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New Collaborations New Approaches

Research for Improvement in Teacher Preparation

By Jenny DeMonte and Jane Coggshall

About the Authors

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Introduction

In April 2017, three dozen top teacher educators, researchers, and school and district leaders met together to conceive of a new approach to designing and conducting research to improve teacher preparation. This new approach would engage researchers and practitioners in tightly collaborative investigations, using rigorous methods to seek answers to questions such as: What changes should our teacher preparation program make to our candidates' field experiences to simultaneously maximize K–12 student learning and candidate performance? How can we improve and scale our approach to teaching mentors to guide their candidates during in-class instruction? How can we more efficiently teach new math teachers to lead group discussions about important content? How can we better match our curriculum to our candidates' preexisting strengths and limitations? How can we assess candidates' data literacy so that we can better understand the supports needed to scaffold their learning?

Research that answers these and other questions is needed to ensure that new teachers are well prepared to meet the challenges of today's classrooms. Participants in that April meeting identified four essential qualities of useful research for improvement: It must be *actionable, nuanced, contextualized,* and *formative*. Table 1 gives brief descriptions of each feature. For a more complete discussion, read the report from the meeting: Fostering a New Approach to Research on Teacher Preparation.

Launching this new approach, participants returned home and worked together in cross-institutional, interdisciplinary teams of practitioners and researchers to develop innovative research designs that would embody the four qualities as well as answer questions immediately relevant to their programs and practice.

Six months later, in October 2017, the participants reconvened to present their study designs to one another and to a small number of additional critical friends—researchers and practitioners who did not create and present a design, but were there to provide constructive feedback to presenters. Participants engaged in deep discussions about their designs, receiving suggestions for improving their questions, designs, and measures, and making important connections to work and research across the country.

The convening was unlike many other research meetings; rather than sharing findings, participants shared designs. Commonalities and patterns emerged across research study designs. Participants asked similar questions about preparation programs and planned to investigate similar aspects of their programs in search of answers. The conversations centered on refining the study designs to make them more rigorous and more actionable. Those at the meeting offered suggestions and advice to each other about their ideas.

What emerged from the meeting was a desire among participants—practitioners and researchers—for some kind of professional learning network. The comments and questions participants asked at the end of the meeting were largely about understanding the richness of sharing research designs, discussing opportunities to improve the designs, and finding others who were embarking on similar projects. At the end of this report are recommendations fueled by the suggestions and remarks from participants.

The innovative research designs the teams developed and the conversations they sparked represent the cutting edge of teacher preparation research. They also foreshadow what this new research-for-improvement approach can look like given appropriate resources, attention, and collaborative support. This report describes each of the research designs presented as well as the challenges that arise when getting down to the work of conducting the research in dynamic contexts. These themes come from a report by Ashley LiBetti Mitchel and Melissa Steel King (2016), titled *A New Agenda: Research to Build a Better Teacher Preparation Program*. The authors described why current research might not be informing program improvement as much as those in the field would like, and they suggested different ways to think about studying teacher preparation.

Table 1. Features of Research for Program Improvement

Essential Feature of Research for Program Improvement	Definition	Description
Actionable	Research that yields information that can be acted on	Research methods and findings that illuminate why a program is working or falling short of expectations are more **useful for improvement** than for obtaining results that focus only on distal outcomes.
Contextualized	Research that takes the context into account	Research methods and findings that illuminate the contexts and conditions that enable or constrain program impact are more **useful for improvement** than research that ignores or mischaracterizes the context.
Nuanced	Research that engages with subtle but important differences in program inputs, practices, outcomes, and contexts	Research methods and findings that differentiate among program components, including particular instructional or administrative practices, are more **useful for improvement** than broad studies of overall program implementation or impact.
Formative	Research that informs program development and improvement throughout implementation	Research methods and findings that provides timely feedback on practices and programs while they are being implemented are more **useful for improvement** than after-the-fact assessments of impact.

Connecting the Conversations: Selected Practice-Driven, Collaborative Research Designs

A key takeaway from the initial meeting is that teacher educators want information about the effect of their programs on what teacher candidates know and can do—but they do not want to wait until years after their candidates have graduated to get that information. They want research studies

that measure more immediate outcomes, such as whether a candidate has learned a particular teaching skill or whether a candidate can leverage a student's background to improve teaching.

Participants were clear-eyed about the challenges to program-improvement research. They identified challenges related to research design, such as the difficulty of addressing threats to validity stemming from inadequate comparison groups, dynamic contexts, and small sample sizes as well as the complexity of measuring teaching practice reliably and comprehensively. They also identified challenges related to study implementation, such as a lack of institutional leadership support; multiple, conflicting priorities and pressures among program faculty that can reduce their willingness to innovate; and an inability to form sufficiently strong, long-term partnerships with K–12 schools.

The conversations were challenging at the first meeting because teacher educators, researchers, and school leaders see the work that needs to be done from different perspectives. But at the end of the day, the group had identified four guiding themes that could help researchers and others as they design research about teacher preparation. These themes are discussed in turn, along with details about specific research designs developed by participants that exemplify each theme.

Eighteen research designs were discussed at the October convening. They were in different stages of development, ranging from a description of a research concept to a fully fledged proposal with specific measures and analyses identified. Some were proof-of-concept studies of novel interventions focused on specific aspects of provider practice, whereas others were focused on collecting evidence for continuous improvement. Still others sought to develop and use state-of-the-art measures to answer basic questions of how best to ensure teacher candidates can be successful. All 18 designs were inventive, collaborative, and focused on important problems of practice.

"It is encouraging to see teacher education programs drill down into practices that are thought to influence the skill development of teacher candidates," said Dan Goldhaber, vice president and director of the National Center for the Analysis of Longitudinal Data in Education Research at American Institutes for Research (AIR). But Goldhaber also noted the challenges in designing research to answer questions about the impact of programs on teacher candidate knowledge and behavior: "There are significant research design issues that need to be addressed in order to learn whether specific reforms or practices are likely to be efficacious." One key issue is access to student and teacher data after teacher candidates graduate and begin teaching.

This report profiles many of the designs, representing a range of questions, challenges, methods, and practices to be explored. We grouped them by theme—actionable, contextualized, nuanced, and formative—but many designs could be put into more than one, if not all, categories. We also discuss two additional themes that emerged during the second convening: the need for sharing and collaboratively using data between teacher preparation programs and K–12 schools and the difficulty of designing and making sense of rigorous measures of program outcomes that are also practical and timely. These are discussed in the sections that follow.

Actionable

For research to be actionable, it must address a specific need in the field about a component of a preparation program or some other aspect of a provider's work, and the findings must directly inform adjustments to providers' practice. Several studies designed by participants embraced the notion of actionable research and built it into their concept papers as central to the work.

Actionable Study Design Example 1

Research that assesses and improves the impact of rehearsal on teaching practice

One study, based in three different teacher preparation programs in three states, proposed to use technology to help teacher candidates learn and rehearse specific high-leverage teaching practices (HLPs) that are foundational and essential in teaching. The three sites for the study are the University of Texas Rio Grande Valley, Kennesaw State University in Georgia, and the University of Massachusetts Boston. HLPs are research-based practices, and various research groups have identified and described them (McLeskey & Brownell, 2015; TeachingWorks, 2018). This proposal builds on previous work that suggests teacher candidates need opportunities rehearse and practice teaching during their training (Lampert et al., 2013). Research has shown that deliberate practice is essential in gaining expertise, but few preparation programs provide that kind of opportunity to learn, rehearse, and practice using HLPs (Ericsson, 2006; Ericsson, Krampe, & Tesch-Römer, 1993; Grossman, Hammerness, & McDonald, 2009).

All 100 participants in the proposed study would complete modules to learn about HLPs. Half of the candidates, randomly assigned, would practice and reinforce what they learned through the modules during role play or through case studies. The other half would engage in deliberate practice through mixed-reality simulations via a virtual classroom. Mixed-reality simulations entail the coupling of technology and human interaction to provide an authentic experience allowing for application or demonstration of competencies. It employs a human-in-the-loop paradigm in which a human (simulation specialist or interactor) puppeteers the avatars (i.e., students in the virtual classroom), allowing for real-time and authentic responses to the teaching event. During the simulation, the teacher candidate can pause the simulation and seek guidance from peers on how to best handle what is taking place in the classroom.

> "We have found that teacher candidates value engaging in mixed-reality simulations as they provide opportunities to practice instructional strategies, develop content expertise, and respond to challenging behaviors in proactive ways with support from peers and instructors,"
>
> Patricia Alvarez McHatton, interim provost at the University of Texas Rio Grande Valley

Researchers hypothesize that this type of deliberate practice and rehearsal will yield information about the type and amount of opportunities candidates have to rehearse instruction prior to student teaching. It will indicate what aspects of clinical training should be reformed to improve what teacher candidates know and can do when they begin student teaching.

Contextualized Study Design Example 2

Research that assesses and improves teacher candidates' data literacy

A recent review of research on data literacy and teachers' use of data found that teachers' use of formative assessments has a positive impact on student learning in mathematics, reading, and writing (Klute, Apthorp, Harlacher, & Reale, 2017). But few teacher preparation programs incorporate data literacy into their curricula (Mandinach, Friedman, & Gummer, 2015).

Arizona's State Board of Education took steps in 2014 to change that for preparation providers in the state. It revised its regulations for approving teacher preparation programs, which included requiring data literacy training for teacher candidates. Providers now must provide evidence that teacher candidates receive training in "how to gather, evaluate, and synthesize multiple data sources and how to effectively use data in educational and classroom instructional decisions" (Arizona State Board of Education, n.d., p. 10).

Teacher educators at Northern Arizona University want to add to their program while also assessing whether their candidates were becoming more skilled at using data. The teacher educators had these questions: Do their candidates have the data literacy knowledge and skills needed to be successful in their first years of teaching? Are candidates struggling with a particular data literacy concept or skill? What are authentic examples of applied assessment and data literacy knowledge and skills for teacher candidates and first to third year teachers? Getting information to answer these questions could help teacher educators modify how they embed data literacy into the preparation program and identify which concepts and skills need more attention.

Northern Arizona University and AIR are working together to create a data literacy assessment battery to measure teacher candidates' data literacy knowledge and skills. For teacher educators, the information from the assessment would be the foundation for action to improve the data literacy training embedded in their teacher preparation programs. The vision is to make the data literacy assessment battery available to teacher preparation programs across the country.

> "Sharing ideas with teacher preparation colleagues from a variety of institutions has focused our attention on initial steps including seeking authentic examples of needed data literacy knowledge and skills for early career teachers. Based on comments and questions generated from the presentation, we recognized this information could benefit the field while working towards the development of the cumulative data literacy assessment battery."
>
> Cynthia Conn,
> assistant vice provost for
> Professional Education Program,
> Northern Arizona University

Actionable Study Design Example 3

Research that identifies the strongest levers for improvement

Preparation programs are composed of many different elements, each of which may have an evidence base that warrants its inclusion. For example, a selective admissions process using teacher characteristics to accept candidates has a research base, as does supervised fieldwork. But how do these aspects of a program interact in particular contexts to produce persistent and effective graduates? Which aspects of the program are less likely to impact the performance of their candidates and should therefore be changed or eliminated?

One concept paper presented at the convening described an approach to exploring these important questions. Relay Graduate School of Education Masters in Teaching program would use the data it collects about its large enrollment of teacher candidates to understand the interplay between candidate characteristics and their experiences and outcomes in the program. For example, this study would examine the relationship between candidates' backgrounds and their experiences in the program to consider whether there are particular aspects of preparation that vary based on candidate qualities. In addition to the rich data Relay has about its candidates and program, researchers would gather twice yearly perception data directly from candidates, sharing the findings and iterating on the questions directly with program faculty.

Research has suggested that the characteristics and attitudes of new teachers can impact their ability to improve student achievement (e.g., Robertson-Kraft & Duckworth, 2014). Evidence shows that particular components of teacher preparation may be associated with a better sense of preparedness among new teachers, as well as improved retention in teaching and greater achievement on the part of the teachers' students (e.g., Darling-Hammond, Chung, & Frelow, 2002).

Researchers would also collect data about the content of the curriculum experienced by teacher candidates to broaden the understanding of how candidates interact with the program. Initially, these data would help teacher educators reform and tweak everything from their admission process to the support teacher candidates as they move through the program, to the design of the program itself. The evidence could be used to inform research at other institutions as they engage in program improvement processes.

Actionable Study Design Example 4

Research to develop preservice and in-service teachers' capacity for empathy in restorative relationships with students

An interdisciplinary team including Marsha Heck from Indiana University South Bend and Deborah Reichman from the Indiana Institute on Disability and Community presented a research design for developing "the person of the teacher" (Korthagen, 2017). The aim of the project was to evaluate and refine training for both preservice and in-service teachers to develop effectiveness in implementing restorative justice practices in classrooms.

The team cites research to argue that public education has relied too heavily on exclusionary discipline and emphasized punishment, to a deleterious effect on students (Balfanz, Byrnes, & Fox, 2013; Fabelo et al., 2011; Fix School Discipline, 2017). This authoritarian classroom management approach negatively impacts teacher–student relationships and unfairly disadvantages non-White students and students with disabilities (Gregory, 2013; Gregory, Bell, & Pollock, 2014; International Institute for Restorative Practices, 2014). The shift in public education to the authoritative paradigm of restorative practices takes many forms, but all have the intention to prevent and repair such harm. The team seeks to conduct actionable research to advance this shift, in particular to study an intervention designed to support teacher candidates and teachers in developing personal traits that are needed in restorative conversations: listening with empathy and responding with accountability to others.

Using several established survey measures to capture empathy and accountability, as well as a combination of virtual classroom performance assessment and live classroom observations to assess implementation of the restorative practices, the team would compare the outcomes of two cohorts of teacher candidates and their mentors from area public schools to gauge the impact of the training. The study results would help program faculty refine the design and implementation of both the training and assessment instruments, or shift the team's direction if the expected outcomes were not achieved.

Actionable Study Design Example 5

Research that builds an evidence base for better decisions about online teacher preparation practices

Given the rapid growth in online teacher preparation, the field of education writ large needs a deeper understanding of the most effective ways to structure and conduct online learning. Some universities now offer some or all of their courses online in synchronous or asynchronous formats. But some have raised concerns about online learning and online teacher preparation specifically. Individual studies have found that online students can have lower graduation rates than on-campus students (Grau-Valldosera & Minguillón, 2014; Jaggar & Xu, 2010). Fogle and Elliot (2013) found that school administrators who had not experienced online learning themselves were reluctant to hire teachers whose coursework was exclusively taken online. However larger meta-analyses have concluded that students from primary school through university can and do learn effectively in online formats (Means, Toyama, Murphy, Bakia, & Jones, 2009; The Future of State Universities, 2011).

Flipped classrooms are also being incorporated into on-campus programs. O'Flaherty and Phillips' (2015) review of the literature concluded that studies of the flipped classroom in higher education show generally positive outcomes. Even while attending class on campus, students can choose to take some of their courses online. In a flipped classroom design, direct instruction moves from the group learning space to the individual learning space (Flipped Learning Network, 2014). Because

teacher education focuses on both declarative and procedural knowledge, the flipped classroom approach may be highly effective (Egbert, Herman, & HyunGyung, 2015); however, more research is needed to understand how and under what conditions it can be effective.

Program faculty from Drexel University proposed to compare candidate outcomes—teacher candidate self-efficacy and language and literacy content knowledge—using two different approaches to teacher preparation. The first approach consists of standard online learning (a combination of remote lectures, activities, course readings, and unsupervised field experience), and the second approach is a flipped course that combines online recorded lectures and course readings with instructor-guided on-campus applied activities such as problem sets, lab activities, or field experiences.

The research team proposes to examine several measures of teacher efficacy and learning as candidates engage in flipped classrooms and compare them with candidates in an online-only program. Measuring these skills while participants are still under the direction of the university is critical. With the information obtained, professors can determine the gaps in knowledge and provide more direct instruction where necessary. Professors can also work with participants struggling with efficacy and provide more opportunities for them to develop confidence in the field. Because both cohorts will learn the course content using identical online learning materials, this research design will be better able to understand the impact of having professors join students in the field. This study also seeks to identify differences in knowledge and efficacy between participants taking the courses face-to-face and those taking the courses online. This information will be important to the course developers and to teachers in the field.

Contextualized

Practice-driven research must account for the contexts in which the programs and practices under study are enacted. The contexts and conditions of interventions can substantially affect how we make sense of the effects (or lack thereof) observed, and the extent to which those findings can be generalized to other programs and practices in other places.

At the first convening, all participants agreed that context varied tremendously from one teacher preparation program to another—from the identities of the teacher candidates and the teacher educators, to the program structure, to the settings in which candidates learn to teach, to the rules and policies of the preparation program, and the state and local policy context. But they also noted that varied contexts should not be a barrier to building an evidence base that benefits many teacher educators and preparation programs.

The following research designs approach the challenges and opportunities of accounting for context in different ways.

Contextualized Study Design Example 1

Research that conceptualizes, measures, and improves teacher learning of high-leverage practices

This research design takes on the challenge of context deliberately by basing the study in two universities of different sizes that serve different populations and are staffed by teacher educators with varying responsibilities. Michigan State University is a land grant institution with a large residential teacher education program served by teacher educators who have significant research responsibilities. Oakland University is a much smaller program, serving students who often live at home and hold down other jobs as they attend school to become certified. Oakland's teacher educators have heavy teaching loads and fewer research responsibilities. These types of differences are typical of differences across preparation programs.

This research and development project will build and test teacher learning progressions and assessments for use in the public domain and across varied teacher education programs—from alternative certification programs to traditional university-based programs. The focus of this research and development work will be on two HLPs: eliciting and interpreting student thinking and explaining and modeling content.

Toward that end, the initial activity of this project is to design an assessment framework that includes tasks and assessments that will allow researchers and teacher educators to collect information about how teacher candidates learn each of the two HLPs. Assessments will be designed to differ across a candidate's training (e.g., at the beginning of a program, before

student teaching, after student teaching), with the goal of discovering and understanding the learning progressions of teacher candidates. To accomplish this, the project takes a design-based approach (Hammer, Elby, Scherr, & Redish, 2005). Given the importance of context, the project's framework and assessments will be deliberately scalable, flexible, and robust. This will lead to standardized tools that programs can use to create comparable findings within and across programs.

This project has three main goals:

1. To map and understand the learning progressions of teacher candidates across the two HLPs and to determine whether and how the progressions for the two HLPs vary
2. To learn how teacher candidates learn about the HLPs and how their experiences vary based on their learning experiences as well as attitude and beliefs
3. To create a set of public-domain assessment tools that support high-quality research and feedback within and across programs

The most important goal of this project is to create tools that can be used across programs and that provide accurate and actionable findings to help teacher educators improve their work.

> "The practice-based teacher education reforms are promising, but they are occurring at just a few institutions. If we hope for them to grow, we need to articulate and then study the learning progressions novices take in these programs, and then develop the assessment tools teacher educators need to track this learning in robust, flexible ways."
>
> Courtney Bell, senior research scientist, Educational Testing Service

Contextualized Study Design Example 2

Research that assesses and bolsters classroom management outcomes in field-based preparation

Effective classroom management is a critical instructional strategy in any classroom, and there is a special urgency to get it right in high-poverty, low-performing school contexts. As researchers have tried to empirically identify specific instructional practices salient for predicting student achievement, a consistent finding has been the positive correlation of classroom management measures with value-added or student achievement (e.g., Chaplin, Gill, Thompkins, & Miller, 2014; Lazarev, Newman, & Sharp, 2014). Unfortunately, it is common for new teachers to experience challenges with implementing strong classroom management strategies, which may be consequential for the learning of their students (Christofferon & Sullivan, 2015; O'Neill & Stephenson, 2013; Wolff, van den Bogert, Jarodzka, & Boschuizen, 2015). The consequences of novice teachers' underpreparation in classroom management skills holds implications for students in high-poverty and low-performing schools given the tendency for novice teachers to be assigned to classes with low-achieving minority students in poverty (Kalogrides & Loeb, 2013; Kalogrides, Loeb, & Beteille, 2012). As such, the field needs information about how best to prepare candidates with strong classroom management strategies in the contexts where they train and in the contexts where they will work upon graduation.

Building intensified, purposeful field-based experiences has been identified repeatedly as a key strategy for preparing candidates to enter the field with the necessary knowledge and skills to serve diverse children, families, and communities (Lim & Able-Boone, 2005; McDonald et al., 2011; Rust, 2010). Field-based teacher education builds upon research linking the quality of contextually based field experiences to enhanced readiness to teach upon entering the profession (e.g., McDonald et al., 2011; Zeichner, 2010). Authentic field experiences have been extensively linked to positive outcomes in P–12, including teacher retention and satisfaction, teacher–student relationships, classroom climate, and student learning (Adams & Wolf, 2008; American Association of Colleges of Teacher Education, 2010; LaParo, Thomason, Maynard, & Scott-Little, 2012; McDonald et al., 2011; Rust, 2010). Although field-based models capitalizing on building contextually based experience show promise, evidence of their effectiveness, and an indication of the work involved in developing and sustaining them, is still scarce (Zeichner, 2010).

One of the proposed studies from Loyola University Chicago would examine the classroom management effectiveness of a cohort of first-year graduates from a teacher preparation program that uses a novel, progressive, intensive field-based approach to candidate preparation. Loyola's model centers the field-based experiences around objectives-based opportunities for candidates to work alongside practicing teachers throughout their preparation, with opportunities to build teaching skills under the dual supervision of classroom teachers and university faculty (Kennedy & Heineke, 2014). These intensive field-based placements are in high-poverty, low-performing schools in a large urban district, working with diverse groups of students and communities.

In the study, classroom management outcomes among recent Loyola University Chicago graduates would be compared with other first-year teachers, all located within one of the largest, urban school districts in the country. A survey of the first-year teachers in the sample would ask teachers to report on (a) the field experiences they had during their preparation, (b) the professional context of the school they are working in, and (c) their own perceptions of how well they were prepared to handle working in their current classrooms. These data would be linked to teacher classroom management effectiveness ratings to reveal which features of field experiences during preparation are beneficial for developing classroom management skills after graduation.

Such a study would provide critical insights into how teacher preparation programs—and their field-based portions of their preparation time in particular—can best prepare teachers to instruct in urban classrooms with diverse learners.

> "As accrediting and governing bodies in education challenge teacher preparation programs to adopt field based approaches to candidate preparation, research needs to keep pace and examine how innovative field based programs facilitate the readiness of new teachers to impact classrooms and students,"
>
> David Ensminger, associate professor and program chair at Loyola

Nuanced

Participants in the first convening defined this feature of research as "designed to investigate something specific, and [taking] a fine-grained approach to considering both the program component and its effect on teacher candidates" (DeMonte, 2017, p. 2). For example, a nuanced study might measure the effect of a single unit inside a course on math pedagogy by observing whether teacher candidates could enact the pedagogy they were taught. The following research designs are examples of nuanced research.

Nuanced Study Design Example 1

Research that develops better supports for teacher mentors

One research design presented would provide the developers of mentor professional development with important nuanced feedback on the quality and effectiveness of their work with teacher mentors. In particular, the proposed research would focus on the development and refinement of an approach to support mentors as they work with teachers *in the presence* of students. Through a variety of in-depth data collection and measurement activities, researchers and program faculty representing four institutions across the country would study how mentors engage with professional development supports, how the supports (as they are engaged with) influence mentoring practices, and how the resulting mentoring practices influence novice teachers' practices. As part of this work, the research team would provide rich descriptions of mentoring practices that are not widespread in the field but that leverage instructional time for the support of novice teacher learning.

This kind of nuanced research is needed because although mentor teachers are consistently identified by novice teachers as the most influential actors in the development of their practice (Duffield, 2006; Feiman-Nemser, 1990), the body of research on how to support mentor teachers to develop their mentoring practice is woefully thin. During the last 2 years, a team led by Dr. Sarah Schneider Kavanagh has developed and piloted approaches to supporting mentor teachers in the development of purposeful and targeted mentoring practices and routines that take place during instructional time with students (Kavanagh & Cunard, 2016). If the research team were to succeed in using data to refine and validate these approaches in a variety of contexts, it would fill a large gap in the research as well as in practice. Any program working to improve the work of mentor teachers could benefit from this work.

Nuanced Study Design Example 2

Research that helps teacher residents and their mentors maximize K–12 student learning (not just novice teacher learning)

In the teacher residency model, immersive, yearlong clinical practice is central to the teacher education experience. This experience requires the deep partnership of teacher educators and

K–12 classroom teachers as mentors and their schools (Guha, Hyler, & Darling-Hammond, 2017). For those mentors and schools, this process requires a considerable investment of energy, human capital, and student learning time in the preparation of novice teachers. However, little research is available to help guide programs and schools to ensure that this investment in novice teacher learning can simultaneously be used to maximize K–12 student learning.

Faculty from the Alder Graduate School of Education proposed a study that would investigate how the mentor uses two, full-time adults (the mentor and the resident) to organize and manage instruction (e.g., the use of residents to teach small groups, work one-on-one with students) and how the mentor employs real-time coaching to keep student and resident learning on track. Although many people have written about knowledge in teaching, as well as mentoring, little is known about what knowledge mentor teachers use to make real-time decisions in the classroom to advance student and teacher candidate learning or to consider the trade-offs they make in the moment to reconcile the two.

The research would employ qualitative methods in order to gain a nuanced understanding of mentor teachers' perspective and experiences of their own use of multiple types of knowledge (e.g., mentoring, motivation, feedback, classroom management, subject-matter content) to support novice teacher and student learning. The research would use stimulated recall (Calderhead, 1981) with mentors of video-recorded observations of classroom instruction (and simultaneous mentoring practice) to understand the in-the-moment decision-making of mentors as they facilitate both student and mentor learning in their classroom. Mentor sampling will be attentive to a cross-section of grade levels and content areas. To complement the observations and stimulated recall, K–12 student achievement data (formative and summative) will be used to understand how the mentors' decision-making affected student learning.

> "Yearlong clinical preparation is core to our teacher education model at Alder. Therefore, it's critical that we understand how to prepare and support mentors to be effective teacher educators. This study is an amazing opportunity for us to get "inside the heads" of mentors so we can better understand their decision-making processes as they support the learning of both residents and K–12 students."
>
> Kristin Alvarez,
> director of research,
> Alder Graduate School of Education

Alder aims to use the findings to engage in continuous improvement of the Alder Master's and Credential Teacher Residency Program of the Alder Graduate School of Education; inform mentor selection, training, and support; and clarify the residency director's role as coach of both mentors and residents. Alder's goal is to implement programmatic improvements so that students in classrooms with an Alder resident experience even greater achievement in the year than their peers in nonresidency classrooms.

Nuanced Study Design Example 3

Research that assesses and improves ongoing supports for teachers learning to implement relevant and rigorous teaching practices

Another example of a nuanced research design is one presented by a team of researchers and faculty from TNTP, Brown University, and the University of Maryland at College Park. They seek to investigate the extent to which TNTP's approach to jointly emphasizing relevance and rigor during Teaching Fellow's preservice preparation results in positive outcomes for former Fellows in their second year of teaching. The team proposes to follow one cohort of 200 teacher candidates as they become in-service beginning teachers learning the skills to build relevance for students using culturally responsive pedagogy alongside instructional practices that emphasize rigorous engagement with standards-aligned curriculum. The research team plans to study changes in instructional practice and student outcomes as the Teaching Fellows experience ongoing program supports for integrating relevance and rigor into instruction.

Their study design is composed of three phases. In the first phase, the Fellow would experience a summer preservice training in enacting relevant and rigorous practices. The team defines relevant practices as those that "reflect culturally responsive pedagogy and making deep connections between worthwhile content and life outside of school," and rigorous practices as those that "reflect content-specific pedagogy and facilitate student ability to meet the demands of college and career ready standards in their subject area." The team would assess Fellows' uptake and use of these practices in their field placement using classroom observation scores, content knowledge assessments, and end of unit/module scores.

In phase 2 of the research, the new teachers of record would receive intensive classroom-centered instructional coaching reinforcing their ability to enact and link relevant and rigorous practices. The research team would explore how variation in knowledge and performance during preservice training is related to classroom instruction, student perceptions of teaching, and students' performance on classroom assignments.

In phase 3, in their second year as teachers of record, the former Fellows would be randomly assigned to one of the following three ongoing developmental supports: in-person coaching, virtual coaching, or a professional learning community. The researchers would investigate which of the supports is most effective at sustaining use of relevant and rigorous practices, as well as enhancing student learning.

Results of this research would be used to adjust and refine TNTP's approach to teaching relevance and rigor, and the field of teacher preparation would have an evidence base of usable strategies and developmental supports during the first 2 years of teaching to reinforce the connection between relevance and rigor. It will also make a unique contribution to the knowledge base for program improvement by tracking teachers from preservice training through their first 2 years of teaching, documenting performance trends over time.

Formative

Rigorous research that lets program faculty know how well their programs work after they have been implemented may be useful for some decisions, such as resource allocation and accountability. However, summative research is not useful for program faculty who are seeking to improve what they do, as they are doing it, and before they do it again. Rigorous formative research is. As discussed in the first convening, "for research to be formative, it should be designed with an eye toward continuous improvement. The research should be able to detect change, and the findings should be able to inform developmental change in a program."

Formative Study Design Example 1

Research that quickly improves methods coursework

Another team proposed to use 5-week design, teaching, and evaluation cycles to make rapid, evidence-based changes to one very specific aspect of elementary mathematics teacher educators' practice—namely how teacher candidates are taught to lead a group discussion on equivalent fractions.

Collaborating with researchers from AIR to collect and interpret the necessary data, Drake will work with a team of course instructors who each teach a section of Michigan State University's senior math methods course. The team will collaborate to create a 3-week module on leading a group discussion on equivalent fractions. Each instructor will implement the module at a different time during the semester. By staggering the implementation schedule, the team will have time between each implementation and the next to improve the module based on data, including data on candidates' knowledge and teaching competencies.

> "We focus on a high-leverage teaching method and content area."
>
> Corey Drake, professor and director of teacher preparation at Michigan State University

> "This design allows for rapid improvement based on data. In just a semester, we can complete three full improvement cycles."
>
> Andrew Wayne, managing researcher at AIR

The short-cycle continuous improvement process (Bryk, Gomez, Grunow, & LeMahieu, 2015) will use 5-week cycles—3 weeks for teacher educators and candidates to complete the module and collect data, then 2 weeks to interpret data and refine the module for the next implementation.

If successful, the work would not only result in more effective pedagogies for teaching high leverage content (equivalent fractions) and practices (leading group discussions) to teacher candidates, but also it would refine an improvement process that can be shared and applied in other subject areas and institutions that offer multiple sections of a course. The research team would report on their findings and their approach to improvement to help make evidence-driven improvement more systemic.

Formative Study Design Example 2

Research that helps ensure observation feedback makes a difference to teacher candidate performance

One team, consisting of preparation program and K–5 elementary school faculty, proposed to test a new and intensive approach to preservice teacher learning. Using the week-long breaks in the school calendar, the team from Endicott College and Bates Elementary School in Salem, Massachusetts, proposes to implement a Vacation Academy, wherein student teachers and their cooperating school-based mentors engage in three teaching-observation-feedback cycles with real students each day. In the first rotation, the cooperating teacher from Bates will teach first and then reflect on the lesson with the student teacher from Endicott. In the second rotation, the Endicott student teacher will teach the lesson to a second group of students and receive targeted feedback from the Bates teacher. The Endicott student teacher will then reflect on the feedback and teach the lesson again to a third group of students, incorporating the feedback from the Bates teacher. Each pair of mentors and student teachers will teach a different lesson to students, so students will have the opportunity to learn different content in each rotation. These rotations would be supported and supervised by Endicott program faculty.

The team proposes to not only implement this intensive intervention using best practices related to providing targeted feedback (e.g., Jacob, 2015) but also study the extent to which it improves student teachers' performance. Using a multimethod case study approach, researchers would use candidate classroom observations, video-taped observations of feedback sessions, candidate and mentor interviews, and document review to understand program efficacy, implementation, and develop hypotheses for future testing. They plan to use measures as proximal to what teacher candidates are learning as possible so they can make immediate changes to not only the Vacation Academy program but also to the practices that program faculty and cooperating teachers use to provide feedback to student teachers throughout the rest of the program.

Formative Study Design Example 3

Research that informs program design and implementation to maximize student learning

Based largely on discussions at the first convening, one research team from the Boston Teacher Residency designed an intervention that consists of residents and their school-based mentor teachers using a carefully crafted action research approach to not only support new teachers in their learning but also ensure that, as an instructional team, they implement continuously better instruction to maximize student learning. Each week, the integrated instructional teams (which include a resident/mentor pair as well as a site-based instructional leader) would collaborate to engage in a study-plan-act cycle. First, the team would analyze student-level data to assess

students' progress (study). Second, they would create instructional plans that start with where the students are, aim at the next learning target, and are very specific about the roles and responsibilities of each adult (plan), and Third, implement the plans; the more experienced instructional leads (mentors, directors of instruction, coaches) provide coaching on the skills, practices, and knowledge base that the resident will need to be successful in carrying out that interval's plan (act). The cycle then repeats as the team gathers data from the week's work that kicks off the next planning meeting.

To learn about the efficacy and effectiveness of this approach, the research team would gather and analyze observation, participant perception, candidate performance assessment, and student learning data, comparing teams that better adhere to the designed action research approach than others. To inform continuous improvement of the model (or its replacement if negative outcomes are demonstrated), the research team would provide Boston Teacher Residency and other stakeholders with quarterly data reports. Rather than a typical straightforward presentation of findings, the research team would lead a co-interpretation℠ of the data analyses and the draft findings and implications. Each set of findings would be examined, discussed, and agreed to before finalizing for sharing results with a wider audience.

Formative Study Design Example 4

Research on tools that measure and improve teacher educators' practice

An associate professor at Texas Tech University, Raymond Flores, developed an approach to quickly understand how and to what extent teacher candidates retain and use what they learn in their math and science methods coursework during their student teaching. The approach makes use of a data collection tool called the Learning to Teach Support System (LETSS) and a rich data dashboard that allows program faculty to make sense of the data and make changes iteratively to their coursework based on the evidence. It captures evidence of preservice teachers' knowledge and teaching practices for lessons taught and video captured during student teaching. The LETSS is used during a specified teaching cycle and is filled out by mentors/cooperating teachers, site coordinators, or even peers. The LETSS is designed to target various teacher preparation issues and to scaffold preservice teachers' learning to teach, while at the same time collecting necessary data during lesson design, enactment, and evaluation stages that can be used to inform the improvement of methods courses taken prior to student teaching.

> "Holding teacher preparation programs accountable for the teachers that they produce after teachers have graduated from their programs is too late. Teacher preparation programs should hold themselves accountable for training effective teachers while they are still in their programs. This is the crucial time when programs can intervene at pivotal learning-to-teach stages and help teacher candidates improve their teaching skills while at the same time improve their programs."
>
> Raymond Flores,
> associate professor,
> Texas Tech University

The LETSS data helps teacher educators decompose the complex teaching process into smaller teaching practices that are measurable, and the data provides scaffolding for preservice teachers who are learning to teach. But LETSS also provides measures that can be used by programs to inform the designs of methods courses and other student teaching interventions that target specific teaching practices. This research is not only formative but also nuanced. These measures that inform programs are fine grained and are based on preservice teachers' transfer of knowledge and teaching practices. These will include surveys with guiding questions and video capture of teaching practices.

Unlike traditional program assessments that are based on input/output and are summative, the LETSS would systematically track preservice teachers' knowledge and teaching practices formatively throughout student teaching while the preservice teacher is in the program.

Shared Data

The need for sharing data was a thread that ran through both convenings, but really it came to the fore in the second one. Teacher educators need data generated in K–12 classrooms on both their current candidates as well as their recent graduates' performance including, but not limited to student learning data, so they can use it to improve their programs. "School systems have a lot at stake and play an important role in the development of teacher candidates," said Dan Goldhaber. "This, however, is not always recognized and hence there is too little focus on the teacher preparation-school system nexus that is student teaching, and in building data bridges to allow teacher education programs to learn about how their teacher candidates perform as inservice teachers."

Two of the proposed studies focused squarely on improving data use inside teacher preparation programs and rely, in part, on data shared with them from schools and districts. By using data more effectively, the study authors predict, teacher educators will be able to find better ways to improve their programs.

Shared Study Design Example 1

Research that builds the capacity of teacher education providers to collect, analyze, and use data for improvement

Teacher education has been part of a broad policy movement toward using evidence to drive change and improvement. But few teacher preparation providers have the infrastructure and the capacity to collect and analyze data about the performance of their candidates in relation to features of their programs (Bastian et al., 2016).

To address this need, the Education Policy Initiative at Carolina proposed Project CURE (Coaching to Understand and Use Research Evidence), a multipronged intervention composed of data coaching, leadership coaching, and professional development designed to help providers develop and sustain the capacity for evidence-based improvement. As an extension of this intervention, Project CURE researchers will collect data to understand the impact of the intervention on the data capabilities of teacher preparation providers.

The three components of CURE include:

- Data coaching to help teacher preparation providers strengthen their data management systems and help them conduct research that links teacher preparation data with data from the workforce,

> "How teacher preparation programs organize themselves to improve requires a greater understanding and use of data and evidence. Project CURE has the potential to fulfill this objective and help programs succeed in a policy context that has increasingly emphasized evidence based improvement. Programs with greater capacity and ability to understand and act on evidence may produce more effective beginning teachers."
>
> Kevin Bastian, associate director, Education Policy Initiative at Carolina, UNC Public Policy

- Leadership coaching for the provider's leadership team to help them identify research needs and to support their efforts to earn faculty buy-in, and
- Professional development sessions designed to assist teacher preparation providers in building data analytic capacity.

Meanwhile, researchers will collect data about the effects on preparation programs that engage in Project CURE, looking for changes in data capabilities, faculty engagement with data, and finally changes in teacher preparation programs. Four providers in North Carolina are ready to participate in Project CURE: University of North Carolina at Charlotte, University of North Carolina at Wilmington, North Carolina Agricultural and Technical State University, and Elon University.

Shared Study Design Example 2

Research that uses data to predict the effectiveness of teacher candidates before they enter the profession

One challenge teacher educators face is determining whether their teacher candidates are progressing in the program, and whether the extra support they receive while in the program help them become competent teachers before they graduate. The author of one proposed study, Karen Kindle, division chair of curriculum and instruction at the University of South Dakota, posed the problem this way: "Despite widespread efforts, we still lack specific knowledge on how to best measure effectiveness of teacher candidates at end of program and early career, and which admissions criteria predict success." Data analysis, however, could help teacher educators begin to tackle these questions.

Teacher educators at the university have already begun collecting more data for institutional reporting and for accreditation about the progress and perceptions of candidates, as well as about the perceptions of their supervisors after their first year of teaching. The project would link that data to demographic information and grades in individual courses, as well as to cumulative GPA. In addition, data from observations of teaching during a candidate's training would be included in the data set.

Researchers would analyze these data to look for patterns among teacher candidates and their progress through the program and into their first job in teaching, as well as to identify data that could signal that a candidate is struggling while still in the program. Such information could help teacher educators know when to intervene with remediation to support a teacher candidate, or when the best course may be to counsel the candidate out of the education program.

Practical Yet Rigorous Measurement

The need for practical data collection and analysis that is low-cost, low-burden, and timely as well as that provide evidence that could be used to make effective improvement decisions was another theme that ran through the entire convening. There was no individual proposal exclusively about measurement, but all participants grappled with challenges related to measurement. For example, the study design presented by practitioners at Endicott College and Bates Elementary school relies almost entirely on observations and interviews, with some survey data. The study design from the University of Texas Rio Grande Valley calls for the creation of rubrics to be used in conjunction with observations of teacher candidates both in and out of the mixed-reality simulator.

Designing such instruments and using them to collect data is time consuming. Another consideration is what is being measured and why. In the case of Michigan State University wanting to get rapid analysis of data related to its 3-week fractions module, one of the key features is speed. Teacher educators want quick information about the impact of the module on what teacher candidates know and can do, so that data can be used to tweak and improve the module for use with other cohorts.

The study design presented by practitioners at Endicott College and Bates Elementary will use the Candidate Assessment of Performance, designed by the Massachusetts Department of Elementary and Secondary Education, as a tool to evaluate the competency of teacher candidates. To understand how the experiences of the Vacation Academy influences how teacher candidates approach their work, researchers will need to interview the participants to get at some of the nuances of the program.

It is critical that those designing research that digs into teacher preparation have valid and reliable tools and methods. As practitioners work with researchers to design studies of teacher preparation, there may be new and better ways to collect and analyze data for program improvement that gets to heart of the curriculum and experiences. “No matter where you are in your design, you need to think about measures,” said Rachel Garrett, senior researcher at AIR. “Not all studies need to be tied to student outcomes, but you still need good measures.”

Conclusion

The second convening of practitioners and researchers was quite different from the first. Participants at the initial meeting were challenged to find common ground and sometimes struggled to name and define the features of research that were important. Participants at the reconvening were focused on the concrete research studies they had designed. As one participant, Erin Grogan, a partner in assessment and evaluation at TNTP said:

> It's rare to get a group like this in the same room, not once, but twice. We appreciated the opportunity to share our proposed approach to continuous improvement with other researchers and teacher educators, while also learning about what other programs were prioritizing. In the first convening, we were able to connect with a project team from Indiana and accessed helpful resources they had used with their candidates.

Unlike presentations in many academic conferences, these sessions were not about sharing findings at the end of study. Instead, they were about strengthening the design of the study as it was taking shape to ensure the findings would one day be meaningful, useful, and worth sharing. It was about making connections across disciplines and institutions, sharing knowledge about research methods as well as preparation practices and program design and implementation. Mary Jean Tecce DeCarlo, associate clinical professor at Drexel University said conversations about research designs seemed to be about invention. "Rather than talking about the end of a study, we are talking about the beginning," she said.

Others said that the shift in focus from research findings to research design sparked different kinds of ideas for moving forward. "This is exciting because we are talking about research designs based on our own practice," said Marsha Heck. "This is a community of institutions sharing these ideas across our institutions."

Most participants said it was surprising to see the patterns and similarities among the research designs, and that practitioners and researchers were working on similar problems across various contexts. If practitioners and researchers knew more about the research designs and studies underway throughout teacher preparation, would it lead to an opportunity to scale-up research? Would that increase the chance for systemic improvement? "Is there a structure that would allow us to get inside each other's research, and then make it possible for us to layer it on practice?" asked Sarah Schneider Kavanagh. "That could be very innovative."

The sense of community around the design of research, rather than just findings, prompted several participants to suggest that there be more meetings to share research designs. Some said it would help teacher educators who are focused on the work of preparing teachers to find research support from others who may have the capacity to carry out studies. Some suggested that by

looking at other's designs, they already had ideas about how to improve their own research plans. "It's great to hear about research in different stages of development. Could there be regional meetings like this?" asked Tamara Lucas, dean, College of Education and Human Services at Montclair State University.

The challenge of improving the practice of preparing teacher educators with each provider working in isolation is similar to what schools and districts encounter when they want to improve and need to learn from others. In 2014, Anthony Bryk, president of the Carnegie Foundation for the Advancement of Teaching wrote:

> Unfortunately, no professional infrastructure currently exists for educators to collaborate in the systematic development and testing of changes and to generate and synthesize practice-based evidence. But it could. Envision national networks of teachers and schools engaged with researchers and program developers around select high-leverage educational problems. These networks would aim to inform educators as to what is more likely to work where, for whom, and under what conditions. Moreover, as educators used this knowledge, the knowledge itself would evolve and be further refined through its applications. (Bryk, 2014, p. 473)

There is a need for networks of teacher educators, perhaps to help them come up with better research designs that will lead to findings to inform continued program improvement, or to work collectively on a single research design that could be implemented across organizations. Just as this kind of network did not exist for schools, it does not exist for teacher educators and research partners.

This convening was filled with inventive research designs, driven by practitioners' questions, that could help them improve. Although questions and challenges remain, we took several steps forward in committing to collaborative research in teacher education, including programs, researchers, and K–12 partners, to discover better ways to get information to improve the way teachers are prepared in the United States.

What Is Next?

Once teacher educators and researchers take the lead on this critical work, how can policy makers, universities, and K–12 schools support them? Challenges need to be overcome to support these efforts. We have some suggestions based on what we learned from this exciting work.

Policymakers and Funders

- Seek out activities among teacher preparation programs to do the kind of research described by participants by spotlighting their work by sharing it with the larger teacher preparation community through communications strategies. Make sure teacher preparation providers know about this effort by staying in touch with teacher preparation membership organizations.
- Enable and encourage additional structured convenings of practitioners and researchers to develop solid research designs together. Neither group can design rigorous and practical research for improvement well on their own. Teacher educators are focused on the consuming work of preparing teachers, and researchers may not know enough about the activities that take place in teacher preparation programs to design research. Consider smaller regional events as well as larger national ones to give more practitioner–research teams the opportunity to participate. Support and foster efforts to create networks of teacher preparation providers, which can lead to a greater sharing of best practices.
- Invest in the improvement of teacher preparation by partnering to provide sufficient funding for the implementation of the most promising research designs. Resources are scarce for this kind of work, so it is critical to be creative, efficient, and dogged; the next generation of teachers and their students depend on it.

Teacher Preparation Providers

- Through incentives including tenure requirements, encourage program faculty to collaborate with fellow faculty and outside researchers to study their practices as a teacher educator. Insist on rigorous yet practical research designs that are actionable, contextualized, nuanced, formative, and shared. Support such research efforts with the goal of improving the practice of teacher education.
- Help designate and support leadership teams in education departments that are willing to press fellow faculty to look closely at their work training new teachers, and ask them to take steps to try new practices, curricula, or processes. Leadership teams should work to create an environment where the practices inside teacher education are the subject of evaluation and continuous improvement.
- Build or join a network of teacher preparation providers and ask members to be critical friends for faculty research designs.

K–12 Schools

- If K–12 educators participate fully in such a partnership, it's likely that school leaders and teachers could help shape the preparation of new teachers who will take their first job in the school or districts. Continue to be generous in partnering with preparation faculty to prepare new teachers. Value the payoff that this allows school leaders and teachers to see potential future colleagues in action.
- Do what is necessary to share data on the candidates placed in your school, and insist that data is used for program improvement. Researchers can do a much better job designing studies and delivering findings to teacher educators if they have access to data about graduates of teacher preparation programs now teaching in K–12 schools. Teacher educators can also use feedback and data about candidates still in training to differentiate support and mentoring.

References

Adams, S. K., & Wolf, K. (2008). Strengthening the preparation of early childhood teacher candidates through performance-based assessments. *Journal of Early Childhood Teacher Education, 29*(1), 6–29.

American Association of Colleges of Teacher Education. (2010). *21st century knowledge and skills in educator preparation* (White paper). Retrieved from http://www.p21.org/storage/documents/aacte_p21_whitepaper2010.pdf

Arizona State Board of Education. (n.d.). *Article R7-2-604 Educator preparation programs. R7-2-604 Definitions* (p. 10). Retrieved from https://azsbe.az.gov/sites/default/files/media/Web%20Version%20FINAL%20Adopted%20EPP%20Rule%20R7-2-604.pdf

Balfanz, R., Byrnes, V., & Fox, J. (2013). *Sent home and put off-track: The antecedents, disproportionalities, and consequences of being suspended in the ninth grade.* Los Angeles, CA: The Civil Rights Project. Retrieved from https://civilrightsproject.ucla.edu/resources/projects/center-for-civil-rights-remedies/school-to-prison-folder/state-reports/sent-home-and-put-off-track-the-antecedents-disproportionalities-and-consequences-of-being-suspended-in-the-ninth-grade

Bastian, K. C., Fortner, C. K., Chapman, A., Fleener, J., McIntyre, E., & Patriarca, L. (2016). Data sharing to drive the improvement of teacher preparation programs. *Teachers College Record, 118*(12), 1–29.

Bryk, A. S. (2014). 2014 AERA distinguished lecture: Accelerating how we learn to improve. *Educational Researcher, 44*(9), 467–477.

Bryk, A. S., Gomez, L. M., Grunow, A., & LeMahieu, P. G. (2015). *Learning to improve: How America's schools can get better at getting better.* Cambridge, MA: Harvard Education Press.

Calderhead, J. (1981). Stimulated recall: A method for research on teaching. *British Journal of Educational Psychology, 51*(2), 211–217.

Chaplin, D., Gill, B., Thompkins, A., & Miller, H. (2014). P*rofessional practice, student surveys, and value-added: Multiple measures of teacher effectiveness in the Pittsburgh Public Schools* (REL 2014–024). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Mid-Atlantic. Retrieved from https://ies.ed.gov/ncee/edlabs/regions/midatlantic/pdf/REL_2014024.pdf

Christofferson, M., & Sullivan, A. L. (2015). Preservice teachers' classroom management training: A survey of self-reported training experiences, content coverage, and preparedness. *Psychology in the Schools, 52*(3), 248–264.

Darling-Hammond, L., Chung, R., & Frelow, F. (2002). Variation in teacher preparation: How well do different pathways prepare teachers to teach? *Journal of Teacher Education, 5*3(4), 286–302.

DeMonte, J. (2017). *Fostering a new approach to research in teacher preparation: Results of the first convening of researchers, practitioners, and K–12 educators.* Washington, DC: American Institutes for Research. Retrieved from https://www.air.org/sites/default/files/downloads/report/Teacher-Education-Research-Agenda-July-2017.pdf

Duffield, S. (2006). Safety net or free fall: The impact of cooperating teachers. *Teacher Development, 10*(2), 167–178.

Egbert, J., Herman, D., & HyunGyung, L. (2015). Flipped instruction in English language teacher education: A design-based study in a complex, open-ended learning environment. *Tesl-Ej, 19*(2), 1–23.

Ericsson, K. A. (2006). The influence of experience and deliberate practice on the development of superior expert performance. In K. A. Ericsson, N. Charness, P. J. Feltovich, & R. R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 683–670). Cambridge, U.K.: Cambridge University Press. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.459.3750&rep=rep1&type=pdf

Ericsson, K. A., Krampe, R. T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review, 100*(3), 363–406.

Fabelo, T., Thompson, M. D., Plotkin, M., Carmichael, D., Marchbanks, M. P., & Booth, E. A. (2011). *Breaking schools' rules: A statewide study of how school discipline relates to student's success and juvenile justice involvement.* New York, NY: Council of State Governments Justice Center, and College Station, TX: Texas A&M University.

Feiman-Nemser, S. (1990). Teacher preparation: Structural and conceptual alternatives. In W. R. Houston, M. Huberman, & J. Sikula (Eds.), *Handbook of research in teacher education* (pp. 212–233). New York, NY: Macmillan.

Fix School Discipline. (2017). *Research.* Retrieved from http://www.fixschooldiscipline.org/research/

Flipped Learning Network. (2014). *Definition of flipped learning.* Retrieved from https://flippedlearning.org/definition-of-flipped-learning/

Fogle, C. D., & Elliott, D. (2013). The market value of online degrees as a credible credential. *Global Education Journal, 2013*(3), 67–95.

Grau-Valldosera, J., & Minguillón, J. (2014). Rethinking dropout in online higher education: The case of the Universitat Oberta de Catalunya. *The International Review of Research in Open and Distributed Learning, 15*(1).

Gregory, A., (2013). *The promise of restorative practices for reducing racial disparities in school discipline.* Chicago, IL: Collaborative on Racial and Gender Disparities.

Gregory, A., Bell, J., & Pollock, M. (2014, March). *How educators can eradicate disparities in school discipline: A briefing paper on school-based interventions.* Bloomington, IN: The Equity Project at Indiana University, Center for Evaluation and Education Policy. Retrieved from http://www.indiana.edu/~atlantic/wp-content/uploads/2014/03/Disparity_Interventions_Full_031214.pdf

Grossman, P., Hammerness, K., & McDonald, M. (2009). Redefining teaching, reimagining teacher education. *Teachers and Teaching: Theory and Practice, 15*(2), 273–289.

Guha. R., Hyler, M., & Darling-Hammond, L. (2017). The power and potential of teacher residencies. *Phi Delta Kappan, 98*(8), 31–37.

Hammer, D., Elby, A., Scherr, R. E., & Redish, E. F. (2005). Resources, framing, and transfer. In J. Mestre (Ed.), *Transfer of learning from a modern multidisciplinary perspective* (pp. 89–120). Greenwich, CT: Information Age Publishing.

International Institute for Restorative Practices. (2014). *Improving school climate: Evidence from schools implementing restorative practices.* Bethlehem, PA: IIRP Graduate School. Retrieved from https://www.iirp.edu/pdf/ImprovingSchoolClimate.pdf

Jacob, S. (2015). *What is targeted feedback and when do I use it?* Seattle, WA: University of Washington, Center for Educational Leadership. Retrieved from http://blog.k-12leadership.org/instructional-leadership-in-action/what-is-targeted-feedback-and-when-do-i-use-it

Jaggar, S. S., & Xu, D. (2010). *Online learning in the Virginia community college system* (CCRC working paper). New York, NY: Columbia University, Teachers College, Community College Research Center. Retrieved from http://ccrc.tc.columbia.edu/publications/online-learning-virginia.html

Kalogrides, D., & Loeb, S. (2013). Different teachers, different peers: The magnitude of student sorting within schools. *Educational Researcher, 42*(6), 304–316.

Kalogrides, D., Loeb, S., & Beteille, T. (2013). Systematic sorting: Teacher characteristics and class assignments. *Sociology of Education, 86*(2), 103–123.

Kavanagh, S. S., & Cunard, A. (2017). *Conceptualizing routines for mentorship of novice teachers.* Paper presented at the annual meeting of the American Association of Colleges for Teacher Education, Tampa, FL.

Kennedy, A., & Heineke, A. J. (2014). Re-envisioning the role of universities in early childhood teacher education: A focus on schools and communities. *Journal of Early Childhood Teacher Education, 35,* 226–243.

Klute, M., Apthorp, H., Harlacher, J., & Reale, M. (2017). *Formative assessment and elementary school student academic achievement: A review of the evidence* (REL 2017–259). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Central. Retrieved from http://ies.ed.gov/ncee/edlabs

Korthagen, F. (2017). Inconvenient truths about teacher learning: Towards professional development. *Teachers and Teaching: Theory and Practice, 23*(4), 387–405.

Lampert, M., Franke, M., Kazemi, E., Ghousseini, H., Turrou, A. C., Beasley, H., Cunard, A., & Crowe, K. (2013). Keeping it complex: Using rehearsals to support novice teacher learning of ambitious teaching. *Journal of Teacher Education, 64*(3), 226–243.

LaParo, K., Thomason, A., Maynard, C., & Scott-Little, C. (2012). Developing teachers' classroom interactions: A description of a video review process for early childhood education students. *Journal of Early Childhood Teacher Education, 33*(3), 224–238.

Lazarev, V., Newman, D., & Sharp, A. (2014). *Properties of the multiple measures in Arizona's teacher evaluation model* (REL 2015–050). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory West. Retrieved from http://ies.ed.gov/ncee/edlabs

Lim, C.-I., & Able-Boone, H. (2005). Diversity competencies within early childhood teacher preparation: Innovative practices and future directions. *Journal of Early Childhood Teacher Education, 26*(3), 225–238.

Mandinach, E., Friedman, J., & Gummer, E. (2015). How can schools of education help to build educators' capacity to use data? A systematic view of the issue, *Teachers College Record, 117*(4), 1–50.

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2009). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online-learning studies.* Washington, DC: U.S. Department of Education.

McDonald, M., Tyson, K., Brayko, K., Bowman, M., Delport, J., & Shimomura, F. (2011). Innovation and impact in teacher education: Community-based organizations as field placements for preservice teachers. *Teachers College Record, 113*(8), 1668–1700.

McLeskey, J., & Brownell, M. (2015). *High-leverage practices and teacher preparation in special education* (CEEDAR Document No. PR-1). Retrieved from http://ceedar.education.ufl.edu/wp-content/uploads/2016/05/High-Leverage-Practices-and-Teacher-Preparation-in-Special-Education.pdf

Mitchel, A. L., & King, M. S. (2016). A *new agenda: Research to build a better teacher preparation program.* Washington, DC: Bellwether Education Partners. Retrieved from https://bellwethereducation.org/sites/default/files/Bellwether_NewAgenda-GPLP_Final-101316.pdf

O'Flaherty, J., & Phillips, C. (2015). The use of flipped classrooms in higher education: A scoping review. *The Internet and Higher Education, 25,* 85–95.

O'Neill, S., & Stephenson, J. (2013). One year on: First-year primary teachers; perceptions of preparedness to manage misbehavior and their confidence in the strategies they use. *Australasian Journal of Special Education, 37*(2), 125–146.

Robertson-Kraft, C., & Duckworth, A. L. (2014). True grit: Trait-level perseverance and passion for long-term goals predicts effectiveness and retention among novice teachers. *Teachers College Record, 116*(3). Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4211426/

Rust, F. (2010). Shaping new models for teacher education. *Teacher Education Quarterly, 37*(2), 5–18.

TeachingWorks. (2018). *High-leverage practices.* Retrieved from http://www.teachingworks.org/work-of-teaching/high-leverage-practices

The Future of State Universities. (2011). *Research on the effectiveness of online learning: A compilation of research on online learning.* Paper presented at The Future of State Universities Conference, Dallas, TX. Retrieved from https://www.immagic.com/eLibrary/ARCHIVES/GENERAL/ACPTR_US/A110923F.pdf

Wolff, C. E., van den Bogert, N., Jarodzka, H., & Boshuizen, P. A. (2015). Keeping an eye on learning: Differences between expert and novice teachers' representations of classroom management events. *Journal of Teacher Education, 66*(1), 68–85.

Zeichner, K. (2010). Rethinking the connections between campus courses and field experiences in college and university-based teacher education. *Journal of Teacher Education, 89*(11), 89–99.

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