LEARNING FIRST

Teaching our teachers: a better way

Using K-12 curriculum to improve teacher preparation

Paper 3 in a series on improving initial teacher education drawing on the work of a global Community of Practice

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Learning First is a global organization of researchers, consultants, policy advisors and teachers. We work closely with education leaders in Australia and around the world to tie policy reform at the highest level of government to deep change in the classroom. For more information, please visit www.learningfirst.com.

Learning First conducted the analysis presented in this report. The interpretations of how these systems operate are the authors', and do not necessarily represent the views or official positions of governments or officials in the systems analyzed.

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Series preface

In September 2015, Learning First formed a Community of Practice (CoP) to tackle the obstacles that undermine reform of initial teacher education (ITE). The CoP bought together teams of providers and system leaders from Brazil, Finland, Australia, and the United States, including the Florida and Tennessee Departments of Education, Relay Graduate School of Education, the National Center for Teacher Residencies, TNTP, and USPREP/Texas Tech University.

Over a two-year period, each team piloted an ITE reform and had access to international convenings, experts, research, and case studies to assist them. The pilots examined various aspects of teacher preparation and early career development, including induction and mentoring, program site reviews, building teacher content knowledge, use of data for program improvement, partnerships between districts and providers, and teacher educator pedagogies and professional development.

All teams focused on a specific element of teacher preparation that concerned their daily work. All believed that working in partnerships with stakeholders was the way to get the most improvement. No one believed they could do this alone. Partnerships are not easy, and the experiences of all teams in the CoP highlight that reform in teacher preparation is complex work. We have learned lessons that reflect the challenges of ITE reform around the world.

This set of papers both sets out what we have learned about creating partnerships to reform teacher preparation, and combines these lessons with global best practice and research on teacher development. An introductory paper, *Connecting teacher preparation and practice*, looks at how to form partnerships to improve the learning of beginning teachers. It recommends that partnerships develop:

1. A common language and approach that explicitly connects *how teachers learn* in initial teacher education, how they learn in professional development, and what they do every day in classrooms;
2. A shared understanding of *what new teachers need to learn* that comes from K-12 curriculum

The second paper, *Developing partnerships to improve teacher preparation*, provides a continuum for the development of partnerships and the role districts and providers play in creating them. It explains that what we already know about good adult and teacher learning and K-12 curriculum provides a clearer starting point for productive collaboration than is often realized.

The third and fourth papers go further into the detail of developing partnerships to improve the learning of beginning teachers. *Using K-12 curriculum to improve teacher preparation* explores how K-12 curriculum can be used to deepen partnerships and improve beginning teacher learning. *Continuous improvement in teacher education* discusses how providers, partners, and systems can use data and improvement cycles to improve how they train prospective teachers. The papers include examples that describe the work, and lessons from each CoP team's pilot.

We hope these lessons will help others to improve initial teacher education in the United States and around the world. These papers are not blind to the barriers to reform, but they also highlight the great opportunities that now exist to produce lasting, beneficial change to relationships between teacher educators, districts and schools and, through these partnerships, to teacher development and student learning.

Overview

This paper discusses the challenges and opportunities of using K-12 curriculum to improve beginning teacher learning in the United States and other systems. Since the term curriculum is often ill-defined and contentious, the paper starts by providing a brief definition of curriculum (at least for the purposes of this paper), and then outlines the common challenges that make it difficult for teacher education providers to better incorporate K-12 curriculum into their programs.

Around the world, high-quality curriculum is critical to the way high-performing school systems prepare teachers. A clear and detailed K-12 curriculum on which to base initial teacher education gives places such as Singapore and Finland a strong advantage. In these high-performing systems, questions such as what content knowledge or pedagogical content knowledge should be taught in initial teacher education are answered with the K-12 curriculum. These questions do not lead to abstract discussions the way they do in the US. Curriculum explicitly connects teacher preparation to the classroom, and it helps new teachers to learn by providing them with concrete examples of how to teach content and assess student learning against student achievement standards.

In the United States, Australia, and many other systems, by contrast, new teachers regularly talk of the disconnect between teacher education and the classroom. Ideas presented in teacher preparation tend to be abstract, and new teachers must figure out for themselves the practical ways to use curriculum in their classrooms. As a result, many new teachers say their training lacks relevance and that they have not acquired the skills needed to improve student learning in specific subjects.

The array of curriculum materials taught in American and Australian schools, and the autonomy that individual schools and even teachers have over what materials they use, make it harder to prepare new teachers using K-12 curriculum. Yet examples cited in this paper are showing that it is possible to use high-quality curriculum to improve teacher learning. The improvements that can come from using K-12 curriculum in teacher preparation far outweigh the logistical challenges.

With the challenges in mind, the paper poses three questions that providers might consider in relation to their use of curriculum to improve prospective teacher learning:

1. Is there detailed guidance – either from our state, district, or national standards organizations – that we can use to help teach our candidates how to interpret achievement standards and plan coherent sequences of instruction?
2. What do we need to teach candidates about recognizing and selecting high-quality curriculum materials in our local context, and are there tools to help with this?
3. Can we implement high-quality curriculum materials as teaching tools in our courses? If so, how do we select and use these materials? What do we teach candidates about adapting and using these materials in classrooms?

The paper concludes by identifying some opportunities for providers and their state, district and school partners to better use K-12 curriculum to improve connections between preparation and practice, and some options for state systems to create incentives for this to happen.

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1 What is curriculum?

Curriculum is a complex and contentious topic in many systems such as the United States, where teachers have a high level of autonomy over materials used in their classroom, and where debates over what students learn in school quickly turn political and ideological. Box 1 explains how this paper defines curriculum.

Box 1: What do we mean by "curriculum"?

In this paper, curriculum means K-12 school curriculum, not ITE program content (sometimes referred to as ITE curriculum). The paper uses several important terms, defined here.

Achievement standards are expressions of the goals of student learning, typically at the state or federal level. Achievement standards outline what we expect students to know and be able to do at different stages of schooling, usually expressed in year levels.[1] The Common Core State Standards in the United States[2] are an example of achievement standards.

K-12 curriculum is the means to achieve the goals expressed in the achievement standards. Steiner and colleagues (2017, p 6) define curriculum as the "lead set of materials teachers use to deliver content to students in a given subject area", including lesson plans and activities, scope and sequence documents, textbooks, computer programs, and associated pedagogical guidance for teachers.

We split the components of K-12 curriculum into curriculum guidance and curriculum materials.

We define **curriculum guidance** as supporting documents that help teachers understand and apply what is in the achievement standards. Learning progressions, developmental continuums, scope and sequence documents, and unit goals and plans are examples of curriculum guidance documents. Box 5 contains examples of curriculum guidance documents from Louisiana.

Curriculum materials are the instructional materials teachers use to help students achieve the learning goals set out in the achievement standards. Common curriculum materials include textbooks, student assignments, assessment tasks and scoring rubrics, computer programs, and lesson plans.

Systems around the world provide varying levels of curriculum support to teachers. High-performing systems tend to provide comprehensive curriculum support, but this support looks different depending on the system. Some systems provide detailed, quality-assured curriculum materials like textbooks, lesson plans, and assessments to support the rigorous enactment of the curriculum in classrooms.[3] Other systems are less prescriptive but provide curriculum guidance documents such as learning progressions and unit goals to enable teachers to develop their own curriculum materials aligned with the achievement standards.[4]

Many high-performing systems ensure teachers have access to standards-aligned curriculum resources (see Figure 1 below for an illustration of how curriculum resources are aligned to achievement standards). However, they do not make them compulsory to use. Teachers are expected to implement, adapt, and update the resources to support the learning needs of their students, and candidates are introduced to the resources and how to use them during preparation. Most high-performing systems include teachers – as well as teacher educators and researchers – in the development of curriculum resources.[5]

[1] Houchens, 2017. Note that achievement standards are referred to as 'curriculum' in other systems. For example, the Australian Curriculum is a set of achievement standards.

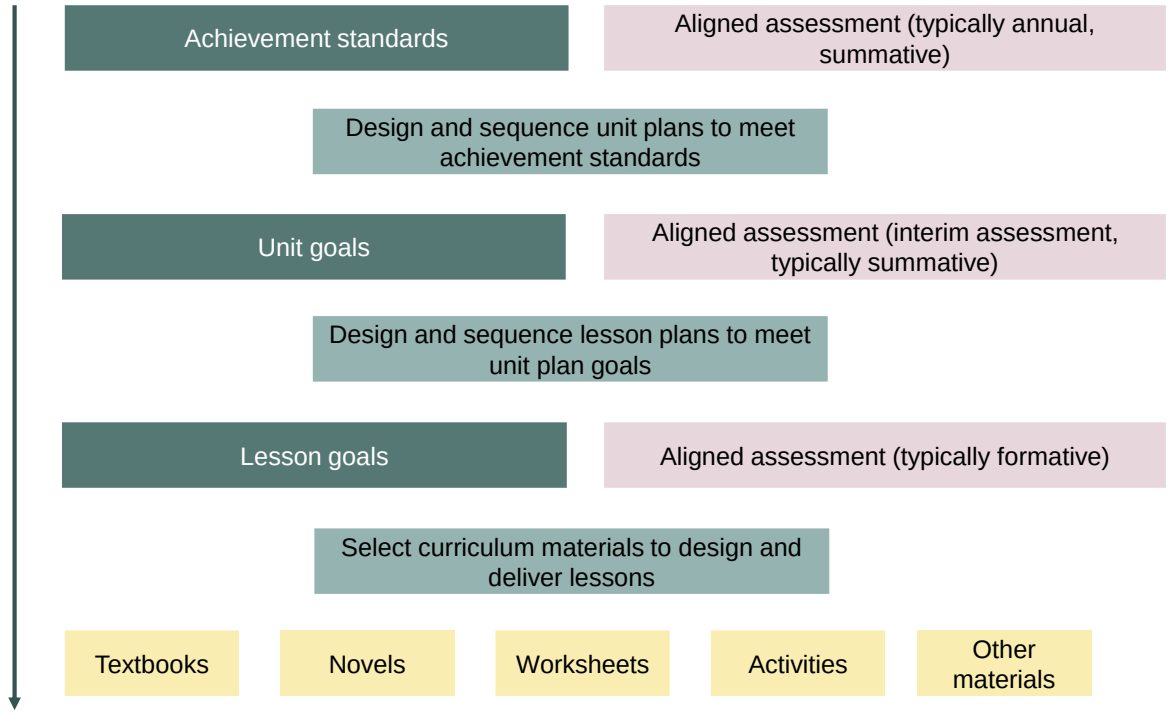
[2] Though there is no national curriculum in the United States, the federal Department of Education has incentivized states to adopt "college and career ready standards." To date, 45 states and the District of Columbia have done so by adopting the Common Core State Standards, which were developed by a consortium of states. While the U.S. Department of Education has encouraged states to adopt high standards, curriculum – how the standards should be taught in classrooms – remains a state and local matter. For more information see the US Department of Education's page on College- and Career-Ready Standards.

[3] C. Lewis & Takahashi, 2013; Jensen, Roberts-Hull, Magee, & Ginnivan, 2016; Magee & Jensen, Forthcoming; Oates, 2014. See for example Japan's courses of study defined by the Ministry of Education, Culture, Sports, Science and Technology.

[4] Magee & Jensen, Forthcoming. See for example British Columbia's curriculum overview and how the national core curriculum is used in Finland.

[5] Jensen et al., 2016; Magee & Jensen, Forthcoming; Ota, 2000; Vitikka, Krokfors, & Hurmerinta, 2012

Figure 1: Aligning curriculum resources to achievement standards



Source: Magee & Jensen, Forthcoming

2 Why must K-12 curriculum be part of teacher preparation?

Teachers must prioritize, sequence, and break down what they need to teach in their classrooms. Good curriculum guidance and materials help teachers – especially beginners – to do so more effectively. [6] When combined with strong mentoring and practice, good curriculum resources help novice teachers to develop deep, subject-specific, and applied teaching competencies, often referred to as pedagogical content knowledge.[7]

Researchers and policymakers in the US and across most of the OECD have regularly underplayed the central role of the K-12 curriculum to education reform. This is true for many areas of education, particularly teacher education and development. The K-12 curriculum plays a critical role in the creation, refinement, and operation of teacher preparation and development in high-performing systems such as Finland, Japan, and Singapore. These systems connect teacher education to classroom practice through curriculum and make the rigorous study of K-12 curriculum, including learning progressions, quality-assured textbooks, or exemplar lesson plans core to their teacher education programs.[8] K-12 curriculum provides a frame of reference for stakeholders responsible for teacher education programs in these systems to agree on the subject knowledge, strategies, and resources that new teachers must enact in practice.

In high-performing systems, beginning teachers are rarely expected to develop lessons from scratch, but by the time they enter a classroom, they are well-versed in how to evaluate, adapt, and use curriculum materials because they have studied and worked with quality curriculum materials throughout their education. Both candidates and early career teachers are given

[6] Schneider & Krajcik, 2002
[7] Shulman, 1986
[8] Ingersoll, 2007; Jensen et al., 2016; Ota, 2000; Sahlberg, 2010

many opportunities to teach K-12 curriculum in a classroom, with feedback from experienced mentors. [9] OECD data demonstrate that beginning teachers in systems such as Finland and Japan feel – and are – well prepared in the content knowledge, pedagogy, and classroom practice required to teach in school.[10]

In the United States, by contrast, specific guidance for what teachers need to teach is not typically available to candidates, early career teachers, or teacher educators. Rather than address this gap, ITE reform has neglected the role that high-quality K-12 curriculum plays in the development of teachers, and reformers have focused on improving generic teaching strategies, such as setting behavioral expectations. The development of general teaching techniques is important, but teacher preparation should not focus on them at the expense of what teachers need to know about K-12 curriculum.

Teacher preparation neglects K-12 curriculum in a number of ways. Most pre-service teachers receive minimal guidance on how to use curriculum materials like textbooks and are given contradictory messages about the value of textbooks for planning and instruction. [11] Many teacher preparation programs do not even discuss the need for teachers to select K-12 curriculum materials.[12]

Even more concerning, the content of teacher preparation is not aligned to what K-12 students need to learn as set out in achievement standards. A 2014 review found that the majority of US states had not aligned their requirements for teacher preparation and licensure with the demands of the new Common Core State Standards (and other standards for college and career readiness).[13]

This approach severs preparation from practice. Teachers spend their day teaching content, and must select, adapt, and use curriculum materials many times a day in their classrooms. New teachers spend a lot of time searching out curriculum materials, and those they find help to determine how they think about and teach their subjects.[14] A New York City study found that new teachers who had the opportunity during ITE to review curriculum used in the school system performed better in terms of student test score gains in English language arts and mathematics.[15]

Small studies have shown that new teachers who lack curriculum guidance want it, and that most who get it appreciate it.[16] In systems with strong accountability measures linked to achievement standards, teachers who are not prepared in the use of curriculum resources may end up overwhelmed by their responsibilities and leave the profession prematurely.[17]

[9] Jensen et al., 2016
[10] OECD, 2017
[11] D.L. Ball & Feiman-Nemser, 1988
[12] Kosnik & Beck, 2009
[13] Greenberg, Walsh, & McKee, 2014

[14] Grossman & Thompson, 2008; Valencia, Place, Martin, & Grossman, 2006
[15] D. J. Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2009. Specifically, the study of 31 elementary teacher preparation programs in New York City found that "teachers who have had the opportunity to review curriculum used in NYC perform better in terms of student test score gains in mathematics and [English Language Arts]" (p.434).
[16] Kauffman, Johnson, Kardos, Liu, & Peske, 2002
[17] Kauffman et al., 2002

Box 2: A summary of the research evidence

There is a lot of evidence on the links between K-12 curriculum and student learning, but less on the links between curriculum and teacher learning.[18]

Evidence that curriculum helps student learning

Multiple large-scale studies have found that the choice of curriculum materials can have a big impact on student learning.[19] A review of 5000 studies by Steiner and colleagues (2017) confirms that curriculum is critical to students' academic success. One study they reviewed (Borman, Dowling & Schneck, 2008) found that students who used the Open Court Reading program scored 12 percentile points higher on average in reading achievement than students in the control group.

A recent study from the Center for Education Policy Research at Harvard found that the impact of high quality textbooks, especially in mathematics, is substantial. In fourth and fifth grade math classrooms, researchers estimated that if all schools switched to top-ranked textbooks, student achievement would rise by an average of 3.6 percentile point -- larger than the improvement of a typical teacher's effectiveness in their first three years on the job when they are learning to teach.[20]

Evidence that K-12 curriculum helps in-service teacher learning

The research on use of K-12 curriculum during in-service teacher learning is not conclusive. Some studies show that blending teacher professional development with research-based curriculum materials can have a positive effect on student achievement, because it addresses the tasks that teachers and students do every day.[21]

The evidence that K-12 curriculum helps pre-service teacher learning

To date, there are few large-scale studies on the connection between curriculum and pre-service teacher learning. Some small studies support the notion of giving candidates opportunities to analyze and critique curriculum materials during training.[22]

[18] For a longer summary of the research on curriculum refer to David Steiner's (2017) Curriculum Research: What We Know and Where We Need to Go

[19] Agodini et al., 2009; Bhatt & Koedel, 2012

[20] Kane, 2016

[21] Slavin, Lake, Chambers, Cheung, & Davis, 2009; Taylor et al., 2015

[22] See for example Ball & Feiman-Nemser, 1988; Beyer & Davis, 2009; Davis, 2006; Davis & Smithey, 2008; Grossman & Thompson, 2008; Lloyd & Behm, 2005; Schwarz et al., 2008; Valencia et al., 2006

While the research is not conclusive (see Box 2: A summary of the research evidence), there are emerging examples from the US that curriculum can help in-service teacher learning.

Louisiana, for example, improved teacher practice through high-quality curriculum guidance and materials accompanied by professional learning in these resources.[23] A recent study found that Louisiana teachers more accurately understood the Common Core achievement standards than did teachers in other states using the same standards,[24] and national test data suggest that student results are moving in the right direction.[25] Similarly, emerging research about the use of EngageNY, a free, widely-used, online repository of standards-alignment curriculum resources, indicates positive impacts on the quality of teaching and learning. In one recent study, 88 percent of mathematics teachers interviewed believed that EngageNY had strengthened their teaching and more than 70 percent of English language arts teachers felt that their students' academic capability had improved as a result of using EngageNY.[26]

The Louisiana and EngageNY examples point to positive early results from creating materials and tools for K-12 curriculum and helping teachers to use them in their classrooms. Louisiana is now expanding their approach to curriculum into teacher preparation. Many providers appear eager to incorporate K-12 curriculum materials

[23] A 2016 study on Louisiana found that the state department revised and aligned curricula, professional development, and student assessments to create a coherent strategy to support teachers' implementation of state standards (p. 12)

[24] J. H. Kaufman, Thompson, & Opfer, 2016

[25] Research has not established a causal link between Louisiana's curriculum reforms and improved student results. Louisiana's fourth graders showed the highest growth among all states on the 2015 National Assessment of Educational Progress (NAEP) reading test, and the second-highest in mathematics, however eight grade scores in reading and mathematics declined slightly, as they did across the US. For more information on the statistics and reforms refer to this EducationNext article.

[26] RAND Corporation's American Teacher Panel is a nationally representative survey of teachers across the United States. From this panel, thirty-one New York and California teachers were interviewed about their use of EngageNY (J. Kaufman et al., 2017).

and tools into their courses, and the state is providing assistance to do so.[27]

As these resources make their way into more classrooms, if they are not integrated into ITE, preparation and practice will likely become even more disconnected. New curriculum resources provide an opportunity to better support beginning teacher learning and to build understanding among ITE stakeholders on what teachers need to know in order to teach.

Elham Kazemi, mathematics professor and teacher educator at the University of Washington, explains the importance of incorporating K-12 curriculum into teacher preparation[28]:

> *The teachers we work with as pre-service teachers are working with anywhere from seven to eight different curriculum materials in their placement schools. So, we have to very concertedly help them learn how to read the curriculum materials they get and how to adapt them to be in line with what they learned through the university…It's not true that just because you've learned how to elicit and respond to student thinking in the field-based methods course that you'll do that in your student teaching if you haven't learned how to use the curriculum materials that you're given.*

3 The challenges of using K-12 curriculum in preparation

In a 2006 paper, education researchers from three US universities summarize the challenges of using K-12 curriculum in preparation and the imperative to overcome them[29]:

> *The job of professional development around curriculum materials belongs to both preservice education and to early career mentoring. At the preservice stage, prospective teachers need to become familiar with and develop a critical eye toward curriculum materials. This should include both careful study of the materials as well as observing implementation. In our experience, this is rarely a priority in teacher education programs—there are time limitations, philosophical dilemmas, and concerns about preparing teachers for a variety of field placements. However, when preservice education programs ignore curriculum materials…they leave new teachers ill-prepared for the realities of today's classrooms. Armed with knowledge and insights about materials, beginning teachers may feel more capable and empowered to deal with the range of mandates and materials in schools.*

Many ITE providers are reluctant to include specific curriculum materials in their programs, citing both the difficulties of identifying high-quality materials and the need to prepare candidates to work in a range of schools that teach an array of curricula and materials. In some ways, it would all be easier if we were in Japan and could just give teacher education students the national textbook they will use in whichever school they end up in. But the landscape in the United States is changing and providing more opportunities for providers to include K-12 curriculum in their preparation programs.

[27] Learning First interview with Louisiana Department of Education, October 2017.
[28] Learning First interview and ITE CoP webinar with Professor Elham Kazemi, April 2017

[29] Valencia et al., 2006

3.1 Preparing candidates to work in a range of locations

Providers point out that they must prepare teachers to work in a variety of locations that use an array of materials. Yet this situation is changing, in two ways.

First, in a small number of states and districts, such as Louisiana and New York City, certain curriculum materials are now widely in schools, so the need to prepare candidates to teach different materials is less of a consideration. For example, a recent RAND study found that nearly 90 percent of Louisiana math teachers surveyed use either EngageNY or Eureka Math.[30]

Second, outcome data is giving us more information about where graduates end up teaching, and in some places, providers may be able to prioritize their use of certain curriculum materials by looking at the districts that their graduates end up working in. [31] Emerging research on where teacher candidates find work challenges the expectation that providers must prepare candidates to work in numerous districts. In local and regional ITE programs throughout the United States, most candidates not only emerge from the community or region where a program is located but plan to spend their careers in that area.[32]

Some providers place most of their candidates in one or two districts and may therefore prioritize collaboration with, and use of curriculum materials from, those districts. Texas Tech University, for example, is a large provider that partners with more than 20 districts, but more than half its candidates are placed in one district.

But not all providers can prioritize specific districts and even those that can do so may find themselves aligned with districts that do not have a well-defined curriculum or extensive set of curriculum materials. In these instances, providers must ask themselves what their graduates will need to be able to do once they become teachers. Clearly, they will need to be able to choose, refine and adapt curriculum materials to their classroom in a sophisticated way (see Box 3).

Box 3: American teachers need to be more intelligent consumers of K-12 curriculum than their counterparts in high-performing systems

American teachers must navigate a much wider array of curriculum materials than their counterparts do in high-performing systems. Teachers in systems like Finland and Japan choose from a limited range of high-quality curriculum materials. They do not need sophisticated curriculum analysis and adaption skills.

Choosing, refining, and adopting curriculum materials is not an easy task. Beginner teachers need to be familiar with high-quality curriculum materials and examples of practice. They need to know how to analyze whether curriculum materials align with the achievement standards, identify the features that make a given textbook a high-quality resource, discuss why instructional materials are constructed in certain ways, and practice how to adapt and use them in a classroom.[33]

A district might not let candidates enact specific curricula during practical training, but even in that case, teaching candidates how to select and use exemplary materials in a classroom ensures they have a starting point if nothing else is provided.[34]

[30] J. H. Kaufman et al., 2016. EngageNY incorporates Eureka Math, and Eureka Math is also available apart from EngageNY. The study asked surveyed teachers separately about the use of each of these materials.

[31] This depends on having access to graduate data, but more states are implementing better data systems to track this, see TNTP's report on Getting to Better Prep for further information.

[32] In a study on New York state, D. Boyd, Lankford, Loeb, & Wyckoff (2005) found that prospective teachers take jobs close to where they grew up or, when they do leave their hometowns, choose to teach in districts with similar demographics to their hometown. Reininger (2012) found that these results hold for a nationally representative sample of teachers. In addition to this, districts tend to recruit prospective teachers locally (Engel & Cannata, 2015).

[33] Bain, 2012; Loewenberg Ball & Cohen, 1996

[34] The use of K-12 curriculum to support beginning teacher learning is further discussed in Section 4.

3.2 Identifying high-quality materials to use in preparation

Many materials on the market are not aligned with current achievement standards, and until recently it was hard to identify what should be considered high-quality.[35] This lack of alignment and quality control made it hard for providers and districts to agree on what materials novice teachers should be trained to use. For example, one study found that professors in two US teacher education programs disparaged the quality of textbooks and discouraged beginning teachers from using them, advising candidates to create their own materials from scratch. This advice was opposite to the district policy that mandated the use of particular textbooks in classrooms where candidates were placed.[36]

New curriculum resources can help district and provider partners identify and agree on high-quality resources. Organizations such as EdReports.org and the Louisiana Department of Education publish annotated ratings and reviews of K-12 curriculum materials, including commercially-available textbooks.[37] Tools such as Achieve's EQuIP and Student Achievement Partner's IMET help teachers and teacher educators analyze curriculum materials to determine if they are high-quality.[38]

Vetted online resources, such as EngageNY, provide new opportunities for teachers and teacher educators to readily access high-quality curriculum resources, and the use of these resources is increasing across the US. Surveys of the RAND Corporation's American Teacher Panel – a nationally representative survey of teachers across the United States – indicate that about 30 percent of mathematics teachers are using EngageNY to support their instruction, as are a little more than a quarter of English Language Arts teachers.

Deciding how to use K-12 curriculum in ITE presents other challenges. Teacher educators in universities and mentor teachers in schools may have conflicting norms and values about using curriculum in ITE.[39] Co-operating teachers may not want candidates to use or alter specific curriculum materials in their classrooms.

Nevertheless, new achievement standards and curriculum guidance, materials, and tools can help to create common ground between school and university-based teacher educators, provided that both are given opportunities and incentives to use them.[40] Many teacher educators do not get professional development opportunities to improve their own K-12 curriculum knowledge and use. Few are extrinsically rewarded or recognized for incorporating them into their courses or practical training placements. This needs to change, a point discussed further in Section 5.

[35] Polikoff, 2015
[36] D.L. Ball & Feiman-Nemser, 1988
[37] Louisiana Department of Education's annotated reviews of curricular resources are available online.
[38] Rating tools include Achieve's EQuIP (Educators Evaluating the Quality of Instructional Products) and Student Achievement Partners' IMET (Instructional Materials Evaluation Tool). The use of rating tools in teacher preparation is further discussed in Section 4.
[39] Schwarz et al., 2008
[40] How districts and provider partners can work more closely together to build a shared understanding of how to improve beginning teacher learning is discussed in the companion paper *Developing Partnerships.*

4 Opportunities to use K-12 curriculum in preparation programs

High-quality curriculum can be used in different ways to improve prospective teacher learning. Providers that prepare candidates to teach in districts that use common curriculum materials can explicitly teach that curriculum and have candidates enact it during practical training.

Others that prepare teachers for diverse locations and a multitude of materials can ask themselves a series of questions to help them use high-quality K-12 curriculum in their programs, such as:

1. Is there detailed **curriculum guidance** – either from our state, district, or national standards organizations – that we can use to help teach our candidates how to interpret achievement standards to plan coherent sequences of instruction?
2. What do we need to teach candidates about **recognizing and selecting high-quality curriculum materials** in our local context, and are there tools to help with this?
3. Can we implement high-quality **curriculum materials as teaching tools** in our courses? If so, how do we select and use these materials? What do we teach candidates about adapting and using these materials in classrooms?

4.1 Curriculum guidance

Achievement standards give teachers and teacher educators a common benchmark for what students should be able to do. New teachers often struggle to figure out how the pieces of learning fit together to ensure student success, and if new teachers do not understand the standards, they may struggle to help students achieve them.[41]

Knowing how to interpret and use achievement standards is essential learning for new teachers. It helps create a common understanding of what students should be able to do, and gives novice teachers the language needed to discuss learning expectations with fellow teachers. This knowledge supports teachers' capacity to compare and assess student learning.[42] Box 4 gives an example of the new Common Core State Standards in the US for mathematical knowledge and practices related to multiplying fractions, and how one preparation program incorporates them into a mathematics methods course.

[41] J. H. Kaufman et al., 2016

[42] Magee & Jensen, Forthcoming

Box 4: How one US preparation program uses achievement standards

There are two types of mathematics standards in the Common Core State Standards. These are content (or subject matter) standards for specific concepts, and general practice (or mathematical thinking) standards that sit alongside the content standards.

Figure 2: An example of the standards related to multiplying fractions

The content standards for multiplying fractions are:

CCSS.MATH.CONTENT.5.NF.B.4
Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.

CCSS.MATH.CONTENT.5.NF.B.4.A
Interpret the product (a/b) × q as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations a × q ÷ b. For example, use a visual fraction model to show (2/3) × 4 = 8/3, and create a story context for this equation. Do the same with (2/3) × (4/5) = 8/15. (In general, (a/b) × (c/d) = (ac)/(bd).

CCSS.MATH.CONTENT.5.NF.B.4.B
Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.

The general mathematics practice standards that sit alongside the content standards are:

CCSS.MATH.PRACTICE.MP1 Make sense of problems and persevere in solving them.

CCSS.MATH.PRACTICE.MP2 Reason abstractly and quantitatively.

CCSS.MATH.PRACTICE.MP3 Construct viable arguments and critique the reasoning of others.

CCSS.MATH.PRACTICE.MP4 Model with mathematics.

CCSS.MATH.PRACTICE.MP5 Use appropriate tools strategically.

CCSS.MATH.PRACTICE.MP6 Attend to precision.

CCSS.MATH.PRACTICE.MP7 Look for and make use of structure.

CCSS.MATH.PRACTICE.MP8 Look for and express regularity in repeated reasoning.

Source: http://www.corestandards.org/Math/Practice/ and http://www.corestandards.org/Math/Content/NF/

Teacher educators need to be familiar with the standards and how they are used in schools in order to know how to incorporate them into their preparation programs. Professor Elham Kazemi, a math teacher educator from the University of Washington, talks below about how she uses achievement standards to teach beginning teachers what they need to know, and how to connect the language used in university with that used in schools.

*We had to think about when and how to incorporate the **domain [content] standards** versus the **practice standards** into what we did. It's not hard to do. **You have to become knowledgeable about it yourself** and then you have to **think about where and how to make those connections**. To do everything is impossible, so **I pick usually two or three practice standards**, ones that I think have a lot of power for disrupting how people think about mathematics normally. Then we try to **connect the language and the meaning** [of the standards] to whatever activities that we do. We don't cover the full terrain…but we try to pick what we think are some really big ideas that will be consequential for their early careers. That's a judgement based on knowledge of the field and our work with schools.*

Source: Elham Kazemi interview with Learning First and ITE CoP webinar, April 2017

Preparation programs should ask themselves whether there is detailed guidance – either from state, district, or national standards organizations – that they can use to help teach their candidates how to interpret and apply achievement standards.

Some systems, such British Columbia in Canada, Louisiana, Massachusetts, and Tennessee, have extensive guidance to help candidates, teachers, and teacher educators understand what achievement standards mean. The guidance creates a shared vision for student learning goals and helps new teachers to plan and implement a coherent program of instruction and assessment, rather than simply focus on discrete pieces of it.

Curriculum guidance documents vary in their format and contents. British Columbia, for example, has learning progressions to help new and experienced teachers to understand what students should be able to do at four different levels, leading up to proficiency at each grade level. [43] Massachusetts has guides that accompany their curriculum frameworks which contain illustrations of mathematical concepts; suggested authors, illustrators, and works for English Language Arts; and learning progressions for critical topics such as fractions

[43] Magee & Jensen, Forthcoming; British Columbia Ministry of Education, n.d.; For more information on what British Columbia does in relation to teacher preparation refer to our companion paper *Connecting preparation to practice*

in grades three to five.[44] Tennessee provides detailed practical guidance in high-impact teaching strategies in one priority curriculum area (literacy).[45]

Louisiana's curriculum guidance documentation outlines subject area priorities, clusters of topics, pre-requisite student knowledge, and exemplar semester plans to help teachers understand what teaching the Louisiana standards looks like.[46] Box 5 contains an example of the Louisiana curriculum guidance documentation and how it helps teachers design and enact lessons aligned with the standards.

There are also various organizations that provide free online guidance that align with college- and career-ready standards, including the Common Core State Standards.[47] Achieve the Core, for example, supplies advice for developing standards-aligned lessons, instructional content guidance such as how to select grade-level texts, coherence maps to show connections between topics described in the standards, and exemplar student writing samples, lessons, tasks, and assessments.

Providers can use such high-quality curriculum guidance documents in methods courses. With their concrete and subject-specific examples, curriculum guidance documents can be translated directly to classroom practice and help build candidates' ability to plan and assess coherent sequences of instruction. For example, a methods course may teach candidates to use guidance documents to plan a unit of instruction and assessment for a particular topic. It might also have candidates assess student work using learning progressions and student work samples contained in guidance documents.

4.2 Recognizing and selecting high-quality materials

New teachers rely heavily on curriculum materials to determine what and how to teach, yet they are often ill-equipped to recognize high-quality materials or adapt poor quality ones.[48]

Preparation programs should ask themselves, what skills in the recognition and selection of curriculum materials do they need to teach to their candidates. In systems such as Louisiana, where most teachers use one math program, teaching candidates how to teach these materials is likely a higher priority than teaching how to select them. In other contexts where teachers must choose their own materials, skills in the recognition and selection of such materials are important to teach to candidates.

These skills do not need to be tied to specific curricula. ITE can teach candidates to recognize the features of high-quality materials, and analyze how they are constructed. Candidates might review samples of curriculum materials from local schools or online repositories, and identify weaknesses in the materials and adapt them.

Candidates should be guided when adapting curriculum materials because at first, they often struggle to identify weak representations of content.[49] A small number of US programs incorporate guided analysis and use of curriculum materials into their courses (see box 6 for an example of how this is done).[50]

New tools such as Achieve's EQuIP and Student Achievement Partner's IMET can be incorporated into methods courses to help candidates analyze curriculum materials.[51] For example, a methods course may support candidates to use one of these analysis tools to evaluate how well different textbooks align to state achievement standards.

[44] See for example page 209 of the 2017 Massachusetts Mathematics Curriculum Framework; page 157 of the 2017 Massachusetts English Language Arts and Literacy Framework; and the Quick Reference Guide for Fractions Learning Progression in Grades 3-5.
[45] See Teaching Literacy in Tennessee
[46] Wiener & Pimentel, 2017
[47] See for example Achieve the Core
[48] D.L. Ball & Feiman-Nemser, 1988; Grossman & Thompson, 2008; Kauffman et al., 2002
[49] Grossman & Thompson, 2008
[50] See for example Beyer & Davis, 2009; Lloyd & Behm, 2005 Schwarz et al., 2008
[51] For more information refer to Achieve's EQuIP and Student Achievement Partners' IMET

Box 5: How high-quality curriculum guidance improves teacher learning

The Louisiana Department of Education produces curriculum guidance that helps teachers understand the achievement standards and prioritize the content they need to teach children.

In the example below of a Grade 5 curriculum plan, teachers are given guidance on the priority topics (major clusters in green), how long to devote to teaching the multiplication of fractions (e.g. Unit 6, Multiplying Fractions, 20 days), the major clusters of content (e.g. Number and Operations – Fractions), and the pre-requisite knowledge students need (e.g. 4.OA.A.1 links to what the Grade 4 standards expect e.g. Interpret a multiplication equation as a comparison).

Many states do not produce this level of guidance. Most simply list the achievement standards for a year level, with little direction on priorities, clusters of topics, and pre-requisite student knowledge. Teachers must figure these things out themselves through trial and error, or seek guidance from a mentor teacher.

Detailed guidance helps new teachers to plan what they need to teach and for how long, and to understand what pre-requisite knowledge their students need.

Figure 3: Example of an exemplar Grade 5 scope and sequence for mathematics in Louisiana

DEPARTMENT of EDUCATION
Louisiana Believes

Mathematics
Grade 5 – Year in Detail (SAMPLE)

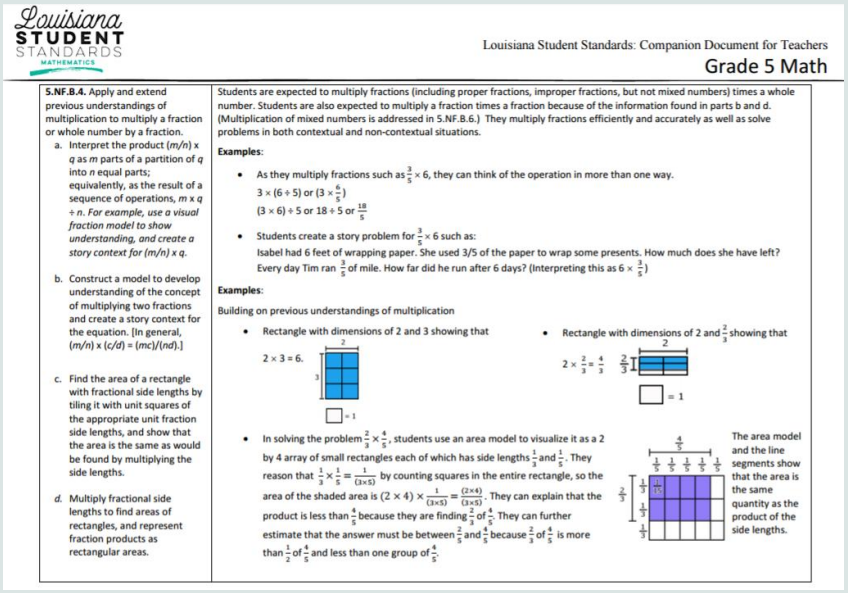
Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10
Whole number operations	Place value with decimals	Add and Subtract Decimals	Add and Subtract Fractions	Multiply and Divide Decimals	Multiplying Fractions	Dividing Fractions	Volume	Classifying 2-D Figures	Coordinate Plane
25 days	20 days	10 days	25 days	20 days	20 days	10 days	10 days	10 days	10 days
5.NBT.A.1	5.NBT.A.1	5.NBT.B.7	5.NF.A.1	5.NBT.A.2	5.NF.B.4	5.NF.B.3	5.MD.C.3	5.G.B.3	5.G.A.1
5.NBT.A.2	5.NBT.A.3	5.MD.A.1	5.NF.A.2	5.NBT.B.7	5.NF.B.5	5.NF.B.7	5.MD.C.4	5.G.B.4	5.G.A.2
5.NBT.B.5	5.NBT.A.4	5.OA.A.1	5.MD.A.1	5.OA.A.1	5.NF.B.6	MP.1	5.MD.C.5	MP.3	5.OA.B.3
5.NBT.B.6	5.MD.A.1	MP.2	5.MD.B.2	MP.2	MP.1	MP.2	MP.4	MP.7	MP.4
5.MD.A.1	MP.7	MP.3	5.OA.A.1	MP.3	MP.2	MP.4	MP.6	4.MD.C.5	MP.6
5.OA.A.1	MP.8	MP.6	MP.1	MP.6	MP.4	MP.6	MP.7	4.MD.C.6	4.OA.C.5
5.OA.A.2	4.NBT.A.2	MP.7	MP.3	MP.7	MP.6		MP.8	4.MD.C.7	
MP.2	4.NBT.A.3	4.MD.A.2	MP.4	MP.8	4.NF.B.4		4.MD.A.2	4.G.A.1	
MP.6			MP.6		4.MD.A.2			4.G.A.2	
MP.7			4.NF.A.1					4.G.A.3	
4.OA.A.1			4.NF.C.5						
4.OA.A.2			4.MD.A.2						
4.OA.A.3									
4.NBT.B.4									
4.NBT.B.5									
4.NBT.B.6									
4.MD.A.2									

Major Clusters	Supporting Clusters	Additional Clusters	Other
NBT – Number and Operations in Base Ten (1, 2, 3, 4, 5, 6, 7) **NF** – Number and Operations – Fractions (1, 2, 3, 4, 5, 6, 7) **MD** – Measurement and Data (3, 4, 5)	**MD** – Measurement and Data (1, 2)	**OA** – Operations and Algebraic Thinking (1, 2, 3) **G** – Geometry (1, 2, 3, 4)	**MP** – Standards for Mathematical Practice Potential Gaps in Student Pre-Requisite Knowledge 4.OA – 1, 2, 3, 5 4.NBT – 2, 3, 4, 5, 6 4.NF– 1, 4, 5 4.MD – 5, 6, 7 4.G - 1, 2, 3

Source: Louisiana Department of Education curriculum guidance documents for Grade 5 Mathematics

In curriculum guidance documentation for teachers (see extract below for the multiplication of fractions), the Louisiana Department of Education explains in detail the concepts to teach, gives concrete examples of what students should be able to do, and shows how students can go about answering problems and explain what they did. The materials give new teachers a detailed basis from which to plan their lessons, rather than leaving them to start from scratch or use unvetted lesson plans from other sources.

Figure 4: Example of curriculum guidance for the multiplication of fractions for Louisiana teachers



Louisiana STUDENT STANDARDS MATHEMATICS

Louisiana Student Standards: Companion Document for Teachers

Grade 5 Math

5.NF.B.4. Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.

a. Interpret the product $(m/n) \times q$ as m parts of a partition of q into n equal parts; equivalently, as the result of a sequence of operations, $m \times q \div n$. *For example, use a visual fraction model to show understanding, and create a story context for* $(m/n) \times q$.

b. Construct a model to develop understanding of the concept of multiplying two fractions and create a story context for the equation. [In general, $(m/n) \times (c/d) = (mc)/(nd)$.]

c. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths.

d. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.

Students are expected to multiply fractions (including proper fractions, improper fractions, but not mixed numbers) times a whole number. Students are also expected to multiply a fraction times a fraction because of the information found in parts b and d. (Multiplication of mixed numbers is addressed in 5.NF.B.6.) They multiply fractions efficiently and accurately as well as solve problems in both contextual and non-contextual situations.

Examples:

- As they multiply fractions such as $\frac{3}{5} \times 6$, they can think of the operation in more than one way.
  $3 \times (6 \div 5)$ or $(3 \times \frac{6}{5})$
  $(3 \times 6) \div 5$ or $18 \div 5$ or $\frac{18}{5}$
- Students create a story problem for $\frac{3}{5} \times 6$ such as:
  Isabel had 6 feet of wrapping paper. She used 3/5 of the paper to wrap some presents. How much does she have left?
  Every day Tim ran $\frac{3}{5}$ of mile. How far did he run after 6 days? (Interpreting this as $6 \times \frac{3}{5}$)

Examples:

Building on previous understandings of multiplication

- Rectangle with dimensions of 2 and 3 showing that $2 \times 3 = 6$.
- Rectangle with dimensions of 2 and $\frac{2}{3}$ showing that $2 \times \frac{2}{3} = \frac{4}{3}$
- In solving the problem $\frac{2}{3} \times \frac{4}{5}$, students use an area model to visualize it as a 2 by 4 array of small rectangles each of which has side lengths $\frac{1}{3}$ and $\frac{1}{5}$. They reason that $\frac{1}{3} \times \frac{1}{5} = \frac{1}{(3 \times 5)}$ by counting squares in the entire rectangle, so the area of the shaded area is $(2 \times 4) \times \frac{1}{(3 \times 5)} = \frac{(2 \times 4)}{(3 \times 5)}$. They can explain that the product is less than $\frac{4}{5}$ because they are finding $\frac{2}{3}$ of $\frac{4}{5}$. They can further estimate that the answer must be between $\frac{2}{5}$ and $\frac{4}{5}$ because $\frac{2}{3}$ of $\frac{1}{5}$ is more than $\frac{1}{2}$ of $\frac{4}{5}$ and less than one group of $\frac{4}{5}$.

The area model and the line segments show that the area is the same quantity as the product of the side lengths.

Source: Louisiana Department of Education curriculum standards companion document for teachers for Grade 5 mathematics

Early studies show that Louisiana's use of curriculum and accompanying professional learning is improving teacher practice.[52]

In Louisiana, department officials have heard from providers that they are eager to incorporate the curriculum resources into their courses. The state is moving to a competency-based approach in ITE which allows programs to move away from course type and length requirements to better align their coursework with the K-12 curriculum resources that Louisiana uses in its districts and schools. Louisiana has defined a list of competencies for initial teacher certification that is heavily based on the subject-specific knowledge and pedagogies required to teach the Louisiana K-12 curriculum.[53]

Louisiana is also looking to train and credential content leaders who have deep expertise in subject-specific topics, curricula and tools, starting with English language arts and mathematics specialists. They plan to allocate some training positions to teacher preparation leaders to build deep expertise in university and well as school-based teacher educators.[54]

[52] J. H. Kaufman et al., 2016

[53] For more information on Louisiana's competency-based approach to ITE, refer to their list of competencies for initial teacher certification.

[54] Learning First interview with Louisiana Department of Education, October 2017

Box 6: How an elementary science methods course uses guided analysis of curriculum materials

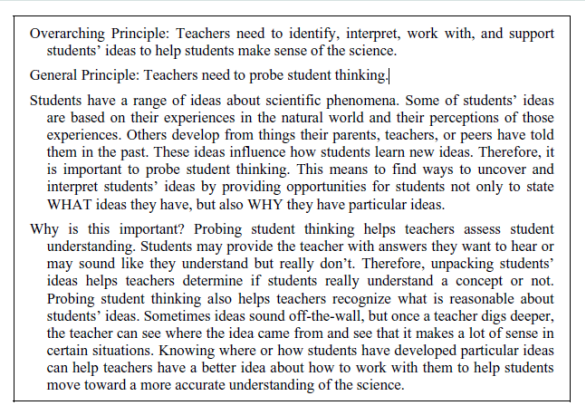
A longitudinal research study of an elementary science methods course at a Midwestern university in the US found that guided analysis of curriculum materials can help beginners' teaching practice.[55]

Assignments asked candidates to identify and explain the strengths and weaknesses of various curriculum materials (such as lesson plans found on the internet or from a commercially available science kit, and a hands-on activity not written as a lesson plan). In early iterations of the course, candidates used criteria developed by teacher educators, with input from candidates, to analyze the lesson plans. The lesson should:

- Set a limited number of instructional goals, including for learning science concepts and scientific inquiry;
- Present the content in scientifically accurate ways, and not promote alternative ideas;
- Allow students to ask others, read purposefully, and evaluate information.[56]

The researchers, finding over the years that candidates struggled to engage in substantive critique about how scientific content was represented, redesigned the assignments.[57] In new iterations, each piece of material or lesson plan included in the assignments contains general and specific guidance to help candidates with their analysis. The guidance is based principles of practice associated with attending to students' ideas in science.

Figure 5: An example of general curriculum guidance



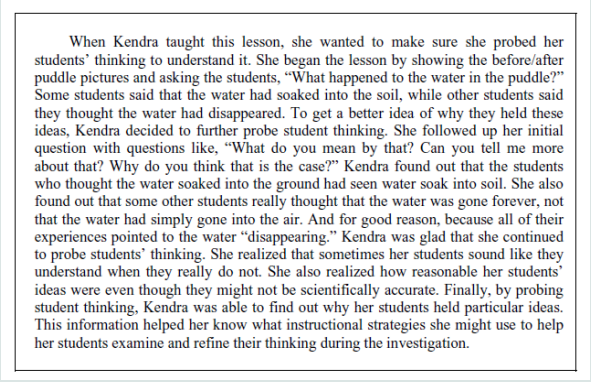
Overarching Principle: Teachers need to identify, interpret, work with, and support students' ideas to help students make sense of the science.

General Principle: Teachers need to probe student thinking.

Students have a range of ideas about scientific phenomena. Some of students' ideas are based on their experiences in the natural world and their perceptions of those experiences. Others develop from things their parents, teachers, or peers have told them in the past. These ideas influence how students learn new ideas. Therefore, it is important to probe student thinking. This means to find ways to uncover and interpret students' ideas by providing opportunities for students not only to state WHAT ideas they have, but also WHY they have particular ideas.

Why is this important? Probing student thinking helps teachers assess student understanding. Students may provide the teacher with answers they want to hear or may sound like they understand but really don't. Therefore, unpacking students' ideas helps teachers determine if students really understand a concept or not. Probing student thinking also helps teachers recognize what is reasonable about students' ideas. Sometimes ideas sound off-the-wall, but once a teacher digs deeper, the teacher can see where the idea came from and see that it makes a lot of sense in certain situations. Knowing where or how students have developed particular ideas can help teachers have a better idea about how to work with them to help students move toward a more accurate understanding of the science.

Figure 6: An example of lesson-specific curriculum guidance



When Kendra taught this lesson, she wanted to make sure she probed her students' thinking to understand it. She began the lesson by showing the before/after puddle pictures and asking the students, "What happened to the water in the puddle?" Some students said that the water had soaked into the soil, while other students said they thought the water had disappeared. To get a better idea of why they held these ideas, Kendra decided to further probe student thinking. She followed up her initial question with questions like, "What do you mean by that? Can you tell me more about that? Why do you think that is the case?" Kendra found out that the students who thought the water soaked into the ground had seen water soak into soil. She also found out that some other students really thought that the water was gone forever, not that the water had simply gone into the air. And for good reason, because all of their experiences pointed to the water "disappearing." Kendra was glad that she continued to probe students' thinking. She realized that sometimes her students sound like they understand when they really do not. She also realized how reasonable her students' ideas were even though they might not be scientifically accurate. Finally, by probing student thinking, Kendra was able to find out why her students held particular ideas. This information helped her know what instructional strategies she might use to help her students examine and refine their thinking during the investigation.

The study found that these types of learning activities help candidates to identify important principles for the analysis and use of curriculum materials, and that a blend of both general and specific guidance is critical for building these skills.[58]

Source: Beyer & Davis, 2009

[55] Beyer & Davis, 2009; E. Davis & Smithey, 2008; E. A. Davis, 2006
[56] E. A. Davis, 2006
[57] E. Davis & Smithey, 2008
[58] Beyer & Davis, 2009; E. Davis & Smithey, 2008

4.3 Curriculum materials as teaching tools

Well-designed curriculum materials improve not only student learning (see Box 2), but also teacher learning. They are closely linked to the classroom context, can be used over an extended period of time (unlike access to mentors or trainers), and provide opportunities to build specific knowledge and teaching strategies.[59]

Preparation programs should ask themselves whether they can implement high-quality curriculum materials into their courses. If so, they should consider how to select and use these materials in courses, and what candidates need to know about adapting and using these materials in classrooms.

High-performing countries commonly use curriculum materials to foster in-depth discussion of subject-specific content, teaching strategies, student learning, as well as the connections between concepts within and across school years. Candidates in these countries practice using and adapting materials in classrooms and reflecting on their impact on student learning.[60] This is not the case in the United States, although studies on select US-based preparation programs show that textbooks can help novice teachers to develop both subject matter knowledge (content knowledge) and subject-specific teaching strategies (pedagogical content knowledge).[61]

High-quality curriculum materials can accelerate development of pedagogical content knowledge by:

- Providing examples of student work, describing common problems that students have in understanding some concepts, and predicting what they may do in response to instruction;
- Supporting teachers' learning of subject matter knowledge and how to teach it by outlining multiple representations of ideas and how concepts connect to each other.[62]

What candidates learn from curriculum materials depends heavily on the nature of the materials and the opportunities for learning embedded within them.[63] Research shows that candidates can struggle to visualize and understand teaching activities listed in curriculum materials and adapt them to learners' needs.[64] Candidates need to be taught how to 'get inside' curriculum materials in order to implement them effectively. Candidates should also learn that curriculum materials are not to be followed uncritically but used a tool to think about teaching decisions and student learning.[65]

Preparation should include opportunities for candidates to practice using and adapting curriculum materials in classrooms with support from an experienced mentor. Conversations with expert teachers and teacher educators about curriculum materials and their adaption can help novice teachers to think through subject matter, as well as the consequences of instructional decisions for student learning.[66] Materials can also be used as part of an improvement cycle, in which novice and experienced teachers select exemplar materials from open educational resources available, study them, plan instruction, practice them with peers, implement them, and then analyze student work samples with peers following the lesson.[67]

Providers must carefully select the curriculum materials to use, as the quality of resources varies considerably in the degree to which they are suitable for use in preparation courses. Well-designed curriculum materials not only provide implementation directions, but they also help teachers how to think about what to teach.[68] Well-designed materials might contain explicit information on the reasons for certain content

[59] Deborah Loewenberg Ball & Cohen, 1996
[60] Jensen et al., 2016; Ma, 1999
[61] See for example D.L. Ball & Feiman-Nemser, 1988; Grossman & Thompson, 2008
[62] Ball & Cohen, 1996
[63] Grossman & Thompson, 2008
[64] D.L. Ball & Feiman-Nemser, 1988
[65] Valencia et al., 2006
[66] Grossman & Thompson, 2008
[67] Wiener & Pimentel, 2017
[68] Ball & Cohen, 1996; Schneider & Krajcik, 2002; Valencia et al., 2006

and activities; how the activities should be sequenced; descriptions of teaching strategies and representations, and how to anticipate and interpret students' ideas; and guidance on how to use and adapt materials in class.[69] Vetted online resources, such as EngageNY, provide new opportunities for candidates and teacher educators to readily and freely access high-quality curriculum resources, even if their local district does not have strong materials.

5 Opportunities for stakeholders to use K-12 curriculum to connect preparation and practice

In large and diverse systems such as those in the United States, where stakeholders have a great deal of autonomy, widespread adoption of high-quality K-12 curriculum is difficult. States and districts like Louisiana and New York City are making inroads, but others are a long way further back. No state has systematically tackled the use of K-12 curriculum by preparation programs.

When providers, districts, schools and systems use it effectively, K-12 curriculum helps to ground preparation in the work of teaching, and in student learning. However, K-12 curriculum looks different in different systems, and the context may not afford stakeholders all the opportunities described below.

5.1 Opportunities for district/provider partnerships

As explained in our companion paper[70], systems can better connect preparation to practice by focusing on deeper partnerships between local providers and districts and schools. District and provider partners are at the cutting edge of educating novice teachers. The best combine to provide the coursework, practical training, induction, and early career PD that set up a highly effective learning journey for the new teacher.

Districts and providers can:

1. Use achievement standards and curriculum guidance to provide stakeholders with a shared vision and common language for teacher and student learning;
2. Use achievement standards and curriculum guidance to identify priority

[69] E. A. Davis & Krajcik, 2005

[70] Refer to our companion paper, *Developing partnerships to improve teacher preparation*

areas for improving beginning teacher learning;
3. Consider how to incorporate high-quality K-12 curriculum into coursework, practical training, induction and early career development;
4. Research and disseminate the best ways to incorporate quality K-12 curriculum into ITE programs.

5.1.1 Use achievement standards and curriculum guidance to provide stakeholders with a shared vision and common language for teacher and student learning

As our companion paper explains, what beginning teachers learn – especially in their coursework – is usually based on the individual viewpoints or research interests of their teacher educators. [71] This leaves candidates with fragmented pieces of knowledge that do not make up a coherent approach to what they need to teach in the classroom.[72]

Achievement standards and K-12 curriculum guidance, however, can help all stakeholders in ITE to forge a shared vision and common language.[73]

In this scenario, achievement standards and curriculum guidance documents define expectations of what students need to know and therefore what teachers need to be able to teach. They enable candidates, teachers, and teacher educators to discuss student learning using the same language. They create a benchmark of what student learning and progress looks like, including examples of student work, at each developmental stage. They help to align the professional judgements of candidates, teachers and teacher educators, who can and should hold each other to account for evidence of student progress against the standards.[74]

This kind of shared understanding helps district and provider partners to collaborate on joint projects to improve beginning teacher learning. Partners can review curriculum together and then progress to joint projects to improve specific curriculum areas. For example, Texas Tech University works with a partner district to improve writing instruction.[75]

5.1.2 Use achievement standards and curriculum to identify priority areas for improving beginning teacher learning

Achievement standards and curriculum guidance can help district and provider partners to prioritize topics in beginning teacher learning, and to review subject-specific areas for improvement.

At present, professional standards are typically used to guide what teachers need to know and be able to do by the end of ITE. Often these lists are too broad and generic to help districts and providers prioritize ITE content. For example, the US Interstate Teacher Assessment and Support Consortium (InTASC) Model Core Teaching Standards contains a list of 174 things that teachers need to be able to do.[76]

Achievement standards and curriculum guidance provide a much stronger framework for prioritizing the content of ITE methods courses because they are more specific, concrete, and grounded in the daily work of teachers. Using K-12 curriculum, districts and providers can review methods coursework to more closely link preparation with teacher practice.

[71] Refer to our companion paper, *Connecting teacher preparation and practice*
[72] Bain, 2012; Grossman, Hammerness, McDonald, & Ronfeldt, 2008
[73] Districts and providers that operate in systems without high-quality guidance can use achievement standards and freely available standards guidance to support the creation of a shared vision and common language.
[74] Magee & Jensen, Forthcoming
[75] For more information refer to a case study on how Texas Tech University built meaningful partnerships with schools.
[76] The Council of Chief State School Officers' Interstate Teacher Assessment and Support Consortium developed standards to describe what effective teaching across all content areas and grade levels looks like. A full list of the standards can be found here. The Council for the Accreditation of Educator Preparation (CAEP) standards require that candidates demonstrate an understanding of the ten InTASC standards in certain categories.

They can, for example, use student assessment and teacher evaluation data to pinpoint the precise concepts that students struggle to learn, and that novice teachers struggle to teach. Often this process helps to identify the underlying cause of new teachers' concerns. Many new teachers, for example, complain of being underprepared in classroom management.[77] Yet programs may dig into and triangulate data with observations to find that the real gap in training was not generic behavior management strategies but that novice teachers lacked the skills to engage students effectively in the content they were trying to teach.

5.1.3 Consider how to incorporate high-quality K-12 curriculum into coursework, practical training, induction, and early career development

As outlined in Section 4, there are many considerations that guide the use of K-12 curriculum in learning experiences for beginning teachers. Provider and district partners should collaborate on these considerations to connect coursework to practical training, induction, and early career development.

Ideally, prospective teachers should understand and work with district curriculum policies. [78] Teacher educators should work with school-based teacher mentors to make curriculum material use in field placements more explicit and aligned with course goals.[79]

The practicality of this type of partnership depends on the number of districts a provider works with and the curriculum policies of those districts. For example, a provider's program should not spend the majority of a math methods course teaching a candidate how to design lessons from scratch if the policy of its partner districts is that all teachers use Eureka Math. Likewise, if a provider prepares candidates for districts that allow teachers to choose their own materials, they should prioritize teaching candidates how to choose the right ones.

5.1.4 Research and disseminate the best ways to incorporate quality curriculum into ITE

More research is needed on the best way to incorporate K-12 curriculum into teacher preparation. Best practice must be more widely disseminated to provide model program and course content that other programs can adopt and adapt.[80] The work of the small number of researchers who have evaluated the use of curriculum materials in their ITE courses needs to be extended.

5.2 Opportunities for states

To encourage providers to use curriculum to better connect preparation to practice, states can:

1. Raise the benchmark for knowledge of achievement standards and use of K-12 curriculum in teacher licensure processes;
2. Use review processes to encourage districts and providers to better incorporate achievement standards and K-12 curriculum into beginning teacher learning;
3. Provide data to districts and providers that help them to identify specific curriculum areas that their beginning teachers need to improve;
4. Offer financial incentives to encourage providers to use and conduct research on high-quality curriculum materials;
5. Provide teacher educators with access to quality K-12 curriculum resources and training.

[77] See for example McKenzie, Weldon, Rowley, Murphy, & McMillan, 2014 and L. Lewis et al., 1999
[78] Deborah Loewenberg Ball & Cohen, 1996
[79] Schwarz et al., 2008. In our companion paper *Connecting preparation to practice* we talk about how teacher residency programs connect field placement with course goals.
[80] See for example David M Steiner et al., 2017 and Cochran-Smith, 2005

5.2.1 Raise the benchmark for candidate knowledge of achievement standards and use of K-12 curriculum in teacher licensure

While many states have some form of licensure, certification, or registration, many such processes for new teachers only cover broad knowledge about a subject or generic teaching strategies. Typically, they require a low standard to pass, and are not aligned with college- and career-ready standards.[81]

A more effective licensure assessment should include questions or tasks that require knowledge of achievement standards, the use of curriculum, and features of high-quality curriculum materials. These inclusions would encourage providers to incorporate these topics into their programs.

The Massachusetts Tests for Educator Licensure (MTEL) tests, for example, are aligned with Massachusetts curriculum frameworks and reviewed by teachers to ensure they contain the knowledge and skills that teachers need.[82] The exams ask candidates to analyze and infer from real student work samples, requiring prospective teachers to have not only theoretical subject matter knowledge, but also the deep and applied knowledge required for teaching.[83]

5.2.2 Use review processes to encourage districts and providers to better incorporate achievement standards and K-12 curriculum into beginning teacher learning

Many states use accreditation processes to set requirements and regularly review whether ITE programs meet them.[84] Accreditation processes could ask for evidence of how achievement standards and curriculum guidance are incorporated into learning experiences, encourage the use of high-quality materials in coursework and practical training, and credit providers who use achievement standards and K-12 curriculum to work with district partners to identify student and teacher learning priorities.

Accredited ITE programs in Ontario, Canada, for example, are expected to reference the Ontario curriculum in coursework and practical training.[85] The Massachusetts Department of Elementary and Secondary Education (DESE) is changing the regulatory language governing the pre-practicum experiences candidates need to have in order to recommend that candidates evaluate, adapt, and implement curriculum materials during early practical training, rather than create them from scratch.[86]

States also have levers, albeit rarely used, to influence how districts and schools prepare teachers. Many have review processes that use data and site visits to determine whether districts and schools are providing quality education. The frameworks of these reviews do not usually include criteria linked to teacher preparation, but the Massachusetts DESE, for instance, is considering how to modify district grant funding and review processes to incorporate the district's role.[87]

5.2.3 Provide data to districts and providers that help them identify specific curriculum areas that their beginning teachers need to improve

A number of states, often as part of accreditation, require ITE programs to collect data on the quality of their graduates.[88]

Some states, such as Massachusetts, Tennessee, and Florida, supply their providers with detailed information on the quality of their graduates.[89] The more specific these data are, the more they help teacher educators to reflect

[81] National Council on Teacher Quality, 2012
[82] For more information on the MTEL development process refer to the Test Information Guide.
[83] See for example Massachusetts' Tests for Educator Licensure Foundations of Reading test
[84] National Research Council, 2010
[85] Center on International Education Benchmarking, 2016
[86] Learning First interview with Massachusetts DESE, September 2017
[87] Learning First interview with Massachusetts DESE September 2017
[88] Council for the Accreditation of Educator Preparation (CAEP) accreditation standards
[89] See TNTP's Getting to Better Prep for more information on the data collected and supplied by states.

on the way their candidates are learning, and on how to improve their teacher preparation.[90]

Districts and providers need access to beginning teacher evaluation data to help them identify the curriculum concepts that their beginning teachers need to improve. For example, the Foundations of Reading licensure test, which is aligned with the Massachusetts achievement standards, collects and reports data by sub-test area, such as "development of reading comprehension" and "reading assessment and instruction".[91] These data give programs rich information on what specific aspects of courses they need to improve, such as how they teach reading comprehension or reading assessment for elementary candidates.

5.2.4 Offer financial incentives to encourage providers to use and conduct research on high-quality curriculum materials

Some states, such as Massachusetts, use small financial grants to encourage innovation in areas of priority.[92] These kinds of grants could be extended to encourage district and provider partners to innovate on the use of and research on high-quality curriculum projects in teacher preparation.

Other systems, such as the Louisiana Department of Education, use state procurement policies to make it easier for districts and schools to access highly-rated materials.[93] They also publish free annotated reviews and ratings of curriculum materials, including their costs, and a "Vendor PD Course Catalogue" that lists professional development vendors and whether they help teachers to implement quality curriculum.[94]

5.2.5 Provide teacher educators with access to K-12 curriculum resources and training

Well-designed curriculum guidance, materials, and tools make life easier for candidates, novice teachers, and teacher educators alike. These tools not only guide teachers, but also help to build the capabilities of teacher educators in relation to K-12 curriculum.

Some states, recognizing their responsibility in this field, have introduced initiatives to build the capability of staff in ITE providers. Given their tight budgets, most states see their role as brokers rather than direct suppliers, but some do extend direct professional development opportunities to staff of ITE providers.

Some US states invite university-based teacher educators to undertake professional development in state achievement standards, curriculum guidance and materials, and teacher evaluation tools. They also make curriculum resources available to preparation programs. Tennessee, for example, gives reading research and data to university-based teacher educators, and offers them training opportunities in new reading achievement standards and state reading initiatives (see Box 7). Louisiana will allocate training places for teacher educators to become certified content leaders, initially in areas such as English language arts and math, alongside school-based teachers.[95]

Going forward, states may want to certify teacher educators (and potentially, candidates) in using curriculum analysis tools such as IMET, perhaps using micro-credentials to assess knowledge of the tools.

Systems in other countries often use teacher educators in curriculum development projects, and widely share best practices linked to curriculum use.[96] Rigorous curriculum guidance, materials, and tools make it much easier for systems to share best practice against a set of standards.

[90] Peck, McDonald, & Davis, 2014
[91] See the MTEL Foundations of Reading Annotated Score Report for more information.
[92] See Massachusetts DESE's district/provider partnerships site for more information.
[93] J. H. Kaufman et al., 2016
[94] J. H. Kaufman et al., 2016
[95] Learning First interview with Louisiana Department of Education, October 2017
[96] Jensen et al., 2016

Box 7: How Tennessee is improving one area of curriculum

Tennessee uses a mix of system mechanisms to improve preparation in a particular area of K-12 curriculum.

The state has a goal to improve literacy, and it has adopted more rigorous reading achievement standards and provided practical guidance for teachers to implement high-impact literacy strategies.

Tennessee incorporated this focus into ITE through more rigorous reading standards for Educator Preparation Programs, more rigorous certification, more transparent reporting, and opportunities for provider staff to improve their practice in relation to reading through data, research, and training.

District-provider partners in Tennessee, such as Shelby County Schools and the University of Memphis, are working together to use the state guidance for teaching literacy to improve their coursework for candidates.

Figure 7: The set of system mechanisms used by Tennessee to improve preparation in relation to reading

Reading Standards	Certification	Reporting	Research, Data & Training
• Rewriting the K–12 reading standards for EPPs to align with Tennessee's expectations for students • Differentiate standards by educator role • Standards identified for most educator endorsement areas: secondary, special education, specialized roles, and instructional leaders	• Review state's reading certification exam (PRAXIS) to ensure alignment • Tennessee will implement a rigorous, statewide performance assessment for reading teachers to demonstrate proficiency	• Highlight teacher preparation outcomes in ELA on the Teacher Preparation Report Card • New annual reports will include disaggregated data	• Provide statewide reading research and data to EPP faculty to improve practice • Invite EPP faculty to training opportunities to better prepare first year teachers for day 1

Sources: Every Student Succeeds Act: Building on Success in Tennessee, p.267; Teaching Literacy in Tennessee; Learning First interview with representatives from Shelby County Schools and the University of Memphis, October 2017.

6 Conclusion

The examples described in this paper reveal how providers, schools, and state education systems can work together to use K-12 curriculum to improve beginning teacher learning. Curriculum explicitly connects teacher preparation to the classroom, and it helps new teachers to learn by providing them with concrete examples of how to teach content and assess student learning against student achievement standards. It can no longer sit on the periphery of teacher education in countries such as Australia and the United States.

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