 22 in English on the ACT OR	Achieve scores of 550 in math and 500 in English on the SAT or scores of 23 in math and 22 in English on the ACT OR

	Achieve a score of 3 or higher on the College Board AP English exam and AP Calculus or AP Statistics exam OR	Achieve a score of 3 or higher on the College Board AP English exam and AP Calculus or AP Statistics exam OR	Achieve a score of 3 or higher on the College Board AP English exam and AP Calculus or AP Statistics exam OR	Achieve a score of 3 or higher on the College Board AP English exam and AP Calculus or AP Statistics exam OR
	Pass a basic skills exam from another state	Pass a basic skills exam from another state	Pass a basic skills exam from another state	Pass a basic skills exam from another state
Content knowledge	Achieve passing score on appropriate subject matter CSET examination(s), which include a score of 220 on Subtest I (reading, language and literature; and history and social science), a 220 on Subtest II (science and mathematics), and a 220 on Subtest III (physical education, human development, and visual and performing arts) OR	Achieve passing score on appropriate subject matter CSET examination(s) OR	Achieve passing score on appropriate subject matter CSET examination(s), which include a score of 220 on Subtest I (reading, language and literature; and history and social science), a 220 on Subtest II (science and mathematics), and a 220 on Subtest III (physical education, human development, and visual and performing arts) OR	Achieve passing score on appropriate subject matter CSET examination(s) OR
	Complete a CTC-approved elementary subject-matter program or its equivalent and obtain verification of completion from authorized person in the education department of a California college/university with an accredited program	Complete a CTC-approved subject-matter program or its equivalent and obtain verification of completion from authorized person in the education department of a California college/university with an accredited program	Complete a CTC-approved elementary subject-matter program or its equivalent and obtain verification of completion from authorized person in the education department of a California college/university with an accredited program	Complete a CTC-approved subject-matter program or its equivalent and obtain verification of completion from authorized person in the education department of a California college/university with an accredited program
Knowledge of reading development	Pass the RICA	None required	Pass the RICA	None required
Knowledge of EL development	Satisfy the Developing English Language Skills, including Reading requirement, by completing a	Satisfy the Developing English Language Skills, including Reading requirement, by completing a	Satisfy the Developing English Language Skills, including Reading requirement, by	Satisfy the Developing English Language Skills, including Reading

	comprehensive reading instruction course that includes; systematic study of phonemic awareness, phonics, and decoding; literature, language and comprehension; and diagnostic and early intervention techniques	comprehensive reading instruction course that includes; systematic study of phonemic awareness, phonics, and decoding; literature, language and comprehension; and diagnostic and early intervention techniques	completing a comprehensive reading instruction course that includes; systematic study of phonemic awareness, phonics, and decoding; literature, language and comprehension; and diagnostic and early intervention techniques	requirement, by completing a comprehensive reading instruction course that includes; systematic study of phonemic awareness, phonics, and decoding; literature, language and comprehension; and diagnostic and early intervention techniques
Integrated teaching practices	Pass the TPA selected by credential program	Pass the TPA selected by credential program	Pass the TPA selected by credential program	Pass the TPA selected by credential program
US Constitution	Complete a course (2 semesters or 3 quarters) in the provision and principles of the U.S. Constitution OR	Complete a course (2 semesters or 3 quarters) in the provision and principles of the U.S. Constitution OR	Complete a course (2 semesters or 3 quarters) in the provision and principles of the U.S. Constitution OR	Complete a course (2 semesters or 3 quarters) in the provision and principles of the U.S. Constitution OR
Additional Requirements	Pass an examination given by a regionally-accredited college or university	Pass an examination given by a regionally-accredited college or university	Pass an examination given by a regionally-accredited college or university	Pass an examination given by a regionally-accredited college or university
			District that employs intern must have developed and implemented a Professional Development Plan in consultation with a CTC-approved TPP. The district intern must have been assisted and guided throughout the training program by either a person designated as a mentor teacher, a teacher selected through a competitive process, or a person employed by the TPP to supervise student teachers. A current Professional Development	District that employs intern must have developed and implemented a Professional Development Plan in consultation with a CTC-approved TPP. The district intern must have been assisted and guided throughout the training program by either a person designated as a mentor teacher, a teacher selected through a competitive process, or a person employed by the TPP to supervise student teachers. A current Professional

			Plan must be on file at the CTC office before the District Intern Credential will be issued. The Plan must include: 1) prior to beginning daily teaching responsibilities, individuals must complete either 120 clock-hours of training in child development & the methods of teaching the subjects and grade levels to which the district intern is assigned OR six semester units of coursework in the same areas; 2) additional instruction in child development and teaching methods during the first semester of employment for interns employed in K-6; 3) instruction in the culture and methods of teaching English learners during the first year of employment for interns who are employed in bilingual classrooms; 4) courses or training as determined by the governing board of the school district; and 5) successful annual evaluation of the intern's performance	Development Plan must be on file at the CTC office before the District Intern Credential will be issued. The Plan must include: 1) prior to beginning daily teaching responsibilities, individuals must complete either 120 clock-hours of training in child development & the methods of teaching the subjects and grade levels to which the district intern is assigned OR six semester units of coursework in the same areas; 2) additional instruction in child development and teaching methods during the first semester of employment for interns employed in K-6; 3) instruction in the culture and methods of teaching English learners during the first year of employment for interns who are employed in bilingual classrooms; 4) courses or training as determined by the governing board of the school district; and 5) successful annual evaluation of the intern's performance

Appendix C

CA High School Graduation Requirements

California *Education Code 51225.3* states that all pupils receiving a diploma of graduation from a California high school must have completed all of the following courses, while in grades nine to twelve, inclusive:

- Unless otherwise specified, each course shall have a duration of one school year:
    - Three courses in English
    - Two courses in mathematics, including one year of Algebra I (*EC Section 51224.5*)
    - Two courses in science, including biological and physical sciences
    - Three courses in social studies, including United States history and geography; world history, culture, and geography; a one-semester course in American government and civics, and a one-semester course in economics
    - One course in visual or performing arts, foreign language, or commencing with the 2012-13 school year, career technical education. For the purpose of satisfying the minimum course requirement, a course in American Sign Language shall be deemed a course in foreign language
    - Two courses in physical education, unless the pupil has been exempted pursuant to the provisions of *EC Section* 51241
- Other coursework adopted by the local governing board of the LEA

Appendix D

RAND American Educator Panels

Technical Documentation for the Stanford University's Getting Down to Facts II study October 2017 Survey: RAND American Teacher Panel and American School Leader Panel

Background

Stanford University (Stanford) contracted with the RAND Corporation to field a survey to the RAND American Teacher Panel (ATP) in October 2017. The RAND ATP and ASLP is are nationally representative panels of K-12 public school teachers and principals who have agreed to participate in online surveys several times each school year. The panels include teachers and principals in every state to provide national estimates, as well as oversamples in twenty-two states to provide state-level estimates in these states. More information about the ATP is available at https://www.rand.org/education/projects/atp-aslp.html

California is one of the states where teachers and principals were oversampled. The ATP California oversample was collected using a single-stage sampling technique. That is, teachers were sampled from a comprehensive database that served as a sampling from of all eligible teachers in CA. Note, however, that there was some moderate oversampling of inexperienced teachers and teachers of core subjects such as math and ELA – otherwise, teachers were sampled with equal probability. The ASLP California oversample was also collected in a single-stage manner; however, there was no oversampling of specific types of administrators.

The surveys target teachers and principals in California. As of October 2017, the ATP and ASLP consisted of 800 teachers and 1037 principals, respectively. The RAND ATP and ASLP team invited all CA teachers and principals to take the respective survey.

Survey schedule

Date/s	Activity
October 27, 2017	Field start date
October 26, November 2-8-14-21-28, December 13, January 3	Reminder email dates
November 20, 2017	Reminder letters mailed to ASLP non-responders
January 5, 2018	Field period closed

Final Response Rates

Of the 800 teachers sampled, 459 were determined complete and weighted in the final data set. The final response rate for teachers was 57.4 percent. Of the 1037 teachers sampled, 318 were determined complete and weighted in the final data set. The final response rate for principals was 30.7 percent. For the ATP survey, anyone who responded to more than 10 percent of the items for which they were eligible received a weight. This low threshold was used due to the relative lack prevalence of item nonresponse on this survey. For the ASLP survey, the threshold was 20 percent.

Sampling Weights

Sampling weights were generated for the Stanford survey and these weights are provided in the data file. There are two primary reasons to weight the RAND ATP and ASLP data.

First, the weights help to adjust for nonresponse (at both the panel recruitment and survey stages). So if, for example, we had relatively fewer elementary school teachers respond than middle school teachers, the weights will reconcile this response differential.

Second, Stanford's interest is in a representative sample of California teachers and principals. The ATP and ASLP have oversampled certain types of educators (e.g., inexperienced educators) for a variety of reasons throughout the development of the panels. Weights also adjust for such oversampling.

Survey weights are calculated by first determining initial weights, which (briefly speaking) are based on sampling and enrollment/response probabilities. These initial weights are then calibrated so that the weighted sets of survey respondents match the national population of teachers and principals based on several school-level (e.g., school size, level, urbanicity, socio-demographics) and individual-level (e.g., gender, education, experience) characteristics. Weights are calibrated to match known national-level totals for these characteristics that are found using the National Center for Education Statistic's Common Core of Data and Schools and Staffing Survey reports.

To facilitate estimation of uncertainty levels (e.g., standard errors) through the use of a jackknife, replication weights were calculated. The ATP and ASLP were each segmented into 80 jackknife replication groups. Each group has 1/80th of the respective panel excluded, and each panelist is excluded from one (and only one) group. A separate set of weights is calculated for each replication group by applying the weighted processes above to the respective group (while ignoring any panelist excluded for the respective group). Therefore, there are 80 sets of replication weights. Note that panelists excluded from a replication group receive a weight of zero for the respective set of replication weights.

Appendix E

Publicly Available Data Sources

TPP Accreditation Reports

First, state-level data include publicly available annual reports from the CTC Committee on Accreditation. These reports list TPP accreditation decisions for all programs that received a visit or revisit from the CTC Committee on Accreditation. However, in order to understand why a TPP did not receive full accreditation but, rather, accreditation with stipulations, major stipulations, probationary stipulations, or with a 7th year report, one must visit a separate CTC accreditation report website. Moreover, TPPs that gain CTC accreditation do not necessarily meet all Common and Program standards required by the CTC Committee on Accreditation. To understand which Common and Program Standards a TPP has not fully met, one must visit the separate CTC accreditation report website and click on individual TPP accreditation reports. Accessing this data provides insight into whether a TPP is lacking in preparing teacher candidates in some KSCs that teachers need on their first day in a classroom. For example, in a review of one TPP that was accredited with stipulations, we learned that the School of Education did not have consistent, accurate, timely or reliable advisement of teacher candidates, an important aspect of a teachers' preparation. Accreditation reports do not contain candidate outcome data that could be used to judge the degree to which a program met its goals. Such data might include, for example, candidate perception data or information about the progress through the program of teachers of color or the demonstrated improvement of learning opportunities to address gaps in candidate's KSCs.

The accreditation reports include select disaggregated program level data that is useful for some purposes but not others. Depending on the state's goals, the current reports may or may not be useful. It is worth noting that at the state level, there is no single database that would allow a researcher, policy maker, the public and other interested stakeholders to easily explore, compare and contrast TPPs' success in meeting the CTC Committee on Accreditation's preconditions, Common Standards and Program Standards.[27] Such information would be necessary for stakeholders interested in streamlining or strengthening accreditation requirements or even understanding how programs respond to various accreditation recommendations.

[27] **Preconditions** are requirements grounded in statute, regulations and/or Commission policy. **Common Standards** address aspects of program quality that cross all approved educator preparation programs within an institution and demonstrate that the program sponsor has sufficient infrastructure to support each program's successful implementation. **Program Standards** address the quality of program features that are specific to preparation for a given credential, such as curriculum, field experiences, and knowledge and skills to be demonstrated by candidates in the specific credential area.

Induction Accreditation Reports

We were not able to locate annual (or occasional) state-level CTC induction accreditation report similar to the TPP accreditation high-level reports that aggregate information above the level of program; however, the accreditation reports of individual induction programs are available.[28] Just as with the TPP accreditation reports, the induction reports specify whether the program met accreditation standards and what the specific issues were, if standards were not met. The reports also contain detailed program information – e.g., what curriculum is used, whether the program partners with the New Teacher Center, the nature of the K-12 student community, etc. The reports also note how many teachers the program has served. The accreditation reports we reviewed did not contain any systematic information that linked these details to valued outcomes, e.g., beginning teachers' views of the support they receive in the program or documentation of beginners' learning over time. Just as with the TPP accreditation reports, the current reports might be useful, depending on the state's goals. As they stand, they might be useful for learning what is in a specific program as well as who the program serves. In their current state of disaggregation, however, they would not be useful for understanding induction program strengths and weaknesses at a system-level or even within a particular geographic area. If any large scale analysis were to be done, all of the text information would need to be put into a database capable of serving that purpose.

Annual Teacher Supply Report

A third source of publicly available information is the annual CTC report on the number of teachers who received credentials, certificates, permits and waivers (CTC, 2017d). The report's goal, which is mandated by AB 471, is to provide essential information on the teacher supply. Specifically, the report provides details "on the number of teachers who received credentials, authorizations, permits and waivers. […] The report responds to the requirements specified in statute and provides a tool for policymakers and others interested in teacher supply." (CTC, 2017d, p.1). It includes information about how many new credentials were issues by type, pathway, and program sponsor, TPP enrollment data, demographic data, and estimated teacher hires by region, county, and subject areas, among other information. The CTC has also recently released an Educator Supply and Demand dashboard which displays this information (plus some additional information) online (CTC, n.d.c., n.d.d.).

Title II Dashboard and Reports

A fourth source of publicly available teacher pipeline data is the state Title II data dashboard, which displays data that are mandated pursuant to the Title II of the Higher Education Opportunity Act. The online dashboard provides topline data as it relates to GPA requirements; distributions of TPP completers by preparation pathway (traditional, university intern, district intern) and subject area; pass rates for required assessments; gender and ethnicity distributions of students enrolled in TPPs, by preparation pathway; and supervised

[28] See https://info.ctc.ca.gov/fmp/accreditation/accreditation_reports.php#LEA for induction reports at the bottom of the site, under "district intern programs and other programs".

clinical experience details (e.g., average number of clock hours of supervised clinical experience required at different time points), by preparation pathway. Data from the annual CTC report on teacher credentials are also provided in the Title II data dashboard file. There is an annual report to the legislature required by Title II (Public Law 110-315, 2008) that aggregates these data to the state level. There is also downloadable data for the last two years that can be disaggregated by all of the variables listed for the topline data.

One piece of data that was not available in the previously described CTC report on teacher credentials but that is available in the Title II report is the number of credentialed teachers broken down by academic major. This data is a good step towards elongating the teacher preparation pipeline reporting to include data on teacher candidates' undergraduate education. Yet, the data is disaggregated only at the preparation pathway level (traditional, university intern, district intern), not, for example at the TPP level. As such, it is not possible to explore questions such as the extent to which a teachers' high school experience or undergraduate major, for example, are related to her success in completing her preparation program or induction requirements.

Credential Completer Surveys

A fifth source of publicly available data already mentioned is the CTC's "Credential Program Completer Surveys," which are data from statewide surveys of (1) individuals recommended for a teaching credential (2) master teachers and (3) employers. The teacher surveys are broken down by credential type (e.g., single subject, multiple subject) and include data on credentialed teachers' perceptions of how effective their TPP was at developing the skills and tools necessary to become an effective teacher, with a specific focus on how well their TPP prepared them to adequately perform the six domains of teaching practice within the *CSTPs*. Response rates for the teacher surveys are high (CTC, 2017e). The master teacher surveys provide data on perceptions of the extent to which the student teachers with whom they worked will step in to a classroom on the first day of work able to adequately perform the six domains of teaching practice within the *CSTPs* (CTC, 2017f). The employer surveys ask employers to complete a survey for a program from which they have hired at least two teachers in the past five years. The employer survey is focused on preparation programs, not teacher candidates and asks about the degree to which program completers are prepared to teach in the six *CSTP* domains (CTC, 2017g). The employer survey response rate is 100 percent but it is unclear whether this represents all programs in the state or simply that every employer filled out a survey for at least one program, which could mean there is a good deal of missing data for small programs or programs for whom the administrator did not hire at least two teachers in the past five years.

Data from the teacher, master teacher, and school leader surveys are not disaggregated by type of preparation pathway (traditional, university intern, district intern) or program sponsor. Moreover, the surveys specifically ask how well *TPPs* prepare teachers, and do not address the extent to which a teacher's undergraduate or high school education may also

contribute toward their preparation as a teacher who can adequately perform some domains of teaching practice within the *CSTPs*.